

# Development of modern physics practicum e-guide on circular iris diffraction materials to calculate He-Ne laser wavelength using professional flip pdf application

**Hardiantinus Sitinjak\*, Sri Purwaningsih, Hebat Shidow Falah**

Physics Education, Jamby University, Jambi, Indonesia

\*Correspondence: hardiantinus@gmail.com

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## Abstract

Development of a modern physics practicum guide on circular iris diffraction material to calculate the He-Ne laser wavelength using the Flip PDF Professional application. To determine student perceptions, as well as the feasibility of developing a modern physics practicum guide on circular iris diffraction material to calculate the He-Ne laser wavelength using the Flip PDF Professional application. This research was carried out using research and development (R&D) methods. R&D is a research method used to produce certain products, and test the effectiveness of these products. In this research, the product produced is a practical guide on circular iris diffraction material using a He-Ne laser, to calculate wavelengths which are expected to increase interest in learning and understanding of modern physics concepts for students. The result of this development is an e-guide to modern physics practicum on circular iris diffraction material to calculate He-Ne laser wavelengths using the Flip PDF Professional application. This electronic practicum e-guide was developed using the 4 (D) model which consists of 4 stages, namely the define stage, design stage, develop stage and disseminate stage. The development of a modern physics e-guide using Flip PDF Professional on material measuring He-Ne laser wavelengths with a circular iris diffraction pattern was carried out to assist students in understanding the learning material so that they were able to understand the practical material on measuring He-Ne laser wavelengths with a circular iris diffraction pattern. Before the e-guide was developed, a preliminary study was carried out to determine the basis for developing the e-guide for modern physics. For student responses, the average score was 3.86 and a percentage of 96% was in the very good category. The media validation results got an average of 3.13 in the very good category, for material expert validation they got a very good category with an average of 4. So the guide created in the category is suitable for use.

**Keywords:** e-guide; flip pdf professional; He-Ne Laser; RnD; media development.

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## INTRODUCTION

Education is the foundation for forming a developed country. Knowledge is conveyed and transmitted through education. Therefore, education plays an important role in the life process, both in

the world of education itself and in coexistence in national society (Amanda, 2022). In the national community in the field of education currently there are many developments between humans and the environment. In the current era of rapid globalization, humans are expected to become quality intellectual forces. For example, higher levels of education require better learning resources, and technology is changing rapidly in today's developed countries. Technological developments are of course influenced by physics which has been studied by experts in the field. There are many benefits to studying physics. In physics, all kinds of sophisticated equipment makes human work easier. One tool that produces a light source is very useful for survival, and light produces a source of electromagnetic waves in the form of diffraction (Heldalia et al., 2021).

Diffraction is the bending process of light that occurs when it passes through a narrow gap. For monochromatic light (light that only has one wavelength), the resulting diffraction is in the form of light and dark patterns (Minarni et al., 2013). On the other hand, when polychromatic light is diffracted by a single slit, a dark line opening pattern will appear on the screen, one of which is circular iris diffraction, circular iris diffraction involves a very narrow slit. It is made by cutting a lens plate with an aperture of 469 87 Membrane allows you to make membranes with a pitch of N20, N40 and N80 of 1mm (Kartika, 2017).

In circular iris diffraction, each line is a gap. Circular slices have a constant (denoted by  $d$ ) that represents the number of strokes per unit length, which is also known as the gap width. In a box, the width of the gap and the distance between two gaps are the same, where  $N$  is the number of scratches per unit length (Pramono et al., 2015).

Helium-Neon (He-Ne) lasers are included in gas lasers. A very effective stimulus used in gas laser pumping is electron shock (potential difference stimulation). The Helium-Neon laser consists of a 10:1 mixture of Helium Neon placed in a long, narrow output tube. The benefit of practical guidance using lasers is that it can help students achieve learning, develop scientific work habits, and be independent in participating in learning. Therefore, a practicum guidebook is a necessity in carrying out practicums (Bertolino et al., 2020).

Practical implementation guidelines include procedures for preparation, implementation, data analysis and reporting and are prepared by individuals or groups of teachers who carry out experiments according to the rules of scientific writing and are used as a guide in carrying out laboratory experiments (Dôme et al., 1991). Therefore, especially in modern physics learning, it is necessary to provide digital practicum guidelines. With the development of technology used as a learning medium, digital-based practicum guidelines make learning activities easier. The quality of education can be improved by utilizing information technology to improve the quality of learning activities. In the last few decades, information technology has become faster and more widespread. One of them is the Flip PDF Professional application (Sianturi & Dongoran, 2020).

Practical-based modern physics learning cannot be carried out optimally in the Jambi University physics laboratory due to current field conditions, indicating that there is no practical guide that can be used for learning modern physics using circular iris diffraction material to calculate He-Ne laser wavelengths. In order for practicums to continue to be carried out, practicum guides are needed to support modern physics learning. This fact was obtained based on initial observations made on physics education students class of 2021 on August 18 2023, namely: There is no practical guide that can be used for circular iris diffraction material to calculate the He-Ne laser wavelength. In modern physics learning, lecturers only use modules and the use of modules is not enough to understand circular iris diffraction material to calculate the He-Ne laser wavelength.

Based on the results of an interview conducted with one of the laboratory assistants in the physics

laboratory of the Faculty of Teacher Training and Education (FKIP) Jambi University, problems were found that made the practical work on circular iris diffraction material to calculate the wavelength of the He-Ne Laser not yet carried out in the laboratory, due to the unavailability of instructors in the laboratory. In this case, the researcher and the research team members conducted an experiment to get the correct experimental steps. Guides that are in accordance with theory can then be used as practical guides.

One application that can be used to create practical guides is Flip PDF Professional. Software that can be used to convert PDF files into digital publications, turn pages and change the appearance of PDF files to make them more attractive like books (Faizah & Munoto, 2016). The Flip PDF Professional application has many advantages, including being easy to use because it can be operated by beginners who have not mastered the HTML programming language, and a feature-rich flipbook maker. which has a page editing function. Flip PDF Professional is an interactive medium that allows you to easily add various types of animated media to your flip book. The advantage of this professional F3PDF application is that the publication is interactive with an attractive appearance (Nurussaniah & Nurhayati, 2016).

In making the practicum guide, Canva and Microsoft Word applications were used to design the design of the practicum guide. Canva is an online design program that provides various tools such as presentations, resumes, posters, pamphlets, brochures, graphics, infographics, banners, bookmarks, bulletins, and so on which are provided in the Canva application (Sholeh et al., 2020). The types of presentations available on Canva include creative presentations, education, business, advertising, technology, and so on (Astrida & Arifudin, 2022). The advantages of the Canva application are that it has a variety of attractive designs, is able to increase the creativity of educators and students in designing learning media because it has many features provided, saves time, and learning media is carried out practically (Mahyudin, 2023).

Based on the description that has been explained, the aim of this development research is to develop a practical guide on circular iris diffraction material using a He-Ne laser, to determine the feasibility of a practical guide on circular iris diffraction material using a He-Ne laser through 2 stages of validation, namely expert validation. material, and media expert validation and to determine student responses to the practicum guide developed through student response questionnaires.

## METHODS

The development procedure in this R&D research uses the Four-D Model (4D) development model. The development model used as a reference in this research is the Thiagarajan model, with Model (4D) which is carried out through 4 stages, namely defining, designing, developing and disseminating (Thiagarajan et al., 1974). The development of an e-guide based on Flip PDF Professional was carried out by applying research and development methods. research and development is a research method used to obtain products and measure how effective a product is and whether it is suitable for use. The location of this "research" was carried out in the FKIP laboratory at Jambi University during the period June 2023 to February 2024. The development stages included three stages."

The trial subjects for the development of practicum guides were tested on physics education students at FKIP Jambi University class of 2021 who had taken modern physics courses, namely 48 students. Qualitative data analysis techniques were obtained from the validation results of media experts and material experts in the form of comments and suggestions, for Quantitative data was obtained from media expert validation questionnaires, material expert validation questionnaires, and student perception questionnaires.

Data collection in this development research used validation sheets and student response questionnaires. The data were analyzed using descriptive analysis techniques

### Preliminary Research Stage

This "stage" is carried out through 2 steps, namely a student needs questionnaire and information collection. The student needs questionnaire process was carried out by one modern physics lecturer. This activity aims to obtain the potential and problems related to e-guides so that they can support students' needs for circular iris diffraction material. The results of the student needs questionnaire found that a guide is needed for modern physics courses, namely in the form of a modern physics book with laser material which is often used by lecturers on campus in teaching modern physics. Learning in the current era of globalization, lecturers are also not yet familiar with Flip PDF Professional based learning guides. The collection of information was obtained from collecting literature reviews related to e-guides as a learning resource. The Flip PDF Professional application has the benefit of creating e-books in the form of flipbooks equipped with several types of multimedia, namely audio, flash, and sharp images and graphics that give a clearer and more interesting impression to read (Febrianti, 2021).

### Product Development Stage

The product development stage is carried out by creating an e-guide using Microsoft Power Point and Canva, then converting it into PDF format so that it can be operated on Flip PDF Professional and automatically takes the form of a flipbook in the form of an e-guide. After the application, several interesting pictures and symbols are added that are appropriate to the material to increase students' understanding of the learning process. The student perception questionnaire was analyzed using a Likert scale with 4 answer choices provided, namely strongly disagree, disagree, agree, and strongly agree. The student perception questionnaire likert scale scores can be seen in Table 1.

**Table 1.** Student Perception Questionnaire Likert Scale Scores

Score	Criteria
1	Don't agree
2	Disagree
3	Agree
4	Strongly agree

Source: Sugiyono (2013)

The equation for determining the interval is as follows:

Maximum Score = number of questions x maximum score of items

Minimum Score = number of questions x minimum score of items

$$\text{interval} = \frac{\text{maximum score} - \text{minimum score}}{\text{number of items}} \quad (1)$$

From the calculation of the score for each statement, the presentation of the respondent's overall answer is sought using the formula:

$$P = \frac{n}{N} \times 100\% \quad (2)$$

By using the equation above, a classification score can be obtained for the student perception questionnaire which is then categorized into a range called an interval. The following classification of student perception questionnaire scores can be seen in table 2.

**Table 2.** Classification of Student Perception Questionnaire Scores

Percentage (%)	User Response Criteria
75.00-100.00	Very good
50.00-74.99	Good
25.00-49.9	Not good
0.00-24.99	Very Not Good

Source: Arywiantari et al. (2015)

### Expert Validation Test Stage

At this stage there are two ways, namely the expert validation stage and product revision. The aim of this expert validation stage is to obtain a development research product in the form of an e-guide. In this e-guide validation test, there are several assessments, namely assessments by material and media expert validators (Lecturers from Jambi University), which ultimately reveal the shortcomings of the product being developed. This research uses an instrument sheet as a data collection technique. The contents of the instrument sheet consist of material expert validation instrument sheets. The media in this research also uses data analysis in the form of quantitative and qualitative descriptive data analysis techniques, which means that the data obtained through this research uses qualitative data, after which it is analyzed through quantitative data in the form of numbers, then explained in sentence form. The instrument sheet used in this research is a Likert scale questionnaire. The number of validators is 2 people, 1 person for media validator and 1 person for material validator. The number of data collection instruments on student perceptions is 48 students from the class of 2021 who have taken modern physics courses.

To find out whether this e-guide can be used, we use a Likert scale for calculations to see whether the e-guide that we created is valid or still needs to be revised again. After the responses are collected, the next step is to find the average value to be mapped into the scale range obtained after the interval is known. The equation for determining the interval is as follows equation (1) and equation (2) and classification of validation scores for material experts, and media experts can be seen in table 2.

## RESULTS AND DISCUSSION

The development of a Modern Physics e-guide using Flip PDF Professional on material measuring He-Ne laser wavelengths with a circular iris diffraction pattern was carried out to assist students in understanding the learning material so that they were able to understand the practical material on measuring He-Ne laser wavelengths with a circular iris diffraction pattern. Before the e-guide was developed, a preliminary study was carried out to determine the basis for developing the Modern Physics e-guide. The initial study was obtained through the share of student needs.

The e-guide is created based on initial studies, then the e-guide can be used as additional teaching material by material experts and media experts through validation sheets. Discussion is the most important part of the entire content of a scientific article. The results of the research that has been carried out show that the development of an e-guide based on *Flip PDF Professional* on circular iris diffraction material to calculate the He-Ne laser wavelength, as well as to find out how valid this media is for students

to use as an independent learning resource. Research and development (R&D) was used in this research. This research uses quantitative data which is carried out using instrument sheets. That the media that has been created is valid for use by students in supporting the independent learning process. The results of e-practicum guide product can be seen at Figure 1 - 4.



Figure 1. Guide cover image



Figure 2. Practical tools



Figure 3. N20, N40, N80 lenses and work table



Figure 4. guide identity and cover cover

The e-guide is validated by material experts through 2 validation stages so that the material contained in the e-guide is in accordance with the learning plan and can achieve learning objectives. Based on the results of stage 2 validation, material experts who assessed material, learning and linguistic aspects obtained an average score of 4.0 with very good criteria and an average percentage of 100%. The results of material expert validation show that the material is of good quality and meets student needs. Then the e-guide is validated by media experts. Based on validation carried out twice by two media experts by assessing aspects of screen design appearance, user-friendliness aspects, usefulness aspects, graphic aspects, a total score was obtained from the results of stage 2 media expert validation with an average score of 3.26 with a percentage of 81% in the very good category and 3.53 with a percentage of 88% in the very good category. Based on the validation results from material experts and media experts, the e-guide that was developed has been declared suitable for use and tested on students.

**Table 4.** Media expert validation scores.

Score	Percentage (%)	Criteria
3,26	81%	Very Good
3,53	88%	Very Good

After the e-guide was declared feasible by the validator, the researchers then conducted a trial on students to find out how students perceived the e-guide that had been developed. Student perception is a student's assessment of an object. The perceptions given by students are very important for the success of developing digital-based Modern Physics learning media, namely e-guides. Based on a large group test that was carried out by giving a perception questionnaire to 48 physics education students at FKIP Jambi University in regular class A class of 2021 with an average score of 3.86 and a percentage of 96% in the very good category. The results obtained show that the e-guide to modern physics on He-Ne laser wavelength measurement material with circular iris diffraction patterns can be used as additional teaching material for Modern Physics.

**Table 5.** Student perception scores.

Score	Percentage(%)	User Response Criteria
3,86	96%	Very good

Based on the description of the literature review that has been described, the researcher also analyzed relevant previous research to become the basis for the research to be conducted. As for relevant research Research conducted by (Yuanita et al., 2015) with the title "Development of a Spectroscopy Practical Guide in Modern Physics Courses" the data instrument used was an anget which was given to students as a practicum guide. The type of data obtained from the research results was qualitative data in the form of Numerical data is interpreted using assessment category criteria guidelines to determine product quality. The results of this research are a practical guide to modern physics material that has been well tested and meets the standards of validity and practicality which has been tested on physics education students who have taken modern physics courses. Scoring on the questionnaire responses of practical students in this study uses a Likert scale, which is in the form of questions or statements whose answers are in the form of a scale of approval or rejection of questions or statements. The student questionnaire responses in this study are in the form of positive statements. Students' answers to positive statements are expressed in the words strongly agree (SS) with a score of 5, agree (S) with a score of 4, unsure (R) with a score of 3, disagree (TS) with a score of 2, and strongly disagree (STS) with a score of

1. Teaching materials in the form of Practical Guides are very suitable for lecturers and students who are very effective and active in learning.

Research carried out by (Kholifudin, 2017) with the title "Toy Laser Light as an Alternative Monochromatic Light Source Practical Light Diffraction Grating" The instruments used in this research are observation worksheets, expert team validation test questionnaire sheets, assessment data from media experts.

## CONCLUSION

This research produced a product in the form of a Modern Physics e-guide on He-Ne laser wavelength measurement materials with a circular iris diffraction pattern which was developed using the Flip PDF Professional application. The developed e-guide contains material on He-Ne laser wavelength measurements with circular iris diffraction patterns, experimental procedures, introduction to practical tools, brief theory, observation results and work tables. Based on the results of students' perceptions of the e-guide for Modern Physics, what was obtained was measuring the wavelength of the He-Ne laser with a circular iris diffraction pattern, the criteria were very good so that the e-guide that was developed could be an additional teaching material in Modern Physics lectures, especially in measuring wavelengths. He-Ne laser with circular iris diffraction pattern.

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