The effectiveness of introduction to nuclear physics e-module as a teaching material during covid-19 pandemic

M Misbah¹, Y Khairunnisa², P D Amrita, D Dewantara¹, S. Mahtari¹, K Syahidi³, N Muhammad⁴, B K Prahani⁵, U A Deta⁶
¹Physics education, Universitas Lambung Mangkurat, Banjarmasin
²Chemistry Education, Universitas Islam Kalimantan Muhammad Arsyad Al Banjari, Banjarmasin
³Physics education, Universitas Hamzanwadi
⁴Physics education, Universitas Khairun
⁵Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Surabaya, Surabaya,

misbah_pfis@ulm.ac.id

Abstract. This study aimed to explain the effectiveness of Introduction to Nuclear Physics E-Module as a teaching material during Covid-19 Pandemic descriptively. The e-module was made by using Flip PDF Professional application. This study aimed to: (1) describe students’ learning outcomes before and after the implementation of e-module, (2) analyze the effectiveness of e-module descriptively through normalized Gain <g>; (3) describe the practicality of the e-module according to students as the users. The research instruments consisted of students’ test results and practicality questionnaire in the use of nuclear physics e-module. The results obtained showed that: (1) There was a difference of the pretest-posttest mean score descriptively; (2) The e-module was effective descriptively to boost students’ learning outcomes through normalized Gain analysis <g>; (3) The practicality of the e-module was in the ‘very practical’ category based on students as the users. Therefore, The nuclear physics e-module can be applied as the effort to provide teaching material in physics lecture during Covid-19 pandemic.

1. Introduction
The spread of Covid-19 pandemic has drastically intruded every aspect of human life, including education. It has created an unprecedented test on education. In many educational institutions around the world, universities are closed and learning activities are shifted to online [1]. Teachers are faced to the need to adapt on online learning [2]. Educators are required to adjust to a variety of aspects, such as the ways to interact with students, types of learning media, the kinds of assignments distributed, and the teaching materials provided [3–9].

Electronic teaching material can be used as learning source and media in online learning during the pandemic of Covid-19. Electronic teaching material is a set of material which is arranged sequentially and systematically while showing the need of competences expectedly mastered by students in learning process and poured into an interactive multimedia [10]. Electronic module (e-module) is one of the electronic teaching materials. Electronic module enables users to learn with or without facilitator or lecturer. One of the criteria of e-module is the independent learning which makes the teaching material train students to learn independently [11].

One of the applications to make e-module is Flip PDF Professional. The available format provided in flip PDF professional are (.exe), (.app), (.fbr), and (.html) [12]. The advantage of using flip PDF
professional is that it is beginner-friendly, even to those who are unfamiliar with HTML programming language. Flip PDF Professional is a flipbook maker with the feature of editing each individual page [13]. Pdf flip professional can utilize any kind of media, such as audio, video and flash [14].

The introduction of nuclear physics is one of the compulsory subjects programmed by a prospective Physics teacher. The topics in this subject are atomic nucleus, nuclear force, nuclear model, nuclear reaction, and radioactivity. Students need to understand those concepts along with the equations and calculations in them. Generally, this subject discusses about declarative knowledge and procedural skill in solving arithmetical problems. To help students to learn independently whenever and wherever, especially in recent situation (Covid-19 pandemic), we need a useful and interesting teaching material. The teaching material which is not only containing material, but also video, exercises, etc. Therefore, the electronic learning module is considered as suitable teaching material in concurrent situation.

There were several studies regarding e-module based on flip PDF professional. As studied by Nisa et al [12], the implementation of e-module with flip PdF professional on mathematics subject produced the effectiveness in moderate category. Additionally, the study conducted by Wijaya and Vidianti [11] showed that the use of interactive e-module on education innovation subject was effective to use to boost learning outcomes. Then, as it was studied by Seruni et al [15], E-module flip PDF professional based on project based learning could be applied to enhance students' critical thinking skill.

However, researchers have not found any study discussing the effectiveness of e-module based on flip PDF professional in physics lecture during the pandemic of Covid-19 yet. Hence, this study focused on describing the effectiveness of the use of e-module in introduction of nuclear physics descriptively as the teaching material implemented during the pandemic in improving students' learning outcomes.

2. Method
This study was a descriptive quantitative research. The aims of this study were describing students’ learning outcomes score, the normalized gain (N-gain) of students’ learning outcomes from pretest and posttest result, and the practicality level of the e-module in introduction of nuclear physics based on students’ point of view as the users.

The research instruments were learning outcomes test sheet and practicality questionnaire of the e-module usage. The research subject was students who programmed the introduction of nuclear physics in Lambung Mangkurat University in academic year of 2019/2020. The mean score of students’ learning outcomes (pretest and posttest) the implementation of e-module in introduction of nuclear physics was determined by using this following equation:

\[ x = \frac{\sum x}{n} \]  

Note:
\( x \) = mean scores of students’ learning outcomes  
\( \sum x \) = sum of students’ learning outcome scores  
\( n \) = number of students

The N-gain analysis which stated that there was an increase in students’ pretest and posttest was carried out in order to determine the effectiveness of cooperative-blended learning model on students’ learning outcomes. The calculation of N-gain and the N-gain criteria refer to Hake[16].

Then, the data of students’ responses were presented in percentages as obtained from the sum of questionnaire scores (scale 1-5) for each indicator as presented in equation (2).

\[ PS = \frac{R}{SM} \times 100\% \]  

Note:
\( PS \) = Percentage score  
\( R \) = Score of each indicator  
\( SM \) = Total sum

The above percentages were then classified according to the interpreted percentage score guidelines [17] presented in Table 1.
### Table 1. Criteria of interpreted percentage of the practicality of e-module

| No. | Interval Percentage Scores | Criteria       |
|-----|----------------------------|----------------|
| 1   | 0%–20%                     | Very less practical |
| 2   | 21%–40%                    | Less practical   |
| 3   | 41%–60%                    | Moderately practical |
| 4   | 61%–80%                    | Practical        |
| 5   | 81%–100%                   | Very practical   |

### 3. Result and Discussion

E-Module of introduction of nuclear physics was made by using the Flip PDF Professional application. The display of pages in the e-module is as seen on Figure 1. Before the implementation, the e-module was validated and stated as feasible to use as learning source for students, especially in introduction of nuclear physics subject.

![Figure 1. The pages of introduction of nuclear physics e-module](image)

Students’ learning outcomes were described based on the mean score of pretest and posttest result before and after the implementation of e-module. Both tests were done to detect whether there was an improvement of students’ learning outcomes. The mean score of pretest and posttest can be seen on Figure 2.

![Figure 2. Pretest and Posttest Result](image)

Based on Figure 2, it shows that pretest result which represented students’ initial knowledge about nuclear physics knowledge gained the mean score of 27.6. After the e-module was applied, the mean score of posttest was 75.8. The N-gain result showed a normalized gain score <g> of 0.67. The effectiveness category based on N-gain criteria was included in moderate criteria. Therefore, the implementation of introduction of nuclear physics e-module in physics lecture during pandemic was effective descriptively to boost students’ learning outcomes.
Then, the percentage of practicality of the e-module was calculated by using equation (2). The percentage of practicality obtained was 95.27% and included in ‘very practical’ category. The comparison of practicality score is as seen on Figure 3.

![Figure 3](image)

**Figure 3.** The comparison of practicality and maximum score

The practicality score as seen in Figure 3 was obtained from the questionnaire in scale of 1-4. The questionnaire was filled online via Zoho form application. The questionnaire consisted of 15 statements, which were: (1) I do not feel helped on engaging in the physics lecture by using the e-module; (2) the electronic module makes the material I learn becomes more difficult; (3) the lecture do not end on time after the implementation of this e-module; (4) The introduction of nuclear physics lecture by using e-module makes learning atmosphere more conducive, especially during pandemic; (5) This e-module makes motivated to learn the nuclear physics material; (6) I found many concepts in nuclear physics material independently while learning with this e-module; (7) This e-module consumes more battery power; (8) This e-module uses language, words, sentences, and paragraph which ease me to understand the material; (9) This e-module is easy to access whenever and wherever rather than printed ones; (10) This e-module does not consume much internet data; (11) The loading of animation, video, pictures, link, or pages in this module does not take much time; (12) The material delivered in this e-module makes it difficult for me to understand the lecture faster; (13) This e-module is easy to access via any kind of network (Wi-Fi, 3G, or 4G); (14) The provided animation video, pictures, and link in this e-module do not make it easy for me to understand the material; (15) After learning with this e-module, I do not get a lot of new knowledge and information.

According to the discussion above, the use of e-module in introduction of nuclear physics in physics lecture gave positive impact on learning, especially on students’ learning outcomes during online learning in pandemic of Covid-19 situation.

It is in line with Purwaningtyas and Hariyadi [18] who stated that the use of module could accommodate learning activity to be more well-planned, independent, complete, and produced clearer output. The function of this module supports the solution of online learning problems during the pandemic. According to study by Allo [19], students suggested that learning material and assignment in lecture should have been explained before. A module facilitates that limitation because there are clear instructions in it to reach its characteristics which is self-instructional. E-module of introduction of nuclear physics is very practical in its use as students believed so. Therefore, e-module can be an option as an effort to provide reading source [20].

E-module which is made by using flip pdf professional application is very flexible and easy to use. Output format can also be applied on mobile application by using mobile device [14]. Hence, it enables students to access the e-module wherever and whenever. With its easy access, it may improve students’ ability and interest in learning using e-module [15,21–25].

### 4. Conclusion

To conclude, the implementation of Introduction to Nuclear Physics E-Module as a teaching material during Covid-19 Pandemic obtained different mean scores of pretest and posttest descriptively, showed effectivity in moderate category to improve students’ learning outcomes descriptively, and showed a
practicality categorized as ‘very practical’ from students’ point of view as the users of the e-module in introduction of nuclear physics lecture during the pandemic of Covid-19.

References

[1] Jena P K 2020 Int. J. Adv. Educ. Res. 5 77–81
[2] König J, Jäger-Biela D J and Glutsch N 2020 Eur. J. Teach. Educ. 43 608–622
[3] Hartini S, Misbah M, Dewantara D, Oktovian R A and Aisyah N 2017 J. Pendidik. IPA Indones. 6 313–7
[4] Mahyuddin R S, Wati M and Misbah M 2017 Berk. Ilm. Pendidik. Fis. 5 229–40
[5] Zainuddin Z, Hasanah A R, Salam M A, Misbah M and Mahtari S 2019 J. Phys. Conf. Ser. 1171
[6] Misbah M, Pratama W A, Hartini S and Dewantara D 2018 PSEJ (Pancasakti Sci. Educ. Journal) 3 109–114
[7] Maimunah M, An’nur S and Misbah M 2016 Berk. Ilm. Pendidik. Fis. 4 82–90
[8] Dewantara D, Wati M, Misbah M, Mahtari S and Haryandi S 2020 J. Phys. Conf. Ser. 1491 12045
[9] Dewantara D, Misbah M and Wati M 2020 Journal of Physics: Conference Series
[10] Sriwahyuni I, Risdianto E and Johan H 2019 J. Kumparan Fis. 2 145–152
[11] Wijaya J E and Vidiandi A 2020 Adv. Sci. Educ. Humanit. Res. 422 86–89
[12] Nisa H A, Wahyu R and Putra Y 2020 J. Pendidik. Mat. Raflesia 05 13–25
[13] Professional F P D F, Flip W, Professional P D F, Windows F, Service O and Upgrade P 2019 Flip PDF Professional Interactive publishing - add video , image , link and. Available: https://www.pdf-flip.com
[14] Kustijono R and Watin E 2017 Semin. Nasional Fis. FMIPA UNESA 1 125
[15] Seruni R, Munawaroh S, Kurniadiwi F and Nurjayadi M 2020 J. Phys. Conf. Ser. 1521 42085
[16] Hake R R 1998 J. physics. Am. Assoc. Phys. Teach. 66 64–74
[17] Riduwan 2014 Dasar-Dasar Statistika (Bandung: Alfabeta Press)
[18] Purwaningsyas P, … W D-J P T and 2017 journal.um.ac.id
[19] Allo M D G 2020 J. Sinestesia 10 1–10
[20] Raihan S and Ahmadi F 2018 Innov. J. Curric. Educ. Technol. 7 7–14
[21] Asrial S, Kurniawan D A, Chan F, Septianingsih R and Perdana R 2019 Univers. J. Educ. Res. 7 2098–2107
[22] Seruni R, Munawaroh S, Kurniadiwi F and Nurjayadi M 2019 J. Tadris Kim. 4 48–56
[23] Komikesari H, Mutoharoh M, Dewi P S, Utami G N, Anggraini W and Himmah E F 2020 J. Phys. Conf. Ser. 1572 12017
[24] Ferdianto F and Nurulfatwa D 2019 J. Phys. Conf. Ser. 1188 012043
[25] Ningtyas R K and Jati H 2018 J. Educ. Sci. Technol. (EST 1 221–227