

## The Development of the Electronics Book Titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits”

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### Abstract

The objectives of this research were to develop the electronics book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” and to evaluate its quality. The targeted subjects of the study were 108 first-year students from the College of Medicine who registered in the course “Life Science Physics” during the second semester of the academic year 2014. The instruments of this study were the electronics book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits,” and the form for evaluating the quality of the e-book in 5-point scales. The evaluation form in the form of a questionnaire consisted of three main areas: contents, designs, and application. The topics of contents included six subtopics; the topics of designs had five subtopics; and the topics of application were with four subtopics. The reliability of the questionnaires was 0.892. Descriptive statistics such as percentage, mean scores, and standard deviation were used to analyze the data.

The research findings were as follows:

1. The e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” consisted of a front cover, a preface, a table of contents, and contents in a total of 42 pages. There were a total of 27 files of mp3 (sound files) and mp4 (video files).

2. The mean scores of the evaluation of the quality of the e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” were the highest in the area of contents on the topic of the constructional contents which covered all learning objectives ( $\bar{x} = 4.22$ ); the highest in the area of designs on the topic of forms of letters and font sizes ( $\bar{x} = 4.19$ ); and the highest in the area of applications on the topic of “Medias for self-directed learning” ( $\bar{x} = 4.09$ ), which was at a good level.

**Keywords:** *electronics book, multimeter, Direct Electrical Circuit*

### 1. Introduction

The Association of South East Asian Nations (ASEAN) has set main strategies leading toward the ASEAN Economic Community (AEC). The main strategies are to become both a market and a production base; to be a region with high-competitive capability; to develop the equal economy; and to integrate it with the World’s economy. It can be seen that this is related to the industrial sector. Actually, not only the industrial sector needs to be transformed, but the educational sector also has to adapt its educational system to conform to the changing contexts in the future, in terms of the vocational and language skills. This is because, when we join the AEC, everything will be based on competition. As education is one of the processes to develop human resources and plays an important role in upgrading the quality of life of people to be equally secure and sustainable, it should be reformed. It is not easy to teach students to be able to think. Thus, the learning strategies, including the application of the educational media and technology in the teaching and learning management, need to be changed. This is because, nowadays, the

development of the information and communication technology has become rapidly advanced. Thus, the information and communication technology has been brought into a part of the learning-process management. Furthermore, at present, the more interesting electronic media is electronic books (e-books). In the advancement of e-books, the computational technology with the computational programs is conducted by scanning the books, managing and storing electronic files of images and characters. Thus, the paper books have become electronic files, instead. It is convenient to publicize the books in the websites. In a website, each page of the website is called “a web page.” Readers can open and read those files by using the web browser through the computer applications which can show messages, photos, and interactions via the internet system. Later, there are many companies which have produced and developed this type of programs until the time when the programs can create the electronic documents with the characteristics, but with special characteristics, in the same way as general books do. The special characteristics of e-books are that hyperlink can be created to other related internal and external websites, and sound and video files can be added. These characteristics cannot be done in general books.

In the teaching and learning management of a physics laboratory, the aim is for learners to have direct experiences and to understand the scientific-process skills, which are needed in the study, research, and problem solution in the future. Learners will practice their analytical thinking and relate the theoretical knowledge to the real situations in the experiments. Sometimes, learners want to practice these skills, outside class schedules, with the educational media which exemplifies how to conduct the experiments of particular topics. Rangsit University, in cooperation with ARIP Public Company Limited, developed e-books under the project titled “The Project of Developing E-Books for Education and Strengthening Meritocracy Dhammadhipateyya.” This is to develop the multimedia in forms of interactive e-books for the benefits of the youths, learners, and general public. The researcher views that developing the e-book of the physics laboratory will suit learners’ needs. The book of the physics laboratory, in the form of an e-book, must consist of videos which show how to conduct experiments for learners to study and follow when they are able to manage their time for their self-study outside classes, as they wish. According to the informal data collection obtained from the students who registered for the course “Physics Laboratory,” it was found that learners wanted the media for practicing the application and reading fine measuring instruments which were, at first, a vernier caliper and a micrometer. Consequently, the researcher developed two physics laboratory books, in the form of e-books, in the pilot project: a physics laboratory book on “A Vernier Caliper” and a physics laboratory book on “A Micrometer” (Kanchana Chanprasert, 2014). These two books that the researcher developed were evaluated. The results of the evaluation of the quality of these two books revealed that the overall scores, the scores for contents and the scores for techniques were in the average of 4.04, 4.25, and 3.86, respectively. These scores were in the “GOOD” level. From the targeted subjects’ opinions and suggestions, the e-books are the learning media that they can choose to learn at their convenient time and place. Learners were able to search for the information that they needed efficiently; to change learners’ characteristics to long for knowledge; and to greatly develop learner’s learning and understanding of the contents of the subjects. This was because the learning video clips contained some animations and were suitable for the teaching and learning courses with contents that were difficult to understand or the courses requiring experiments. This provides learners more time to self-study. The results gained from the

evaluation of the quality of the two e-books were correlated with the ones presented by Suchart Jaisathan (2009), Santhana Songkarin (2009), Jesada Thawornuwong (2010), Patcha Intarasm (2012), and Supranee Khamkam (2007). From the above reasons, in this study, the researcher developed a physics laboratory e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits.” This book is in the series of the physics laboratory books for learners in the tertiary level.

## **2. Research Objectives**

The objectives of this study were as follows:

1. To develop a physics laboratory e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits.”
2. To evaluate the quality of the e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” from the perspectives of learners.

## **3. Research Questions**

This study was designed to address the following questions:

1. What are the components of the e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits”?
2. How are the quality characteristics of the e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits”?

## **4. Research Hypothesis**

This study was designed to test the following hypothesis: The quality of the e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” should be in a “GOOD” level.

## **5. Definitions of Specific Terms**

1. The subject “Life Science Physics” refers to a 3-credit course in sciences in the General Education which students from the Faculties in Science-Health consisting of College of Medicine, Faculty of Dental Medicine, Faculty of Medical Technology, Faculty of Nursing, and Faculty of Optology are required to take.
2. Electronics books mean books which have changed the form to be files, publicized in the form of websites. The books appearing on each page of a website are called “web page.” Readers can open those documents by using a web browser, which is an application program. The program can show the messages, pictures, and interactions via the internet network system.
3. The e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” refers to the physics laboratory manual which was introduced in the form of an electronic book.

## **6. Participants or Target Group**

The participants or the target group of this study was 108 students of the College of Medicine who registered for the course PHY 136: Life Science Physics during the second semester of the academic year 2014.

## **7. Research Instruments**

The instruments used in this research were as follows:

1. The e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits.”
2. The evaluation form for the quality of the e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits.”

## **8. Data Analysis**

In this research, descriptive statistics was used to calculate the basic statistic values such as frequency, percentage, mean, and standard deviation of the basic data and the data obtained from the quality evaluation of the e-book entitled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits.”

## **9. Conclusion and Discussion of the Research Results**

The research on “The Development of the Electronics Book titled The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” was aimed at developing the physics laboratory e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” and evaluating the developed e-book. The researcher had three stages of conducting this research.

Stage 1. The development of the electronics book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” was preceded by studying and synthesizing the concepts and principles of creating an e-book, and developing an evaluation form of quality. After that, the main contents of creating the e-book and the contents of the course: Life Science Physics, in terms of laboratory concerning the use of multimeter in the measurement of electrical quantities in direct electrical circuits, were synthesized and correlated. This was developed to be an e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits.”

Stage 2. The use of e-book was tested via the application named “RSU book” with the target group, consisting of 108 students of the College of Medicine who registered for the course PHY 136: Life Science Physics during the second semester of the academic year 2014. The instrument used in this stage was the form for evaluating the quality of the e-book.

Stage 3. The data gained from the evaluation of the quality of the e-book was analyzed with the use of mean and standard deviation. The results and discussion were presented in detail, as follows.

### 9.1 The Conclusion of the Research Results

9.1.1 The e-book entitled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” consisted of a front cover, a preface, a table of contents, and contents in a total of 42 pages. There were a total of 27 files of mp3 (sound files) and mp4 (video files).

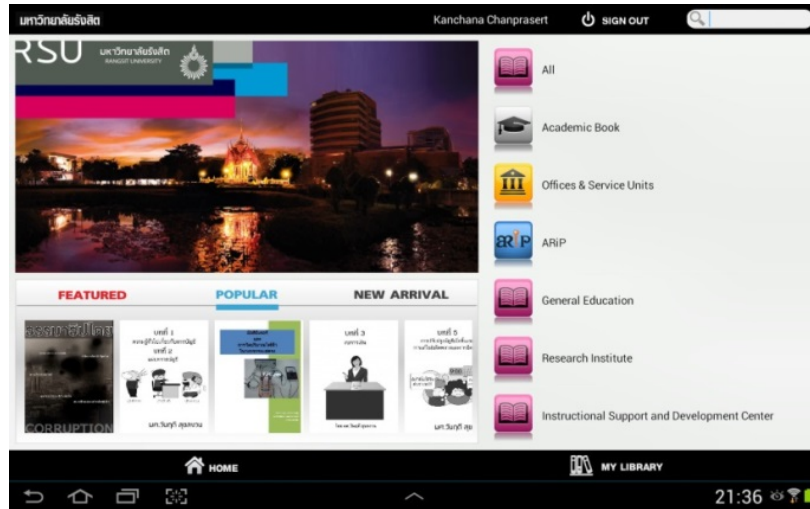


Figure 1: The Homepage of the RSU Book Apps.

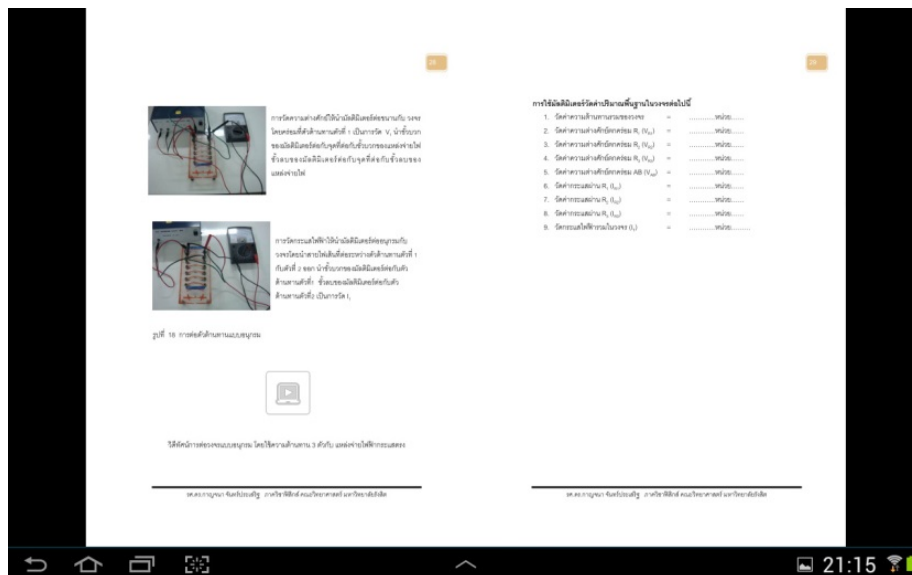
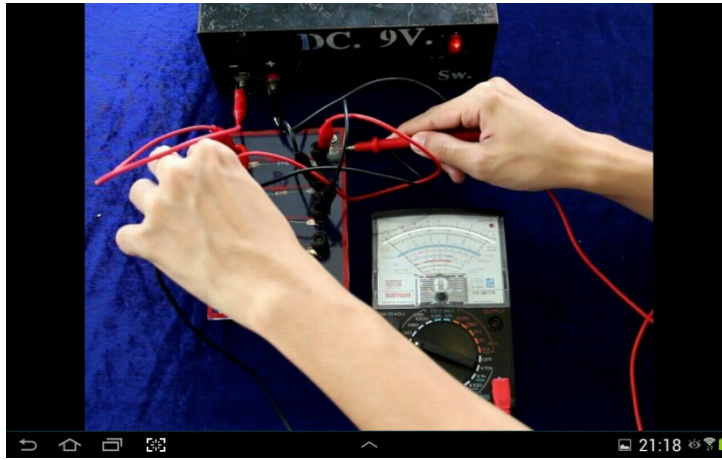


Figure 2: Examples of the E-book entitled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits”



**Figure 3:** An Example of Videos in the E-book entitled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits”

9.1.2 The results concerning the quality of the e-book titled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits,” evaluated by the target group of students, revealed that the area of contents on the topic of the constructional contents which covered all objectives of learning had the highest average score at 4.22; the area of designs on the topic of forms of letters and font sizes had the highest average score at 4.19; and the area of applications on the topic of “Medias for self-directed learning” had the highest average score at 4.09.

## 9.2 The Discussion of the Research Results

From the results of the evaluation of the quality of the e-book entitled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits,” it was found that the majority of the listed items were evaluated with the “GOOD” quality. This was because the researcher studied the materials and other research related to the development of electronics books. After that, the researchers brought out the strengths of each part to be the foundations of this development. As for the evaluation of the quality of the e-book entitled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits,” the area of contents which gained the highest average score, was on the topic of the constructional contents which covered all objectives of learning. This was because the researcher analyzed the contents used in the physics laboratory book.

In addition, from the opinions and suggestions of the target group of subjects, the group wanted the university internet system to be improved. This was because, during the time when a large number of students used the e-book and downloaded large files at the same time, it consumed a longer period of time. However, the e-book entitled “The Use of Multimeter in the Measurement of Electrical Quantities in Direct Electrical Circuits” can be the learning media and resources that learners can choose to learn at their convenient time and place. Learners can also find or browse information that they needed efficiently. This e-book can change the habits and

characteristics of learners to long for knowledge and assist learners to develop their better learning and understanding of the course contents. This finding was correlated with the results of Wanwisa Jitsupa (2010: 105-107); Paramaporn Mathep (2008: 552-53); and Sirinee Jantarachat (2013: 88).

## 10. Suggestions

- 10.1 A suggestion for applying and using the research results (the e-book)
  - Learners are recommended to download the e-book in the communication tool, prior to the use of the e-book.
  - The exercises at the end of each chapter should be added, so that learners can take part in the two-way learning.
- 10.2 A suggestion for future research
  - There should be a development in other topics or other courses which are suitable for becoming e-books.

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