Development of online learning device based on demonstration models on heat transfer materials

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Abstract. Whether we realize it or not, the faster and rapid development of technology has an impact on the faster and faster progress in the world of education. During the current covid-19 pandemic, much needed online learning tools, the concept of home-schooling has never been mainstream in the national education discourse. Because the teaching system has been changed through online learning, there is a need for the development of learning tools for teachers to be able to continue delivering material to their students. This study aims to develop online learning tools based on demonstration models on effective heat transfer material during the covid-19 pandemic. The development of this research uses the ADDIE model with stages of development: 1. Analysis, 2. Design, 3. Develop, 4. Implement, 5. Evaluate. Learning tools are made online to make it easier for teachers and students to carry out teaching and learning activities during online learning. Validation was carried out by 3 experts, namely media experts, material experts, learning experts and tested on students. The results of the analysis of the validation of material experts obtained an average percentage of 86.80 % in the very high category, the results of the analysis of learning experts obtained an average percentage of 88.70 % with a very high category, the results of the analysis of the media expert obtained a percentage of 86.70 % with a very high. The subject was tried in class XI high school. Data collection instruments using a questionnaire through the Google form. From the results of the development of online learning tools based on online demonstrations on heat transfer material obtained learning tools (Free Learning Implementation Plan, Worksheet and online media) have been tested for eligibility by experts and field trials with good criteria and are suitable for use.

1. Introduction
1.1. Background
Whether we realize it or not, the faster and rapid development of technology has an impact on the faster and faster progress in the world of education. During the current co-19 pandemic, much needed online learning tools, the concept of home-schooling has never been mainstream in the national education discourse. Although increasingly popular, the application of online learning (online learning) has also been limited to the Open University, lecture programs for employees at a number of universities and additional courses (online courses). However, because the teaching system was changed through online or distance learning, so it is necessary to develop learning tools for teachers to be able to continue to deliver material to their students well. Since the outbreak of COVID-19 epidemic, the higher education institutions in order to implement the requirements of no suspension of
learning, no suspension of teaching during the COVID-19 period, the Chinese Universities organized the largest e-learning and online instructions with the largest scale ever. Therefore, the largest number of online courses and the widest coverage of all of the courses are on-line in a very short period of time. This is a quick response to the epidemic, however, it is also a big challenge for most of the instructors who get used to lecture the courses offline in the classrooms [1]. Minister of Education and Culture Nadiem Makariem’s statement on the Learning Implementation Plan (Free Learning Implementation Plan) 1 sheet, which includes education units, subjects, classes / semesters, subject matter, time allocation, basic competencies, learning objectives, learning activities, and assessment is called the Free Learning RPP [2]. Generally, e-learning and online instructions environments utilize interactive network system to enhance the quality of teaching and learning by managing content provided to learners across various learning activities [3]. During the Covid-19 pandemic, teachers were required to change the learning system directly into online learning. In class learning, teachers are required to use learning models. One model of learning is the demonstration model. But because of this online system, During the Covid-19 pandemic, teachers were required to change the learning system directly into online learning. The effective learning process in education is needed because it is highly influential for the development of students’ learning. On the other hand, students are expected to be able to master all the subject matter provided by the teacher. To achieve the learning objectives on each subject matter, students must achieve a minimum mastery of 75% of the whole material. All children should fully understand what is taught [4]. An interactive demonstration generally consists of a teacher demonstrating the use of a tool and then asking questions about what will happen. Interactive demonstrations are not only used as laboratory activities, but can be used as part of the inquiry process [5]. Demonstration learning model is a way of teaching that is done by using a demonstration to clarify an understanding or to show how to do something for students. Based on the results of the needs analysis carried out contained in Figure 1.

![Graph Analysis of Student Needs](image)

**Figure 1.** Graph Analysis of Student Needs

Based on Figure 1 above, it can be seen that students’ understanding of physics concepts in heat transfer is 58.48%, the use of physics learning devices is 62.1%, the achievement of learning media use is 33.05%, the demonstration model use is not yet achieved by 85% , the need for developing learning devices is 85.8%. So it was concluded that students need demonstration-based learning tools on heat transfer material due to the low model used by teachers during online learning, the quality of the use of instructional media is still lacking and the use of learning models for heat transfer materials is not used during online learning. In addition to students, there is also a need analysis of the teacher, while the results of the teacher needs analysis can be seen through Figure 2.
Based on Figure 2 above, it can be seen the achievement of students’ understanding of physics concepts in heat transfer by 43%, the use of physics learning devices by 67%, the achievement of the use of learning media by 77%, not yet achieved the use of demonstration models by 44%, teacher interest in development needs learning device by 100%. Then it can be concluded that teachers need demonstration-based learning tools on heat transfer material for online learning. Because every teacher needs the development of learning tools for distance learning as the demands of the times that occur in the current era, it can be seen from the graph that 100% of teachers agree with the development of learning tools to be developed. Therefore, a demonstration-based online learning tool is the right solution for teaching and learning for teachers and students. Because in teaching, teachers have an obligation to prepare learning tools in the learning process. Learning device is a device used in the teaching and learning process. Therefore, every teacher in the education unit is obliged to develop learning tools that take place interactively, inspiratively, fun, motivating students to actively participate.

1.2. Literature Review
In the learning process can not be separated from the learning device. Because the learning device is a teacher’s equipment in the learning process. Learning devices can be interpreted as completeness tools used for learning. From this understanding we can know that learning tools are important in the learning process. Because this learning tool can be used as a guide for both teachers and students. In the learning device there are several components which consist of:

1.2.1. Syllabus
Syllabus is a learning plan for a particular group of subjects / themes that includes core competencies, basic competencies, subject matter / learning, learning activities, indicators, assessment, time allocation, and learning resources / materials / tools. Besides the syllabus is also a translation of core competencies and basic competencies into the subject matter / learning, learning activities, and indicators of achievement of competencies for assessment.

1.2.2 Learning Implementation Plan
RPP is a guide to teacher activities in learning activities as well as a description of student activities related to teacher activities. Learning implementation plans can also be interpreted as plans that describe the procedures and organization of learning to achieve a basic competency set out in the Content Standards and outlined in the syllabus.

1.2.3 Student Worksheet
Student worksheets are student guides used for conducting investigations or problem solving activities. This activity sheet can be a guide for developing cognitive aspects of the exercise or a guide for developing all aspects of learning in the form of an experimental or demonstration guide. So that we can know that LKS is a student guide that is used to solve a problem in the development of cognitive, affective, and psychomotor aspects of students.

Simplifying the Learning Implementation Plan (RPP) in accordance with Permendikbud number 14 of 2019 dated December 13, 2019 is one of the new breakthroughs made by the Minister of Education and Culture Nadiem Makarim, he said the simplification of this RPP was dedicated to teachers in order to ease the administrative burden of teachers, he also added further the Ministry of Education and Culture will provide several examples of short RPPs that are sufficiently done on one page. Responding to the new policy, teachers appreciated the Ministry of Education and Culture’s Basic Education Policy which would simplify the Learning Implementation Plan (RPP). So far, the administrative burden arising from the preparation of lesson plans is often complained by teachers. As reported previously, Minister of Education and Culture Nadiem Makarim will simplify the RPP to just one sheet, but includes the elements needed in learning. Based on Permendikbud Number 22 of 2016 concerning Basic and Secondary Education Process Standards, Plans Learning Implementation (RPP) is a plan of face-to-face learning activities for one or more meetings.

The lesson plan is developed from the syllabus to direct the learning activities of students in an effort to achieve Basic Competence (KD). Dozens of RPP components are simplified into three core components that can be made on one page, namely learning objectives, learning activities, and assessment or learning assessment. The remaining components are only as a complement and can be chosen independently by the teacher as needed. According to Nadiem, it can be the focus of building students’ character education. Based on the existing Learning Implementation Plan (RPP), the teacher must fill in with at least 13 components in the lesson plan, but now the long component is only three main components. The three main components are contained in one sheet far less than dozens of sheets that had to be filled. The existing lesson plans have only been a burden on teachers. Various RPP formats start from the curriculum implemented until the revision kurtilas have undergone various concept changes. The term also experienced various changes. The goal remains the same, namely learning planning before entering class. The concept of RPP with the existing format so far is considered rigid. In addition there are too many formats with 13 components in one lesson plan. Then the teacher arranges their own RPP per Basic Competency (KD) according to the field of study they are in.

Online Demonstration Learning Model is a teaching model that uses demonstration to clarify an understanding or to show participants how to do something. Syntax The online demonstration learning model consists of 7 stages, as follows: Competency information; a general description of teaching material; dividing the task of discussing the material for each group; appoint students or groups to demonstrate their parts; classroom discussion, inference and evaluation; and reflection.

2. Research Method
The type of the research is research and development. The development model used is ADDIE. [6] It is one of the systematic learning design models, chosen based on the consideration of this model is developed systematically and rests on the theoretical foundation of learning design. This model is structured programmed with sequences of systematic activities in efforts to solve learning problems related to learning resources that are in accordance with the needs and characteristics of students. This model consists of five step, namely: (1) analyze, (2) design, (3) development, (4) implementation, and (5) evaluation [7]. Visually the ADDIE Model steps can be seen in Figure 3.
Validation in this study was obtained by distributing questionnaires to each expert namely a media expert, learning expert, material expert and one teacher. The initial step is analyzing the needs of teachers and students regarding the demonstration-based online learning tools on heat transfer material. Data obtained from teachers and students through a questionnaire distributed via Google form. Furthermore, online learning tools are designed to be developed which consist of the Merdeka Belajar lesson plan on heat transfer material using demonstration learning models, worksheets, and online media. Next, online learning tools are developed that are needed by schools, teachers and students that were previously designed. Next is the implementation of media developed in high schools. Students try demonstration-based online learning tools on heat transfer material as learning media, implement a sequence of learning information that has been made on the online media ‘Schoology’ that has been prepared. The last is an evaluation conducted by material experts, media experts, learning experts and physics teachers to assess the feasibility of developing media.

3. Result and Discussion
The product of this research is an online learning device based on a demonstration learning model on heat transfer material. The tool developed is the Free Learning Plan (RPP) namely:

LEARNING IMPLEMENTATION PLAN (RPP)

| School                        | Senior High School of Daarul Islah Cilegon |
|-------------------------------|--------------------------------------------|
| Lesson                        | Physics                                    |
| Class / Semester              | XI / 1                                     |
| Theory Principal              | Heat Transfer                               |
| Allocation Time               | 2 X 45 Minute (1 meeting)                   |

1) Basic Competency (KD) and Learning Objectives

| Basic competencies | Learning objectives                                                                 |
|--------------------|--------------------------------------------------------------------------------------|
| 3.8 Analyzing the influence of the chart and heat transfer in everyday life. | After online learning, students are expected to analyzing heat transfer by conduction, convection and radiation, can identify the factors that can affect the heat transfer by conduction, convection and radiation, and can apply the application of heat transfer in daily life. |

2) Learning Activities

a. Teachers and students use the Zoom and Schoology application to do online
learning. Personal Meeting ID Zoom: 375 260 2697, Pass.: 6B51Df.

b. The teacher starts the learning with greetings, pray and check the attendance of students. Students get motivation from the teacher and students are given apperception of the previous material by the teacher.

c. The teacher conveys the learning objectives. The teacher asks various facts about what the teacher has told during apperception.

d. Individual students pay close attention and record various facts found when the teacher tells a story. After that Based on the story from the teacher, students raise questions that correspond to what is being observed.

e. The teacher assesses students’ observing skills.

f. Learners ask questions about matters relating to the events that are presented at the beginning of learning (apperception). After that The teacher assesses students’ skills in terms of asking.

g. Students are given a video display of some examples of heat transfer in daily life without turning on the sound. Video Link: https://www.youtube.com/watch?v=omO0b012KxA https://www.youtube.com/watch?v=fLEuYtlKE

h. Students in groups are asked to experiment with gas expansion according to the steps in the worksheet.

i. The teacher assesses students' attitudes in group work and guides / assesses the skills to try, use tools, and process data, and assesses the ability of students to apply concepts and principles in problem solving.

j. Each group concludes the results of the discussion.

k. The teacher guides / assesses the ability of students to process data and formulate conclusions.

l. Representatives from the group present the results of the group discussion.

m. The teacher assesses students' ability to communicate verbally.

n. Students make conclusions about learning outcomes about heat transfer.

o. The teacher provides reinforcement to students who are already active in learning.

p. Give students homework by looking for examples of heat transfer events that occur in everyday life.

q. The teacher gives examples of questions and assignments to students.

r. The teacher informs the next learning and closes the learning activities and ends the learning with greetings.

3) Assessment

Section 1.01 Knowledge, Attitude, Psychomotor Assessment

Cilegon, 11 June 2020

Physics Teacher

Widia Tri Priane, S. Pd

The Free Implementation Plan has been validated by 7 validators consisting of 2 media experts, 2 material experts, 2 learning experts and 1 teacher.

3.1. Results of media expert validation
The results obtained by the validation of media experts in validator 1 amounted to 85% and validator 2 amounted to 88%.

3.2. Results of material expert validation

The results obtained by the validation of material experts in validator 1 amounted to 87% and validator 2 amounted to 90%.

3.3. The results of the learning expert validation

The results obtained by the validation of learning experts on validator 1 by 87% and validator 2 by 90%. The results of the validation of online learning tools in the form of the free learning plan in this study obtained an average of 3 experts consisting of material experts, media experts, learning experts and one teacher presented in Figure 7.
Based on the average results of the three experts with an average score of 87.4\% and suitable for use as a medium of learning in schools. The results of the validation of the media experts showed 86.7\% which is very good. The results of the material expert validation showed 86.8\%, which is very good. In this study, the learning implementation plan was tested on students through the zoom application as below and students are given student worksheets by the teacher as shown in figure 8 and figure 9.
4. Conclusions

Online learning tools based on online demonstration models on kaor transfer material can make it easier for students and teachers in the online teaching and learning process of the Covid-19 pandemic and for online-based learning. This learning tool has been tested to experts with an average score of 87.4% and is suitable for use as a medium of learning in schools. The results of the validation of the media experts showed 86.70% which is very good. The results of the material expert validation showed 86.80%, which is very good. The results of learning validation showed 88.70% very good. Thus, the development of demonstration-based online learning tools on heat transfer material has proven to be effective in online learning.

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