Computer Based Test (CBT) using Moodle-based High Order Thinking Skills in network design subjects

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Abstract. This study aims to determine the description of the process of making CBT-based question instruments and the level of valid instrument tests. The procedure developed in research is Research and Development (R&D) with a Moodle-based web system. The results of the test instrument validation for each number with an average at intervals of 84.2 to 100, the results of CBT based Moodle validation have an average of 90.65% which means it is very valid, the difficulty level of easy question categories with intervals of 0.82 to 0.92, the medium category with an interval of 0.50-0.67 and a difficult problem category with an interval of 0.21-0.28 the next distinguishing power has an interval of 0-0.75.

1. Introduction

The research that adopted Codeigniter as a platform in making online test questions, it was successfully implemented in the classroom [1]. The above statement is an inspiration in making computer-based tests using a learning management system (LMS) platform. LMS development requires good planning that is organized so that development can be delivered overall learning objectives. LMS is available in a variety of options, including online tutors, interactive whiteboards, online classes, Moodle and more. Moodle is free open source software [2]. Moodle is a learning platform that is designed to be used by educators, administrators, and students as a reliable and secure integrated system so that it becomes a learning environment suitable for every user [3].

Patterns of learning in the 21st century that is learning that integrates the capabilities of knowledge, skills, attitude, and mastery of ICT. These capabilities can be developed with some of the learning models based on activities that fit the appropriate competence characteristics one of them with the development of higher-level thinking skills (High Order Thinking Skills / HOTS) appropriate education in preparing students in the 21st century. HOTS characteristics can assist students in presenting arguments well, sort out the concept in a logical and clear, able to hypothesize and solve problems, and to know the complicated things become clearer. Technological developments have affected all aspects included in the learning development process often encountered things that computer-based examinations and tests help in facilitating the learning of students with an online-based application that is Moodle [3]. Moodle provides learning that can be accessed online also provides the manufacture of multiple-choice tests, the description, bernard-one, match. This condition refers to students who are still difficulties in analyzing information and tend to be passive in asking questions. Based on these problems there are efforts made by developing higher-level thinking test instruments by using Moodle-based e-learning.
2. Literature review

2.1. Test instruments
Tests are procedures/tools used to know something according to the rules that have been set usually in the form of questions, tasks, and commands - the commands to be done. The test was given after learners taught some earlier material, the test aims to determine the learners' mastery of the achievement test should be able to measure the proficiency of learners in understanding yang already given. The test can be used for teachers and schools as a placement student proficiency level among friends - friends. Tests have various forms one multiple choice. The multiple-choice test is a set of instruments that determine the response of alternative answers that have been provided [4].

2.2. High-Level Thinking Skills (HOTS)
According to an understanding of some experts explain that the definition of HOTS the thinking at a level higher than just telling laidback or remembering a fact which has heard from other people, at this stage requires students or someone to understand, connect and concluded based on the facts and by applying the concept of a problem sous. In general, the instrument type HOTS on activities assessment determines proficiency: (1) Move one concept to another concept (2) understand the interrelationships between the different information - different (3) work and use the information that has been obtained (4) examines the information and ideas critically, Puspendik 2017 describes an instrument with the type of HOTS can train students to think in terms of levels of analysis (C4), synthesis (C5) and evaluation (C6). In preparation of this type generally use about the matter with a stimulus, the stimulus presented should be interesting and contextual. The stimulus can come from the issues - global issues such as the economy, infrastructure, education, health, science, and information technology. A stimulus is presented on issues around environmental education unit and the case - the case of the area.

2.3. Moodle
Moodle is too long of Modular Object-Oriented Dynamic Learning Environment, this application allows users to implement a system with the concept of e-learning (learning electronically) and distance learning (learning rarely far) with this concept teaching and learning systems can be done anywhere and anytime as long as it's connected with an internet connection. Moodle permits so that users can incorporate in digital classrooms to access course materials, electronic journals, quizzes. Some of the subject matter that may be published by the teacher that is a word processing application, presentation materials, lessons in audio and video format, material support ex format and flash animations [2,5].

3. Methods
Method development in research using the Research and Development (R & D) which is a method that aims to get the new products through the development of products in the form of verification of learning and education to produce the products used are researched and evaluate the feasibility analysis needs to function in society-wide. The research focuses on the development of test instruments Moodle-based learning media. The instrument is made in the form of questions and quizzes scrom bang package that is implemented on the subjects of network design. According to the 2016 procedure or step the planning development planning instruments can be seen from the pictures flowchart with the writing phase grating - grating, writing about, research (qualitative analysis), the assembly problems, test questions, Quantitative analysis of problems and selection problems. The development chart has several phase changes tailored to the needs of researchers at the school.
In Figure 1, stage researchers in developing the problem with the early stages of determining the purpose of the test until the final stage which has a valid instrument included in the Moodle learning media.

In Figure 2, stage researchers in developing the problem with the early stages of determining the purpose of the test until the final stage which has a valid instrument included in the Moodle learning media.
3.1. Data analysis technique

Analysis techniques used in the study: (1) Analysis of the validity of the problem (2) Analysis of media validation (3) analysis about the difficulty level of data obtained from the responses of the students (4) distinguishing matter.

(1) The results of the analysis of matter obtained through the validator assessment of instrument tests obtained with the calculation [6]:

\[ V_a = \frac{TS_e}{TS_h} \times 100\% \]

Information :
\( V_a \) = value obtained validator
\( TS_e \) = total score obtained
\( TS_h \) = total maximum score

(2) the validity of the results obtained by giving feedback based on criteria very valid, invalid, pretty, pretty valid, is less valid, invalid. These results were obtained from the calculation [6]:

\[ HR = \frac{\sum_{i=1}^{5} n_i i}{N \times i_{\text{max}}} \times 100\% \]

Information :
\( n_i \) = number of validators that have value i
\( i \) = weight value of quantitative assessment (1-5)
\( N \) = number of validators
\( i_{\text{max}} \) = maximum value

| Table 1. Assessment criteria [7]. |
|----------------------------------|
| Category | Value | Weight | Percentage (%) |
|----------|-------|--------|----------------|
| Very valid | 5     | 81 - 100 |
| Valid     | 4     | 61 - 80  |
| Valid enough | 3     | 41 - 60  |
| Less than valid | 2    | 21 - 40  |
| invalid   | 1     | 10 - 20  |

(3) Level of difficulty matter, this analysis was designed to determine the matter being tested has a category of easy, medium and hard [6].

\[ P = \frac{B}{J_s} \]

Information :
P = index of difficulty
\( B \) = the number of participants who answered correctly
\( J_s \) = total participants

| Table 2. Classification of the level of difficulty [7]. |
|-----------------------------------------------|
| difficulty level | Classification       |
|------------------|----------------------|
| 0.0 ≤ TK ≤ 0.30  | Difficult Question   |
| 0.31 ≤ TK ≤ 0.70 | Medium Question      |
| 0.71 ≤ TK ≤ 1.00 | Easy Question        |
(4) Power distinguishing about the ability an item to differentiate among the aspects measured in accordance differences d in Group [6].

\[ DP = \frac{B_A - B_B}{J_A - J_B} \]

Information:
B_A = number of test-takers answer the group on the right
B_B = number of participants of the test group who answer the question below correctly
J_A = number of participants of the test group over
J_B = number of participants under the group test

| Distinguishing power item | Information                                      |
|---------------------------|--------------------------------------------------|
| 0 – 0.20                  | Item items have weak distinguishing power         |
| 0.21 – 0.40               | The item items have a moderate distinguishing power|
| 0.41 – 0.70               | The item items have good distinguishing power      |
| 0.71 – 1.00               | The item items have very strong distinguishing features |
|                           | The item items have very poor distinguishing power |

4. Results and discussion
This research resulted in the Moodle-based media containing multiple-choice questions test instruments and quiz activities such as SCROM discussion package. The figure 3 is the study course page views of students on the course menu, available several modules related subjects could download it by the students.

![Figure 3. Course menu display belongs to students.](image)

The following figure is an additional display quiz form scrom Network Design package, admins and teachers can also add to bang about and set are not visible from the students. Research and Development (R & D).
Figure 4. Additional page views quiz.

Figure 4 is a quiz to see early entry form filling hint about by students.

Figure 5. Display charging instructions about.

Figure 5 in the form of a quiz to see that done by the students, numbering about 30 multiple choice questions with 10 points each number comes with working time.

Figure 6. The initial view of workmanship quiz.
Based on the figure 7 the results of the assessment of the two validators show aspects of the format has a value of 96%, 93.3% stated ilustrasi aspects, language aspects 80%, the content aspect with a mean 93.3% - the overall average of 90.65% stated aspects of the media is very valid and deserves to be applied in research.

![Figure 7. CBT based Moodle validation results.](image)

4.1. Level of difficulty problem analysis results
The result of the difficulty level of the test instrument from the test results is obtained at intervals of 0.82 to 0.92 show category easy matter at the number 1 to 15 that many of the participants chose the correct answer on the question, the category of matter being has the interval from 0.50 to 0, 67 in numbers 16-24 which participants choose between right and wrong answer balanced, category have a difficult matter interval from 0.21 to 0.28 on the number 25 to 30, meaning that only a few students were able to answer questions correctly.

5. Conclusions
It can be conclude that based on the analysis of research as for some of the procedures that have been made in the research are: a) Establish the purpose of assembly tests, b) Preparation of lattice - lattice matter, c) Writing about / test instrument, d) Analysis items/review process test instruments, e) repair matter, f) Implementation of moodle learning media, h) Calculation of test results. Products produced using multiple-choice tests on subjects tested Design Build Network via e-learning Moodle.

Validation results from four aspects about the valuation aspects of formatting, illustration, language, and content has the average - average 90.65% to the criteria very next valid instrument validation results of tests on each number has an interval with a value of 84.2 to 100 showed improved results following advice validator. Results of analysis about the difficulty level of easy categories with the interval from 0.82 to 0.92. The problem category of being at intervals of 0.50 to 0.67 and about the difficult category has the interval from 0.21 to 0.28. Results of the analysis of test items show different power categories of good, fair and weak with the value of the interval from 0 to 0.75.

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