# Development Of Junior High School Mathematics E-Book And Student Project Sheet Based On Integrated *Merdeka Belajar* Project Based Learning

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***Abstract***.
*The pandemic Covid-19 has resulted in limited direct interaction between teachers and students in the classroom. Learning goes from offline to online. The development of interactive e-book for Middle School Mathematics and student project sheets based on project based learning integrated Merdeka Belajar is very relevant to helping distance learning students to be actively involved in learning. Some of the features contained in the Junior High School Mathematics E-book include concept maps, instructions for using e-modules, embedding youtube links, google form links, audio features, teacher presentation videos, student assignment links, student project sheets and student evaluation links. These features make the e-book interesting and interactive. The independence of learning can be felt by students when choosing a project that is in accordance with the conditions of the surrounding environment. The results showed that the developed E-book in terms of the validity aspect of the material and media validator assessment was 3.67 with a very feasible category. The practical aspect seen from the responses of students and mathematics teachers was 3.50 (87.5%) and 3.64 (91%) in the very practical category, respectively. For the student project sheet developed to stimulate 6 aspects of student learning independence based on the learning independence instrument (Hidayati & Listyani, 2010) as many as 19 items. The given project sheet is able to stimulate students to achieve learning independence in the medium category (mean 3.27 on a scale of 5).*

***Keywords:*** *Middle School Math E-book , Student Project Sheets, Merdeka Belajar*

## I. INTRODUCTION

Ki Hadjar Dewantara has a concept of education based on the principle of independence which means that humans are given freedom from God Almighty to regulate their lives by staying in line with the rules that exist in society. Students must have an independent spirit in the sense of being independent physically and mentally and with energy. An independent soul is needed throughout the ages so that the Indonesian people are not dictated by other countries. Ki Hadjar Dewantara has the term among system, which prohibits punishment and coercion on students because it will turn off their free spirit and kill their creativity (Dwiarso, 2010).The Ministry of Education and Culture of the Republic of Indonesia has launched the *Merdeka Belajar* policy package as a forum for developing human resources which is a priority for national development in the education sector (Setiawan, 2020). As stated by Nadiem Makarim that *Merdeka Belajar* is freedom of thought determined by the teacher (Kemendikbud, 2019). So that the main key that can support the sustainability of this free learning policy is an independent teacher.Teachers and students are subjects in this learning system because teachers and students collaborate with each other in finding the truth. The position of the teacher in the classroom as a driving force in exploring the truth, reasoning, and critical of students. Meanwhile, learning continues to favor students which encourages students to try a lot, ask a lot of questions, and do a lot of work (Kemendikbud, 2019). Therefore, teachers can exercise freedom in utilizing developing technology as a tool to choose learning teaching materials according to the interests and talents of students so that they can learn creatively, innovatively, and independently, not least in learning mathematics.

The independent learning concept initiative is an alternative solution that makes it easier for teachers and students to interact virtually in online learning. The goal is that during the current pandemic, schools do not become new clusters of adding Covid-19 cases. Problem based learning is an alternative for implementing

learning in schools. Although it would be better if online learning needs to be combined with offline learning while still implementing the 5M health protocol called blended learning.Project Based Learning is a learning model that uses projects as the core of learning by providing projects as student performance where students work independently in constructing their learning and lead to real products. The following are some definitions of Project Based Learning from several book sources, namely (1) According to the NYC Department of Education, the Project Based Learning learning model is a learning strategy where students must build their own content knowledge and demonstrate new things. understanding through various forms of representation. (2) According to the Buck Institute for Education, Project Based Learning learning model is a systematic teaching method that involves students in learning knowledge and skills through a structured process, real experience and thorough designed to produce products. (3) Project-Based Learning is a learning method that gives students freedom of thought regarding the content or teaching materials and the planned objectives. (4) According to Boss and Kraus, Project-Based Learning Model is a learning model that emphasizes student activities in solving various open problems and applying their knowledge in working on a project to produce certain authentic products.

The condition of online learning that occurs in the field, especially at State Islamic Junior High School of 02 Medan City *(MTSN 2 Medan)*. Students have many difficulties. Especially in understanding students' mathematical concepts and reasoning. One of the contributing factors is that learning still uses teacher videos and math textbooks. Based on several research results, the obstacles experienced by students include: 1) students experience signal problems during online learning, 2) students have not been able to master some of the learning applications used so that it will affect the learning process, 3) students have difficulty communicating with teachers and prefer or prefer face-to-face discussions in class, 4) students have difficulty understanding the concept of material if it only comes from books, 5) students often experience anxiety during online learning.The triggers for student anxiety during online learning are difficulty understanding the material, difficulty doing assignments, availability and conditions of the internet network, technical problems, and concerns about the next task, 6) students also experience psychological problems during online learning (Oktawirawan, 2020; Puspaningtyas & Dewi, 2020; Rahmatia et al., 2020). The results of Utami & Cahyono's research (2020), 75% of students have difficulty learning mathematics using e-learning, 73% of students have problems implementing learning in terms of interactions, assignments and teaching materials in online learning and 77% of students experience technical signal problems and inability to learn online (e-learning). In addition, based on the results of the researcher's informal interviews with several teachers in elementary schools, it was stated that not all schools were able to organize online and interactive learning with applications that were already available. This happens because of the limited facilities and knowledge of information technology (IT) owned by students.

## II. METHODS

This research was conducted at State Islamic Junior High School of 02 Medan City which is located at Jalan Peratun, Number 3, Sidorejo Hilir Village, Medan Tembung District, North Sumatra Province. And the product trial was carried out in the even semester of 2020/2021 with class VII research subjects at State Islamic Junior High School of 02 Medan City. The development model used by the researcher is research on the development of 4D devices (Sivasailam Thiagarajan, Dorothy S. Semmel, & Melvyn I. Semmel) as follows.


**Fig 1.** 4D Development Steps

In accordance with the 4D development steps, there are 4 stages to be carried out in this development research, namely; (1) Defining Stage. At this stage there are four main steps, namely front-end analysis (front-end analysis), concept analysis (concept analysis), task analysis (task analysis), and formulation of learning objectives (specifying instructional). objectives). (2) Design Phase, this stage aims to obtain an initial draft on

the development of students' E-modules and Project Sheets. This stage consists of four steps, including the preparation of the test, the selection of teaching materials and the initial prototype of the student project sheet, the selection of the format, and the initial design. At the format selection stage, it is done by identifying the various components of the integrated interactive e-module that will be designed for independent learning.

These components include background, video and audio, material path, and button features. Researchers chose Flip PDF Corporate Edition software to design these various components. This is because Flip PDF Corporate Edition has a full range of features to design e-modules and an effective publishing process as needed. (3) Development Phase (Develop), at this stage researchers make e-modules and student project sheets, validate integrated interactive e-modules for independent learning to material and media experts, work on revisions in stage one, after which a trial of student responses is carried out , small group trial, second revision, and large group trial. (4) Dissemination stage, the final stage of a development is the disseminate stage. The disseminate stage serves to introduce a development product to be accepted by users, either independently, in groups, or in systems. The dissemination stage was carried out by showing and presenting teaching materials in the form of an integrated interactive e-module for independent learning to the schools studied, namely State Islamic Junior High School of 02 Medan City and Islamic Junior High School of ALHijrah *(SMPIT ALHijrah)* Deli Serdang, North Sumatra Province.

## III. RESULTS AND DISCUSSION

### Results

### 1. Expert Validation

The final validation data by three material expert validators can also be presented in tabular form. The following is the data from the validation results of three material experts in each aspect in graphical form.

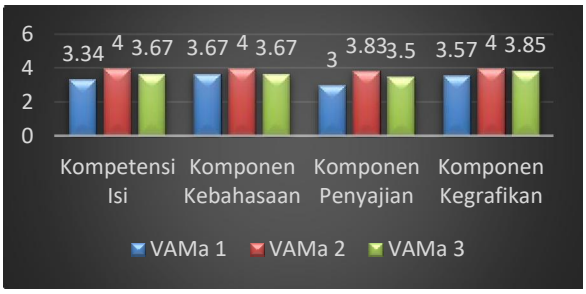



**Fig 2.** Data Expert Validation Results

Based on Figure 2, it can be seen from the comparison of the assessments of each material expert. Thus, the results of the material expert's assessment of all aspects obtained an average score of 3.67. Based on the results of the assessment, it can be concluded that the interactive e-book developed is in the range of 3.26 < (x) 4.0. The integrated self-learning interactive e-book for SMP Class VII is stated in very valid criteria. The following is a revision of the material on the integrated interactive e-module for self-learning on statistics material.

| Before Revision | After Revision |
|---|---|
|  |  |

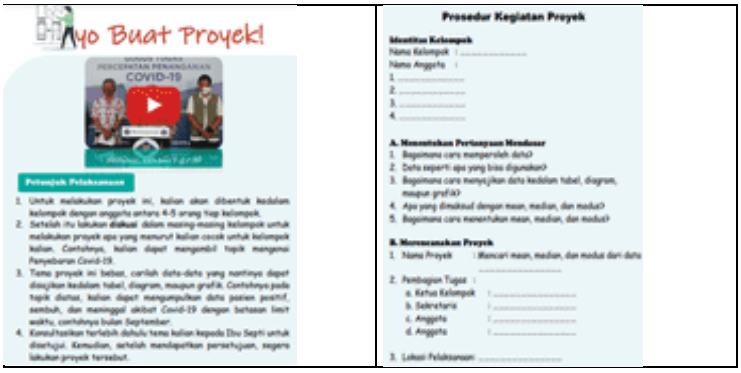



**Fig 3.** Revision from Material Expert

**2. Media Expert Validation**

Final validation data by three media expert validators other than in graphical form.

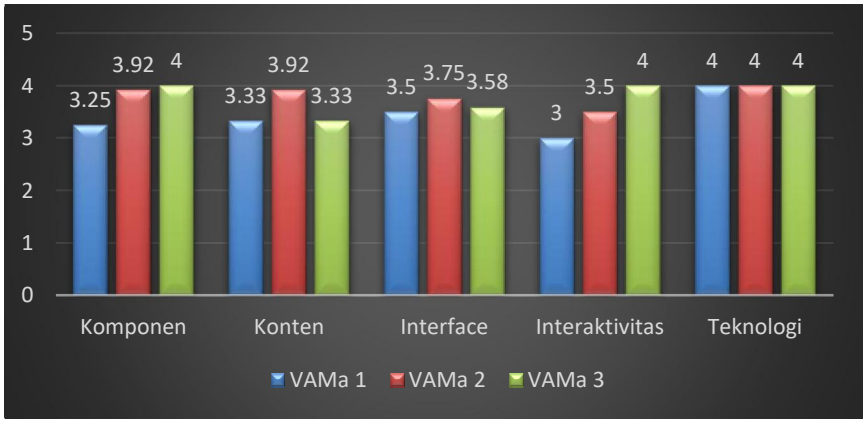



**Fig 4.** Media Validation Data

Based on Figure 4, it can be seen a comparison of the assessments of each media expert. Thus, the results of the media expert's assessment of all aspects obtained an average score of 3.67. Based on the results of the assessment, it can be concluded that the interactive e-module developed is in the range of 3.26 < (x) 4.0. Integrated self-learning interactive teaching materials are stated in very valid criteria. Revisions from media experts suggest that illustration images can be designed in various ways for each sub-material so as not to be seen repeatedly.

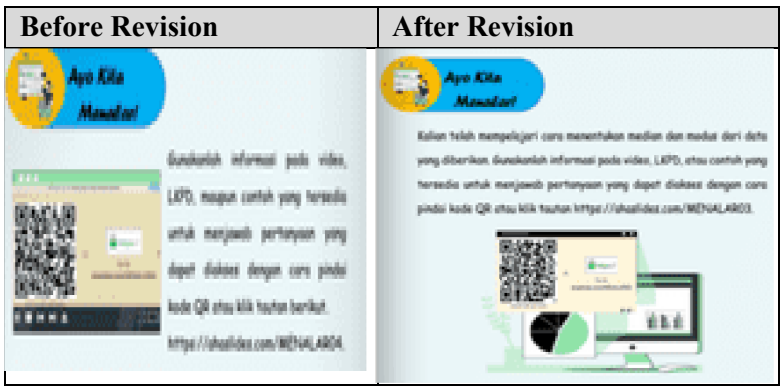



**Fig 5.** Revision of images from media experts

**3. Product Trial**

The development trial is the stage that is carried out when the product has been completed at the repair or revision stage in accordance with the suggestions and input from the material and media validator experts. This stage aims to determine the practicality after the product is declared valid or feasible by the validator expert. The implementation of this interactive e-module product trial was carried out through a process of testing

the responses of students and mathematics teachers. The trial of the Class VII Mathematics E-book product was carried out by teaching some of the material contained in the e-book, both through virtual meetings (Zoom meetings) and face-to-face in learning classes. The trial was given to obtain data on the practicality of the E-book from 32 students and two mathematics teachers representing MTs Negeri 2 Medan and were selected heterogeneously based on the students' ability level and gender. Product test results data can be seen in the following table.

**Table 1.** Response Data of Students and Mathematics Teachers

| No. | Response Data | Aspects seen | $\bar{x}$ | *criteria* | Analysis Results |
|---|---|---|---|---|---|
| 1. | Student | Practical | 3,50 | Very | |
| 2. | Teacher | Practical E-book Practical | 3,64 | Very | |

Based on the results of the questionnaire response analysis of students and mathematics teachers, it was found that the average practicality of the seventh grade Mathematics e-books for Junior High Schools was 3.50 (87.5%) and 3.64 (91%). So that e-modules can be categorized as very practical. This is in accordance with the guidelines for practicality criteria used by researchers, namely the device is declared very practical if it has an average practice validity value in the range of 3.26 < (x) 4.00. For the student project sheet developed to stimulate 6 aspects of student learning independence based on the learning independence instrument (Hidayati & Listyani, 2010) as many as 19 items. The given project sheet is able to stimulate students to achieve learning independence scores in the medium category (mean 3.27 on a scale of 5).

**4. Some Parts of Designing a Mathematics E-book**

**a. Cover Page**

The cover page (cover) of the integrated interactive e-module of Independent Learning is designed with a combination of various colors of green and light blue and is equipped with pictures related to statistical materials and illustrations of *Merdeka Belajar*. The cover section contains the title of the material, the target audience, the name of the author, agency, year, and the university logo.


**Fig 6.** Integrated Interactive E-book Cover Page *Merdeka Belajar*

When the interactive e-module is opened, there are 5 navigation bars according to the number of chapters in the seventh grade junior high school math book. The goal is to make it easier for users to move and choose from chapter to chapter, as shown below.

**Fig 7.** Some Navigation Barcodes on Interactive E-books

**b. Module Contents Page**

Once the barcode is open, students can click on one of the barcodes. And will be directed to one of the material chapters. Once open, you will be redirected from one page to another. such as next page, previous page, first page, and last page. In addition, the e-module in its use is also equipped with various features contained in the application such as word search, zoom, thumbnails, auto flip, share, select text, and users can also provide background music.


**Fig 8.** Some of the Navigation Keys on an Interactive E-book

**c. Foreword and Table of Contents**

The foreword section in the integrated interactive e-module merdeka Belajar is a section containing gratitude by the author for the completed process of making the e-module, the advantages of the product made, and thanks and apologies if there are deficiencies in the product developed. Apart from being in text form, the author also provides a preface in the form of a video that users can watch if they don't want to see the text. The table of contents in the interactive e-module is automatic so that users can go directly to the desired page by clicking on the title contained in the table of contents. The automatic table of contents aims to make it easier for users to use e-modules effectively and efficiently.


**Fig 9.** Foreword Section


**Fig 10.** Table of Contents

**d. Mathematical Symbols**

The integrated interactive e-module for independent learning also provides a table of mathematical symbols contained in the e-module. The table is equipped with descriptions and how to read the symbols.

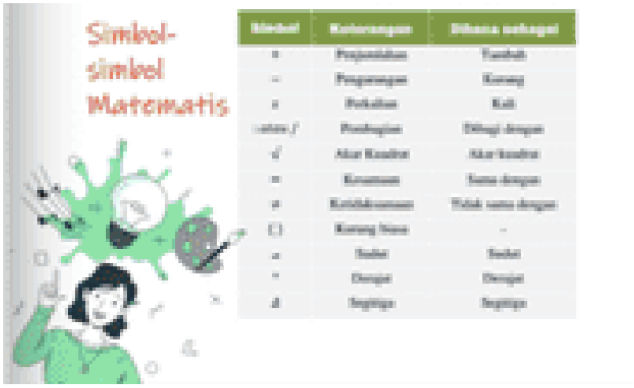
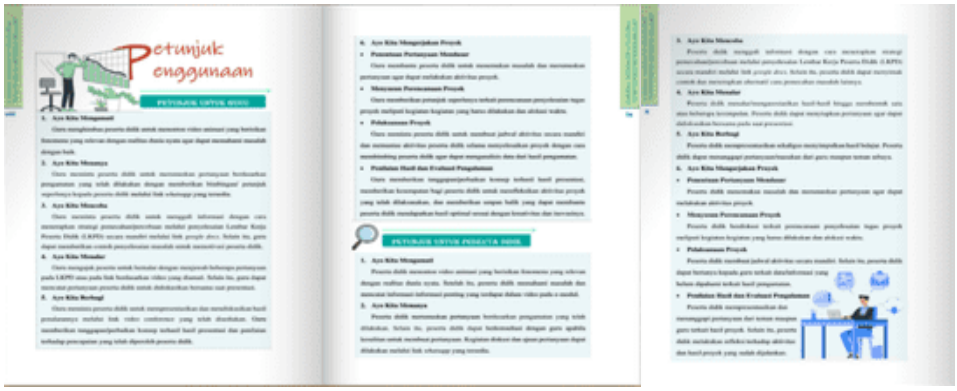



**Fig 11.** The Mathematical Symbols Section

**e. Instructions for use**

This component contains instructions for using the developed independent learning interactive integrated e-module. Instructions for use consist of two parts, namely instructions for use for teachers and instructions for use for students. Instructions for use serve to clarify the role of the teacher in the learning process as well as for students to be able to learn independently.




**f. Concept maps**

The concept map is a general description of the material that will be studied by students in a hierarchical manner. The use of concept maps aims to make it easier for students to remember the main concepts that will be studied in statistical material. As in the table of contents, the concept map is also automatic so that users can easily go to the desired section by clicking on the subtitles contained in the concept map.


**Fig 13.** Concept Map Section

**g. Apperception**

Apperception is a part that aims to make students recall the material that has been studied previously as a prerequisite material / provision needed to study statistical material. The prerequisite material is in the form of multiple choice questions related to data presentation material that has been studied in class VII. Making apperception questions is by using the quiz feature found in the Flip PDF Corporate Edition application. The question is interactive because it can be answered automatically in the e-module as well as students can check the correctness of the answers directly.

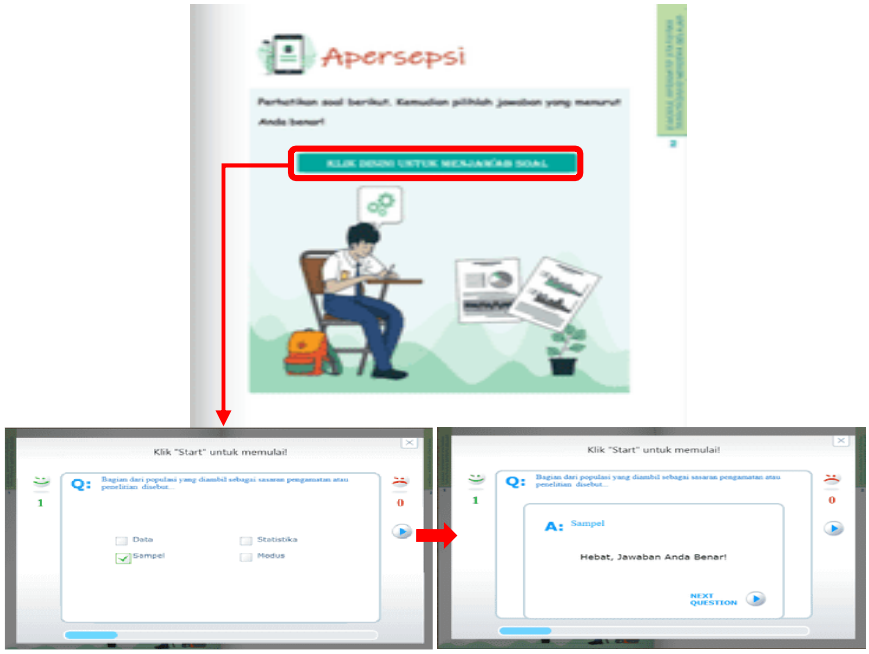



**Fig 14.** Apperception Section and Question Pieces

**h. Assignment**

After studying the learning material, the teacher and students reflect on the activity by working on a project. Students are invited to apply their knowledge of class VII statistics.


**Fig 16.** Provisions for the Implementation of Project Tasks

**i. Evaluation**

The evaluation contains multiple choice questions that aim to measure the achievement of students towards the learning objectives that have been formulated in the interactive e-book. The evaluation question sheet can be answered on the google form via the link that has been embedded at the end of the question sheet. Students answer questions by clicking on the available options A, B, C, or D. If all the questions have been answered, students can see the final score and correct the work results through the available answer keys.


**Fig 17.** Evaluation Section

**j. References**

The bibliography section contains sources that are used as references in making interactive integrated e-modules for independent learning on statistical material. Users can download these various reference sources through the links provided.


**Fig 18.** Bibliography Section on Interactive E-Modules

**k. Glossary**

The glossary is a section that contains a list of important terms along with definitions for these terms contained in the interactive e-module. The glossary aims to assist students in knowing the meaning of difficult terms so as to make it easier for students to understand the material.


**Fig 19.** Glossary Section and Answer Key

## IV. DISCUSSION

The development of interactive e-modules and student project sheets is needed, especially in blended learning. The use of interactive e-modules will make it easier for students to understand the concept of the subject matter given either online or offline learning. In line with the Government's policy on free learning, of course, the development of project-based learning-based learning tools will be needed. The goal is to stimulate creativity, innovation and the formation of student learning independence. so that in any condition students are able to follow the learning in accordance with the availability of resources in the environment around students.

## V. CONCLUSION

Based on the results of the study, it can be concluded that the Class VII Junior High School Mathematics E-book and Student Project Sheets developed using the Flip PDF Corporate Edition application are feasible to use. Judging from the aspects of validity and practicality. Judging from the validity aspect, the interactive e-book has met the validity criteria based on the assessment of the material and media validators with the same average score of 3.67 with a very decent category. As for the practicality aspect, the interactive e-module has met the practicality criteria based on the results of student and mathematics teacher responses with an average score of 3.50 (87.5%) and 3.64 (91%) in the very practical category. Thus, the VII Grade Junior High School

Mathematics e-book is declared feasible because it can and is very practical to use in the learning process. Likewise, the given project sheet is able to stimulate students to achieve learning independence in the medium category (Mean 3.27 on a scale of 5).

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