ABDIMAS: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang
Vol.7(4) November 2022, 697-707
p-ISSN: 2721-138X e-ISSN: 2548-7159
http://jurnal.unmer.ac.id/index.php/jpkm

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Application of 3D printer production techniques for face shield design as a method of preventing Covid-19 transmission in the community

Penerapan teknik produksi 3D printer untuk desain face shield sebagai metode pencegahan penularan Covid-19 pada masyarakat

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ARTICLE INFO:

Received: 2022-05-01
Revised: 2022-06-28
Accepted: 2022-08-13

Keywords:

Covid-19, Face shield, Method, Production, 3D Printer

ABSTRACT

Coronavirus Disease 19 or known as COVID-19 is a virus that attacks a person's breathing. And it is believed that it spreads through human-to-human interactions through saliva splashes. Until now, there is no medicine that can cure it. So that various parties related to health are only able to apply limits related to activities and interactions between humans. Therefore, at this time to tackle it only in the form of prevention. Face shield is one form of preventing the spread of COVID-19 which can be a new reference at this time. 3D printers are known as production tools that can be used as tools that can be presented at home, because of their small size, 3D printers can also be maximized as a tool to create objects. The use of the face shield production introduction method in the form of a webinar is an option for the public to find out methods that can be carried out in productive activities to suppress the spread of COVID-19. Besides having an online system in providing knowledge to produce face shields, it directly contributes significantly to producing something during the current pandemic, especially face shields that have use values.

How to cite: Ramadhan, A., Syarifuddin, G., Hadi, P. A., Pribadi, S., & Ramadhan, S. (2022). Application of 3D printer production techniques for face shield design as a method of preventing Covid-19 transmission in the community. *Abdimas: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang, 7*(4), 697-707.
https://doi.org/10.26905/abdimas.v7i4.7768

1. INTRODUCTION

Transmission of the Covid-19 virus from person to person through droplet transmission can cause viral infections and flu-like symptoms such as fever, cough, and runny nose. A few days later, when someone infected with the virus experiences shortness of breath due to infection in the lungs, it can develop into the Covid-19 virus (Fitria et al., 2020). With the spread of the virus from human to human,

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WHO issued several policies related to activity restrictions and took preventive actions through several objects that could minimize the presence of droplets. (Telaumbanua, 2020). Increasing number of people are doing activities outside the home so that the use of a face shield or face shield is believed to protect themselves from the Covid-19 virus. A face shield is a personal protective device that covers a face like a shield made of transparent plastic. This tool has long been used by doctors and nurses for medical procedures such as surgery and swab tests (Wati, Lestari, Jayanti, & Sudarma, 2020). *Face shields are currently believed to protect the eye, nose, and mouth areas* (Yakob, Hidayat, Suciani, & Nucifera, 2020). Face shield is believed to be able to protect users from viruses by 96% when used within 0.5 meters of cough sufferers. Face shield helps develop communication between humans at a safe distance. Face shield can reduce the transmission of infectious diseases, including Covid-19 caused by the corona virus. Face shield can protect the public such as medical workers who are vulnerable to contracting the corona virus (Yakob et al., 2020). Currently, there are still many people who use masks inappropriately so that they are not effective in preventing disease transmission (Prastyowati, 2020).

During the pandemic, the problem of the spread of the Covid-19 virus affects all elements of society (Ismawati et al., 2020) . This has an impact on various activities that must be carried out using health protocols. Therefore, it is necessary to prevent the transmission of COVID-19 in a way that is relatively good, easy, and safe to the public (Yamali & Putri, 2020).

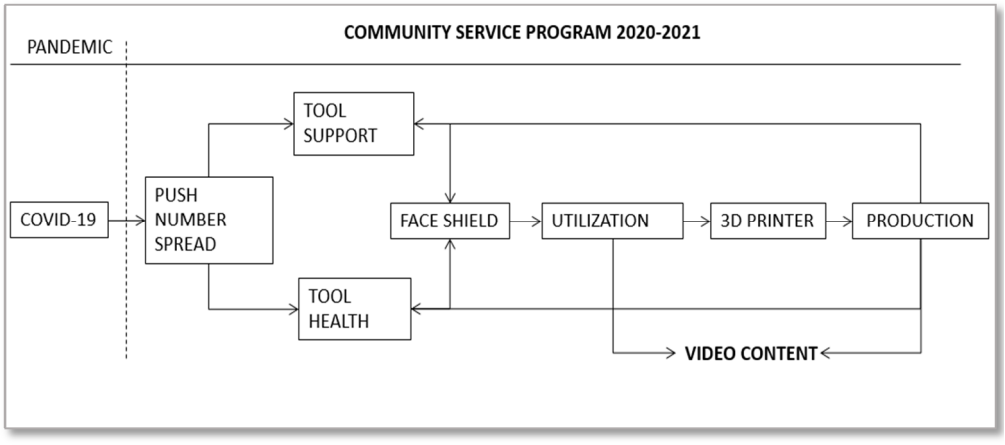

Figure 1. Utilization of 3D printers in producing face shields using video content

Partners of the community service program are one of the 3D printer manufacturers, namely IMA 3D Printer and as one of the Small and Medium Enterprises (SME) engaged in the production of 3D printers that try to create diversification of 3D Printer products so that they can be better known by the public. During the pandemic, this community service program can be used as a moment to show the response of institutions and industry in responding to environmental conditions that are experiencing social restrictions. So that people can understand 3D printers as a production tool that can provide benefits to the environment individually or in groups at large.

This community service program aims to provide knowledge and training to the community about 3D printers for making face shields. 3D printers are known as products that are used as a tool for prototyping products. Can be developed into a tool used in the product development process (Ramadhan, Atmadi, & Dinata, 2019). Making face shields with a 3D printer is done through several stages such as digital modeling, CAD-CAM, 3D print modeling, and prototyping using software (Ramadhan, 2016).

2. METHODS

This community service program undergoes three methods:

Online socialization

The online socialization aims to provide explanations about the use of 3D printer tools to be used to produce face shields. The socialization does not use direct/offline face-to-face to avoid crowds of people so that the prevention of COVID-19 transmission in the community can be maximized (Diarti et al., 2020). With this method the service program can be carried out properly. The implementation of this method is done by creating video content regarding the use of 3D printers in producing supporting equipment and medical devices in the form of a face shield.

Offline production

The production carried out this time is used to be able to produce products that can help prevent the transmission of COVID-19 through the manufacture of face shields. In this production process, the design process, printing process, and packaging process are carried out. In addition to the production of face shields, the production method which is one of the proofs of the implementation of the program has made a real contribution to the community. The implementation of this community service program leads to the presence of real products that can be used by the community.

Distribution

Distributing face shields to the general public is not announced openly and is carried out in a limited manner in order to prevent crowds of people and carry out health protocols promoted by the Health Office. The implementation of the face shield distribution is also a real contribution of universities to the general public.

This program is carried out in one of the workshops called "Ardesign26workshop" which is located on Jl. Pandan Raya Block 2 No. 8, Cibodasari Village, Cibodas District/Village, Tangerang City, Banten, Indonesia. The implementing partner for the community service program is IMA 3D Printer, which is located at Jl. White Land Permai No. 46, RW.2, Ketapang, Kec. Cipondoh, Tangerang City, Banten, Indonesia. The distribution of products is carried out around the Cibodasari area of Tangerang as well as several parties who are in accordance with the target of using face shields. Meanwhile, the target for video content creation is all viewers (viewers) of video content, which are wide and unlimited.

The implementation of this community service program is carried out during the pandemic, so there are several criteria that become the basic benchmark in achieving the activities. These criteria include:

The measure of success from implementation

The measure for the success of the implementation of the activity is the implementation of the activity in accordance with the provisions that have been given and is limited by the health protocol that is applied and the implementation period that has been determined. Therefore, there is good cooperation between implementers and partners so that the implementation of this activity can run well.

The measure of success for the Community Service Team

The measure for the success of the Community Service Team is being able to make a real contribution through online and offline implementation and in accordance with the health protocol that

is being promoted by the government to suppress the spread of COVID-19 and be able to contribute through products optimally and on target.

3. RESULTS AND DISCUSSION

Results

The implementation of community service programs carried out during the current pandemic provides results from various activities carried out both online and offline. Therefore, in the implementation of each activity that has been carried out, it is reported and evaluated. Figure 2 presents a scheme for implementing community service programs.

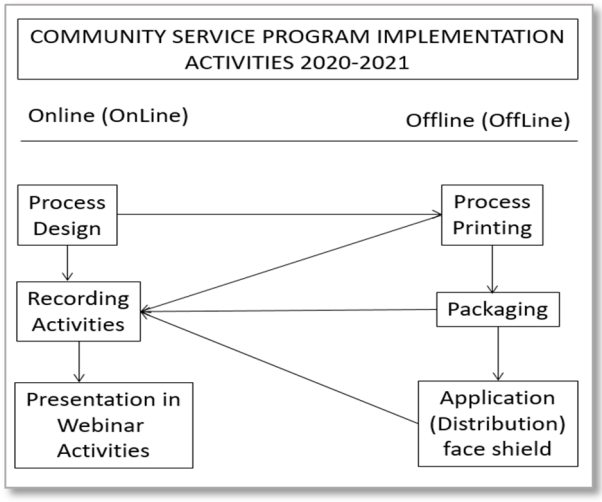

Figure 2. Outline of the program implementation process

Based on Figure 2, online activities in the implementation of this service program are carried out in the form of a design process, activity recording, and presentations in webinar activities. Meanwhile, offline activities include printing, packaging and distribution of printed face shield products to the general public.

Online Activities in the Community Service Program

The first activity carried out was conducting online activities for making face shields through the creation of video content. Online media can help carry out an activity without having to leave the house. Online media is media related to technology and the internet (Valentino et al., 2021). The form of online socialization carried out is related to the use of computer equipment, internet facilities, and software needed to support activities.

Design Process

The design process as a fundamental process, especially for designing elements related to physical form. The design is tailored to the desired function and production. The design process is an interactive process that starts from a market need to meet a need.

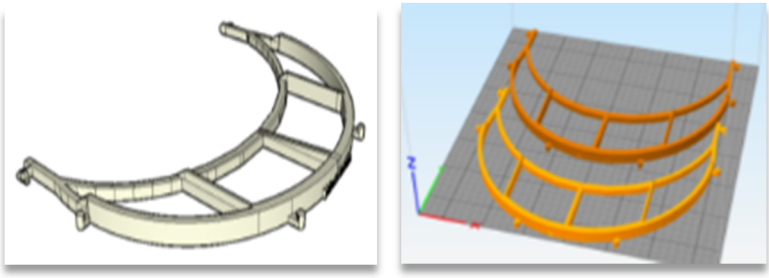

Figure 3. Design process using software

The first device used to produce the face shield frame is design software which is a software program used to create design objects. The use of software is intended as a visual representation of ideas with symbols, words, and images by using a computer. The software used in the face shield design process is software that can produce a 3-dimensional visual image or model of the face shield frame design on a computer. This is done as a way to find out so that the size and shape do not differ from the desired result. In addition to the design process, the use of software is used to generate face shield frame objects to be converted from image processing into machine movement commands. These files are all included in a format that can be read by a 3d printer. So that there are no errors in the process of making the face shield frame.

Activities Recording

Recording of activities is carried out as a process or method that is stored in an object such as an image, video or sound so that it can be attached again as material for proving the activity carried out. One of the recordings is in the form of a video that can display the process in one full stage. In recording activities, the media that can be used can vary with accountable results. Therefore, in recording, the element of activity becomes an important point to be shown.

Figure 4. Process of activities recording

Recording of activities carried out in this service program uses photo and video media, this is because the use of these media can describe or display the activities carried out. Video is used to record activities related to the work process being carried out. One example is the use of video to show the process of making a product using software and the manufacturing process using a 3D printer. In addition, to display the results obtained from the 3D printing process. This is done to show that the activity is indeed carried out and can be accounted for.

Photo media is used for recording activities that are not primary and that require time, such as the packaging process. By using photo media, all activities can be recorded and can save time. If all activities

are recorded using video media, the duration of the video will be long, so that the documentation process for the main activities is getting less. Activity recording using video and photo media is combined to produce complete and informative documentation.

Webinar Presentation

Presentation is the activity of submitting a topic, opinion or information in front of audiences. In other words, a form of oral communication regarding the delivery of information to others with specific purposes. With the development of technology, presentation activities can be done online, using certain internet-based websites or applications. This method allows speakers or presenters to share their information remotely, via the internet or other electronic media. In this context, the activity can be categorized as a webinar (Gogali et al., 2020).

Figure 5. Presentation in form of webinar

The presentations are intended to provide information about the community service program that have been carried out. Therefore, this implementation utilizes internet media and online presentation software. In addition, the presentations made were also adjusted to the activities that had been made by the team from the Faculty of Design and Creative Arts, Mercu Buana University. In this activity, the presenters are not only one person or one team, but all community service teams and presenters actively explain activities and programs to partners and the general public.

Offline Activities in Community Service Program

Offline media is used as opposed to online media. This is because "offline" can be interpreted as a form of communication that is not at all connected to the internet or intranet network (Pratama & Mulyati, 2020). Therefore, it is not uncommon for offline to be known as being disconnected from a computer network.

In the implementation of service activities carried out, the offline principle is carried out within certain limits without having to make a crowd. And offline activities that are carried out put more emphasis on activities that do not use the internet and software. These offline activities include: 3D printing process, packaging process, and face shield distribution process.

Printing Process

Printing is a process for mass-producing text and images, especially with ink on paper using a printing press. As a process, 3D printing using a tool in the form of a 3D printing machine or can be called a 3D printer is known as a tool to create three-dimensional objects from digital files (Andriyansyah et al., 2021). The manufacturing process is done by placing thin layers in sequence until the object is formed according to the desired shape which eventually forms a 3-dimensional object.

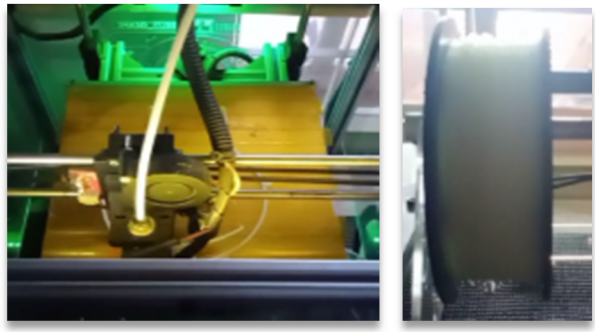

Figure 6. Face shield frame printing process

In Figure 6 is the initial stage of product manufacture. In this stage, the face shield frame is printed using a 3-dimensional printer (3D Printer). This is done because the frame is the main focus in the design of the face shield. Face shield frames need to be done carefully to maintain the quality of the resulting face shield shape. This process is influenced by the design process and the activity recording process that has been carried out previously. The success of printing face shield frames can affect the quality of face shield products. If the production is of high quality, then the face shield can be used properly, safely, and comfortably. The realization of this community service program has increasingly high value benefits for the community.

Packaging

Packaging aims to prepare goods to be ready to be transported, distributed, stored, sold, and used. The packaging process helps to prevent or reduce damage to the products contained within (Arifudin, 2020).. In addition, packaging also functions to protect from the dangers of pollution and physical disturbances such as friction, impact, vibration or in other words conditions that can damage the product. In addition, packaging has a function as a container to place a processing product or industrial product so that it has forms that make it easier for storage, transportation, and distribution (Mashadi & Munawar, 2021).

Figure 7. Packaging process

In this community service program, the packaging process is carried out as a way to prevent damage that occurs due to unwanted things. This is so that at the time of distribution, the face shield that has been produced does not experience negative impacts such as being exposed to dirt or even damaged. If it is exposed to dirt and is damaged, it will reduce the benefits of the face shield as a

personal protective equipment and maintain health protocols during the pandemic. The packaging of the face shield product is also equipped with a disposable protection mask (medical mask) to protect the public, alcohol swab (alcohol wipes) to clean the frame, and mica face shield before use to ensure cleanliness before use (Figure 7).

Face Shield Distribution

The last stage of this community service program is the distribution of face shields. After the face shield packaging process, the Community Service Team conducted a survey and identified the community as the face shield distribution target. The target community is prioritized for productive people who have high activity in social interaction by making direct contact with other people.

Figure 8. Implementation in the form of distributing face shields to elements of society

Figure 8 shows the distribution application of the face shield package. The package is intended so that the face shield product that has been made using a 3D printer can be used directly by the public. So that people can carry out their activities with normal conditions but with new conditions (new normal). The distribution of the face shield package is carried out in 2 methods, the direct distribution method which is intended so that the recipient can be noticed directly by the Community Service Team, and indirect methods such as distribution using representatives whose implementation is monitored directly by the team through documentation or photos of distribution activities.

The distribution by the direct method is carried out to parties who work in a government office or work unit below it, such as to the sub-districts (*kelurahan*) and job training centers. The Community Service Team also coordinates with several authorized parties in the agency in determining the number of face shields needed, so that the distribution process can be managed properly and there is no shortage of quantities. The indirect method is carried out to elements of society who can be representatives for the distribution of the face shield. This is done separately so that there are no queues and no crowds at the time of distribution. This method is mainly applied to traders or traveling merchants, so that it does not interfere with their activities and traders get a face shield to use directly.

Community Service Program Relevancies

The implementation of community service program activities at Mercu Buana University has undergone many changes from the program planning that has been set previously. This is due to the COVID-19 pandemic, so most program activities are carried out online. However, this activity did not reduce the interest of the Community Service Team to carry it out. This activity has generated relevance

through several applications of the knowledge possessed. In addition, the knowledge and insights possessed by the Community Service Team can be applied in real terms, by producing designs that can directly provide results and benefits for the community. This community service program produces a face shield as a product that can be directly used by the community.

Figure 9. Community Service Program Relevancies

In the implementation of the service program, it started with the aim of providing scientific contributions to the community through design objects that have functions and can directly answer one of the problems regarding suppressing the number of virus distribution during a pandemic. With the application of the knowledge possessed by the implementing team, it can produce evidence that changes are needed for a common goal through the results of the face shield design and distribution.

Discussion

The implementation of community service programs is carried out online and offline. This program implemented by following the health protocol set by the government without having to reduce community involvement with the Community Service Team. In addition to the relationship between partners and implementers from the university, this program activity resulted in an increase in the ability of the Community Service Team to carry out activities that were adjusted to the rules imposed during the pandemic. In practice, this community service activity is able to produce several supporting factors and inhibiting factors that can be used as evaluation material or can be used by other parties to carry out similar activities. The supporting factors obtained from the implementation of the community service program in the form of applying 3D printer production techniques for the face shield design which were carried out consisted of: (1) non-physical aspects in the form of demonstrations of making from the design process using a computer to presentation in a webinar. As well as support from implementing partners in the form of preparation in terms of various data and ease of accessing their activities without disturbing the activities carried out. (2) There is a physical aspect of the product in the form of face-shied assistance from the design of the implementing team so that it can be applied directly by the community. (3) The enthusiasm of partners to provide opportunities for implementers to provide access and information to provide face shield products. (4) There is an opportunity for the implementation team to produce a face shield design as the implementation of the knowledge of the implementing team. So that this process provides direct experience to the implementation team in producing hands-on experience.

In addition to the supporting factors, in this activity there are several inhibiting factors from the implementation of the community service program which consist of: (1) the implementation is limited to activities that follow the applicable rules so that there are some limitations in carrying out activities. Such as the need for coordination with various parties in order to accept these provisions. During the ongoing pandemic, program activities will be limited without crowds. So the Community Service Team needs to work around so that face shield distribution activities can be carried out. (2) Changes in weather that may affect online activities such as during a presentation in a webinar. This is an obstacle because in certain situations, online implementation can be affected by the received internet signal. (3) There needs to be various adjustments in making the design up to its implementation, the design applied is the result of revision until finally the design can adjust to the user.

CONCLUSION AND RECOMMENDATIONS

Conducting the community service program in online manner is one option in suppressing the spread of the COVID-19 virus. With these activities, the implementation of service activities can still be carried out without having to change the flow of implementation. The ability to display online activities directly can have an influence on the community because its implementation can be seen directly by elements of the community and is expected to be an example. The implementation of offline activities also has an impact because indirectly, the community can use a face shield that is designed and produced on a limited basis. Even so, this is a challenge in itself in this implementation. Because on a limited basis, this implementation can help the community in carrying out activities but in conditions that have changed and need to be adapted. Therefore, with the distribution of face shields to elements of the community, the program activities carried out can be more real.

Realizing the suppression of the spread of the virus during the pandemic, the implementation of the service program can provide positive values. This is because this implementation demands to remain productive even during a pandemic where activities are limited. However, the role of technology in this activity can be an added value so that, apart from being productive, the community can directly be given real examples. The results can be applied by the community itself although with various limitations. And in the following conditions, the role of the community will not be limited. Because it can indirectly provide new knowledge that can be used later.

ACKNOWLEDGEMENTS

Acknowledgements were conveyed by the head of the Center for Community Service, Head of the Research, Community Service and Publication Bureau of Mercu Buana University who had helped and informed the latest form of implementing community service programs. And appreciation to the lecturers and students of the Product Design Study Program at Mercu Buana University and the IMA 3D Workshop team who have helped and exchanged ideas and the webinar event that was held went well.

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