

Development of Web-Based Learning Tools Oriented to Increase Student Skills

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Abstract—This study aims to explain stage development of web-based learning tools which oriented on improving the student's skill about building material testing and the effectiveness of skill increases. The learning tools consist of material, job sheet, and instrument evaluation. Development model refers to ADDIE model. The analysis method is descriptive. Development model involving validator to assess the instrument. Preliminary testing and field testing relating to a student of Building Engineering Education who took subject Building Material Testing. There is five-step process analysis, design, develop, implement, and evaluate. The analysis step resulted that learning condition with conventional model and learning process was not effective. The purpose of design stages is to prepare the design of learning tools with using website. In developing step, the feature of tools and instrument created. Implementation of the tool held in main field testing for 40 students and resulted well student response. Evaluating step is an analysis of student skill and the effectivity of tools. Learning media based on the website is effective to increase student skill. The activity of student and teacher were active and indicated that media is feasible to use in university.

Index Terms—Web-based learning, student skills, building material.

I. INTRODUCTION

Civil engineering education is responsible for preparing graduates with technical and professional skills, these skills are very useful for the career of educational employment graduates. Many industries need graduates with professional skills and well-developed technical knowledge [1], [2]. In college, learning experiences in laboratory is expected to improve students' skill. Nevertheless, the problems of student are a lack of references access, such as accessing book and many others learning resources. The problems require learning tools which can be accessed easily by students. The teaching-learning process should be designed to involve learners in each stage and make effective process [3].

The learning process is a system that integrates various components. Each element has an own function with the intention that learning goes by activating students and teachers. Learning activities require interaction between students and their learning environment, teachers, friends, tools, learning media and other learning resources. In addition, the characteristics of learning are related to components such as goals, materials, strategies, media and evaluation of learning [4]. Achievement of learning objectives is supported by communication process. The communication process is realized by exchanging messages or information in the form of knowledge, skills, ideas and experience.

One subject in Department of Civil Engineering Education is Building Material Testing. This study aims at providing knowledge and student skills about building materials testing. The development of quality measurement techniques for developing building materials encourages teachers to create practical and easy-to-understand teaching materials to students. Diverse teaching materials and complicated testing stages require considerable time and energy. Furthermore, the learning process on the subject of equipment testing should be supported by effective and easy-to-use instructional media.

Learning media that use communications technology can enhance the learning environment. This media should improve learner's spirit, timesaving, turn the student with full attention and help students' memory about learning matter. The tools of learning should use information technology. This learning media can also facilitate the working system among lecturers, technicians, and students [5]. Development of communication and technology is a vital role of learning implementation and education. Recently, teachers required to create the effective learning and interestingly for students. As a learning tool, utilization of information technology opens accessibility that almost infinite [6].

Several studies about the learning media based on information technology conducted and described function and characteristics of information technology. Information and technology can facilitate the communication process of human resources in learning management practices [7], [8]. The influence of information and communication technology in the educational process (defined as e-learning) enables students to access learning tools inside or outside of classroom. There are some characteristics of e-learning. The first characteristic of e-learning is the learning tools propose a multimedia environment and the second is incorporate several kinds of information. The third characteristic is e-learning systems support collaborative communication, whereby users have total control over their own situations of learning. In the fourth place, e-learning support networks for accessing information. Lastly, e-learning allows systems to be implemented freely on various kinds of computer operating systems [9], [10].

E-learning media can increase interaction between learners and teachers while enhancing the independent learning. The media is useful for the development of student expertise and encourage self-confidence skills [11]. Web-based learning supported by the use of web based internet technology, which is called web-based learning tools (WBTs). The tools give a chance for students to free learning without limited space and time. Web-based learning tool known as learning objects is generally can be used for

science education. The tools can support the learning process which is effective, efficient and engaging[12]. The learning tools using internet media can extend the opportunities for learning greater than conventional classroom[13].

With the help of the Internet and other technologies, distance education has become a viable and valuable option for individuals who are unable to enroll full-time or part-time in traditional learning institutions. [14]. Web-based learning can encourage the students in innovations development, responsible and less dependent entirely on the lecturer. In addition, this media also quite flexible, refer to a condition that allowed students to learn any time because it is accessible for 24 hours a day and seven days a week [15]. This has not only given an opportunity for students to study during their free time but also enables them to learn at their own pace as they are given time to do so. This type of learning approach is very suitable for those who are learning at a distance.

II. MATERIAL AND METHOD

This study uses a qualitative method to describe the process development and the quality of learning model. Development process model refers to ADDIE model[16], [17]. There are five-step process ADDIE, they are analysis, design, develop, implement, and evaluate. (Fig.1) The quality of learning model refers to response of student and learning achievement

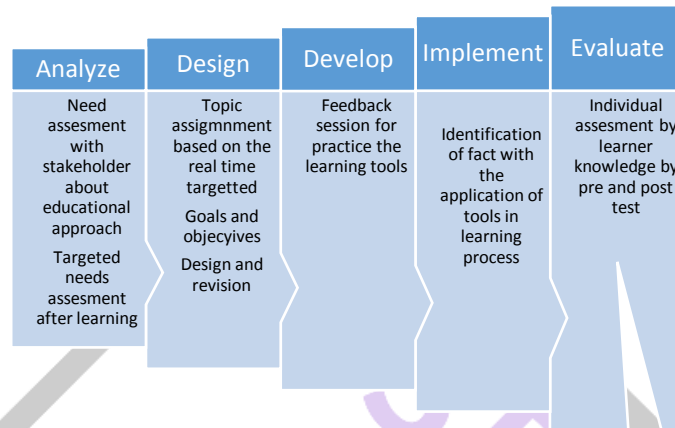


Fig. 1. Step of Addie Model

The following two sections describe the two application related works on learning model

A. Content Management Systems

Preparation of web content in accordance with the needs of learning models using Content Management System. Desktop-based CMS is easy to use and an essential tool in building an interactive website. This software allows designers to combine between learning data and information system. Thus, this software strengthens the practitioners in making learning media.[18]

B. Wordpress

WordPress as an open source blog engine, users can view and obtain the codes of software freely. Users can make modifications and develop the program in making learning media.

Validity measurement involved three lecturers. There are 40 students involved of primary field test. All research subjects are Building Material and Testing students in Department of Civil Engineering Education of Universitas Negeri Makassar. Estimation of student response and validator response is using weight of value for 4 criteria as seen in Table 1. [19]

Table 1 Weight of Value for Media Validation and Student's Response

Validator Response	Student Response	Value
Perfectly valid	Very interesting	3.50 – 4.00
Valid	Interesting	2.50 – 3.50
Less valid	Less Interesting	1.50 – 2.50
Not Valid	Not Interesting	1.00 – 1.50

Learning materials of the subject divided into two parts that concrete material and design and testing of concrete. There are seven sub-materials, and each material has many job sheet (Fig.2)

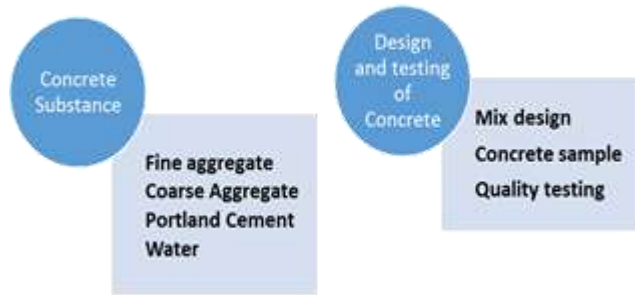


Fig 2. Learning material

III. RESULT AND DISCUSSION

Development of learning tool

The first step of development is an analysis of learning condition with the conventional model. Student skills as learning result in Building Material Testing indicates that learning process was ineffective. The evaluation resulted at the end of learning activities was ineffective. Fact shows that only around 55% students are able to finish 16 pieces of matter. The student's obstacles are the difficulties of matter and job sheet while the time allocation was limited and amount of assistance was not enough to serve the student.

The summarize of learning step are represented in fig.3

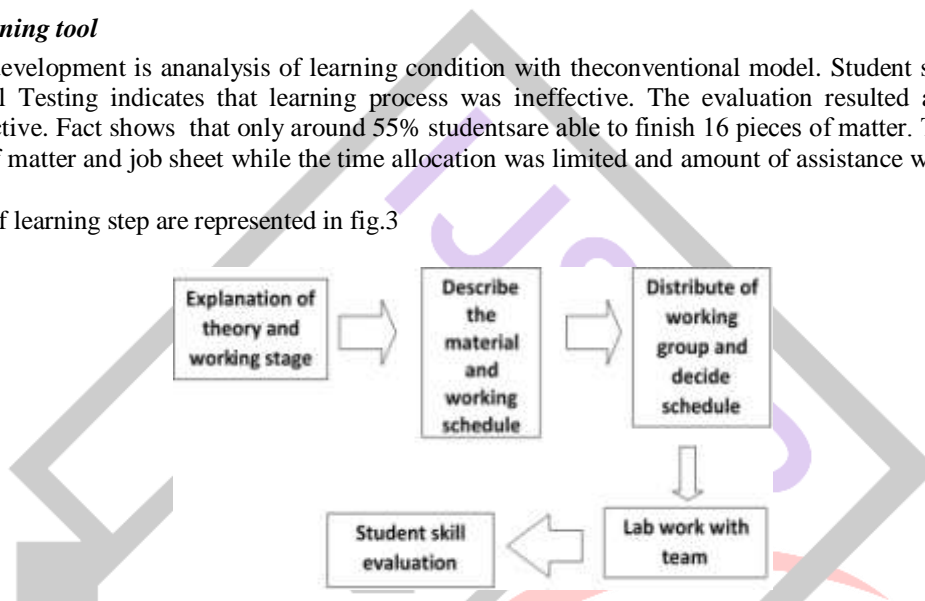


Fig. 3. Conventional learning step in Material Testing Laboratory

The second phase is the design of learning tool. The purpose of this stages is to prepare the design of learning tools using website. The stages are redesigning the product, designing the device of learning based on website, validating learning tools, and producing learning tools consists of five parts as in Figure 4.



Fig 4. Product of learning tools

The third step is developing website learning tools. The result of developing is feature and its view Table 2.

Table 2 Feature of Learning Tool

Feature	View
Home	First feature in link http://lab-ujibeton.net .
Matter	Teaching materials, job sheets, and video tutorials
Evaluation	Instrument evaluation
Forums	Discussion forum
Admin	Admin profile

The following two figures represent the display of the website. Displays on the website features include images of testing support tools as an effort to attract students.

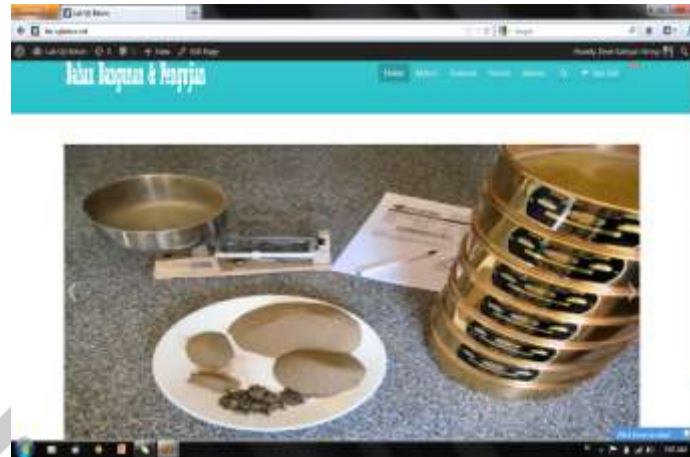


Fig 5. Design of homepage



Fig. 6. Design of job sheet feature

After completing the media, the researcher needs input about the quality of media, so that it needs validation. Validation is a critical phase in development research. Fig.7 shows the result of validation which consists of two items, they are application and display. The application refers to the accuracy of selecting software, the ease of using and navigation completeness, meanwhile display shows the accuracy of using a template, the size of the letter, background color, and animation. The result of validation indicated that media is perfectly valid.

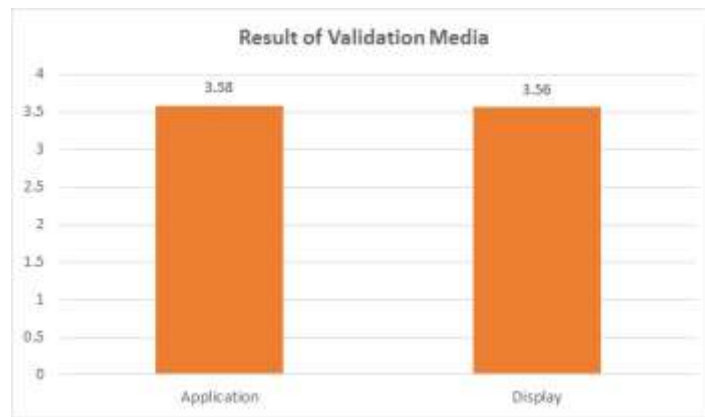


Fig7. Result of validation media

Similarly in the material validation, validator express that textbook material was perfectly valid. This test comprises four aspects refer to the description of the concept, characteristic of sub concepts, language, and construction. Assessment theory refers to material conformity with learning objectives. One of the learning materials is an aggregate that describes properties of aggregate testing such as moisture content, mud content, gradation, specific gravity, and volume weight. Knowledge of the nature of aggregates underlies students' skills in conducting material testing.

Sub-concept assessment refers to the description of the material that supports the improvement of student skills. Aggregate gradation material on sand and gravel arrangement is useful in improving students' ability in planning concrete compressive strength. Language assessment in textbooks refers to the use of language that is easy to understand and following to multiple interpretations. Construction assessment refers to material explanations that motivate students in improving materials testing skills. The validation result of four aspects of matter is presented on Fig.9. Furthermore, Fig. 8. shows an initial view of the aggregate material that containing the equipment test image. This drawing makes it easy for students to understand the contents of the material.

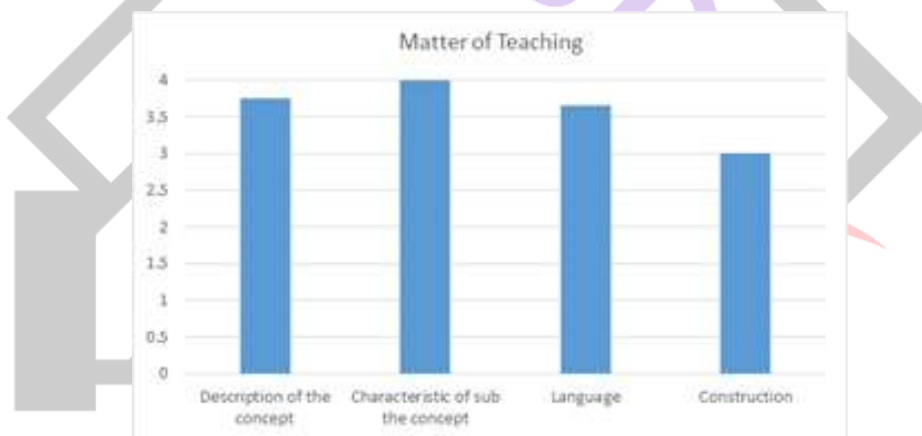


Fig 8. The Result of Material Validation in The Teaching



Fig. 9 . Initial view of sub matter

Job sheet is a tool which illustrates about work stages on practice activity. It's also been validated by an expert on the quality of content, the quality of language and the quality of report format. Job sheets include a description of the sequence of job execution for each stage of material inspection. This job sheet is a guide for students in sampling and testing. This instructional material should be described in precise language and exciting drawing tools.

Fig 10 shows the result of job sheet validation and weight of value indicate perfectly category.

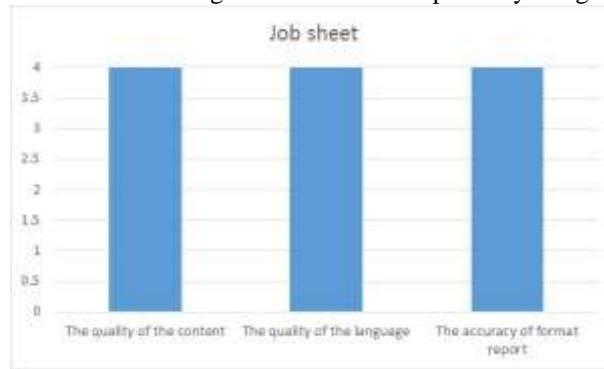


Fig. 10. The result of the job sheet

The instrument about the evaluation of result study was validated in four aspects; they are questions, construction, language and time. The result of validation of instrument presented in Fig.11

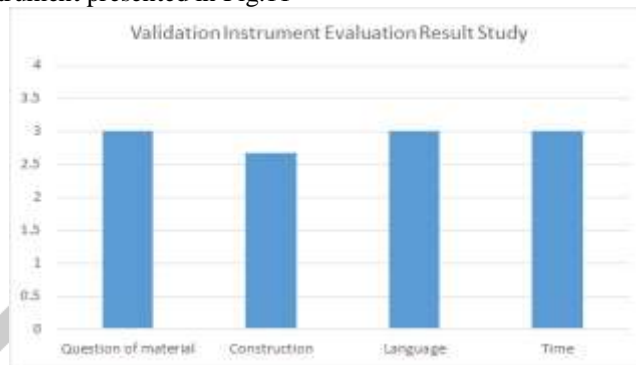


Fig. 11. The Results of the Validation Instrument Evaluation Result Study

Fig.11 illustrates that instrument evaluation is invalid with average value 2.92. Expert considered that sentence on instrument uncomplimentary and uneasy to understand by students. Based on the result textbook, job sheet and instrument evaluation, as well as recapitulation of validation in Fig.12

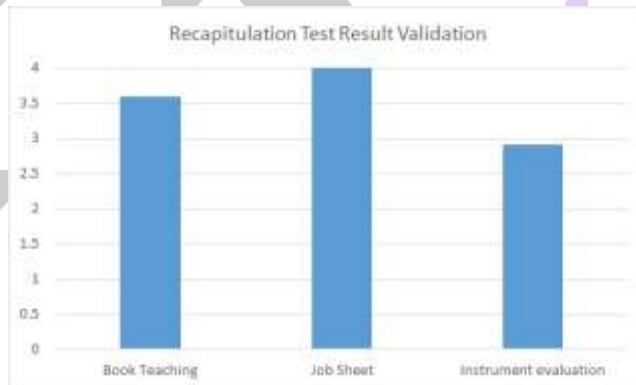


Fig.12. Recapitulation test result validation

Learning activity should be an evaluation in the implementation of tools. Instrument to assess the learning activity includes of lecturer activity, student activity, and student response. Validation result for three instruments presented in three figure below.

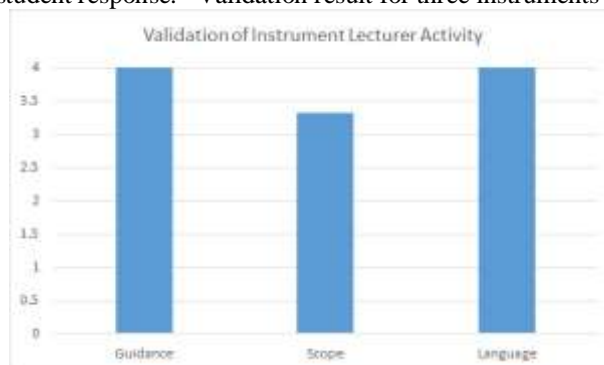


Fig. 13. The result of validation instrument activity educator

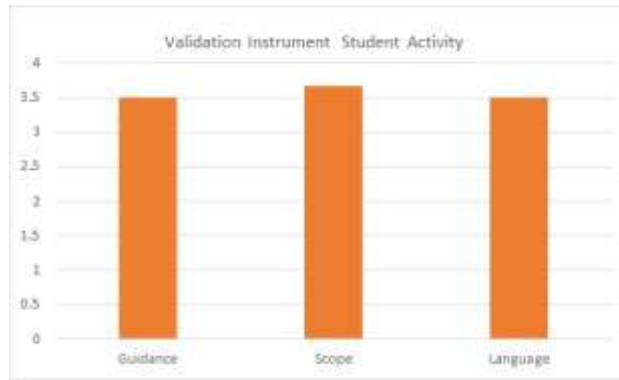


Fig. 14. The Result of the Validation Instrument Student Activity

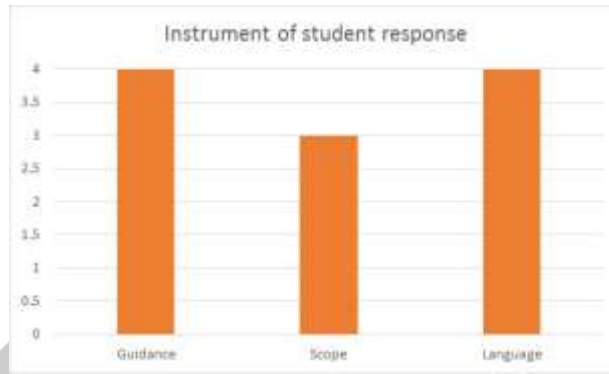


Fig. 15. Result of the Instrument Validation of Students' Response

As shown in Fig.15 that scope instrument is still limited and uncovered all activities. In guidance aspect and language are appraised perfectly valid. Table 8 shows validator considered that all characters in instrument perfectly valid to assess student activity similar with the instrument of response student. The calculation of validity for three components of learning activity shows in Fig.16. It indicates that instrument is perfectly valid.

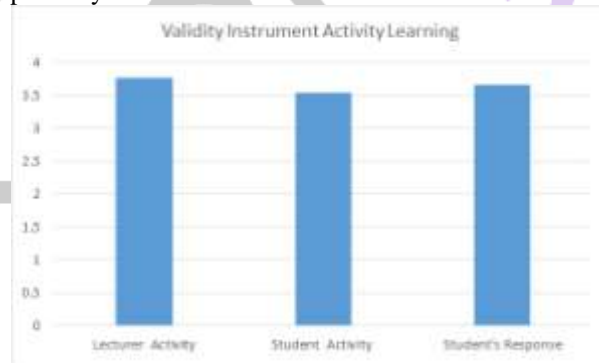


Fig.16. The results of the validity instrument activity learning

Implementation phase divided into two stages; they are preliminary field testing and main field test. The result of preliminary field testing showed the good response of students about the visualization of the subject. The response of student represented is on Fig. 17.

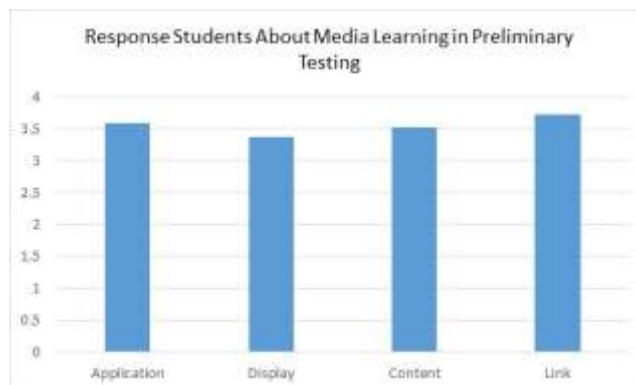


Fig.17. Students' response about learning media in preliminary test

The response of students about the application is very interesting, similar to other variables. The average for four variables is 3, 56 or very interesting. It means that the website is interesting for the student. In another word, all tools in media learning are useful for the student. The students judged that website legible and effectively as learning media.

However, there are many inputs about the quality of website obtained from students. Display of websites should be improved by using brighter color and the letter still less attractive. Therefore, the revision of product conducted for color and letter. After revision of the product, main field testing held to ensure that learning tools based website useful to increase students skill, there researcher did initial field test which involved 40 students. The test is done to find out the practicability device in Building Material and Testing Subject.

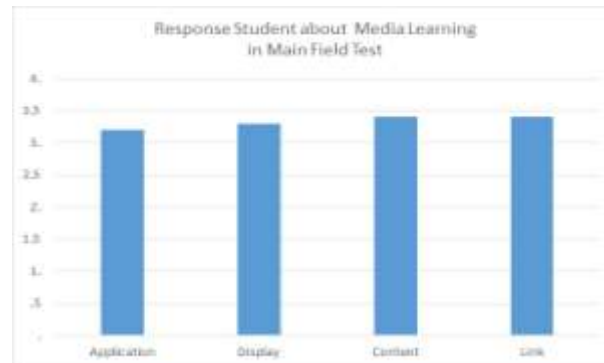


Fig.18. students' response to learning media in main field test

The result of student response in broader test indicated that learning tools are fascinating. Response value for 3.31 is lower than response value in preliminary testing. These results are likely to be related to different student impressions. So, this finding indicates that there is a positive reaction from students about learning tools. It is practically and useful to help student considering of material and work stages.

Evaluation of learning tools held by measuring the effectiveness. Feasibility of using website as learning tools is performed by measuring effectiveness which consists of three kinds of tests. Firstly, measurement of educator activity using two observers. Secondly, analysis of student activity using eight monitors. Thirdly, learning result evaluation which compares the difference between pre and post-test.

Educator activity as the result of observer indicates very well category, which is similar to student activity. The first aspect to be observed is that the application. Teacher and students are easy to operate the tools and supported by precise navigation on a website. Secondly, the display of website is interesting for students. Template, font, and size caused the interesting media. Thirdly is content which covered the systematics of material, consistency to learning goal and visual animation. The third aspect is facilitating the students to remember the stage work in material testing. The last point is the clarity of link to access the website. It is very clear for students and teacher.

Pre and post-test are using to quantify the students skill attained before and after implementation of website learning tools. Initially, the students have low skill before learning with the average value for all students is 25.27. Many facts about the student skills before the implementation of the website in the laboratory. (Table 3)

Table 3 The Facts About Student Skills

No	Item testing	Facts
1	Aggregate gradation	Students can not distinguish sieves for fine aggregates and coarse aggregates.
2	Mud Content of fine and coarse aggregate	Students do not understand aggregate leakage stage
3	Quality testing of concrete	Students are not familiar with fresh concrete test equipment and concrete strength
4	Analysis of concrete strength	Students do not understand the instruction of calculation of concrete strength.

After using website learning, the skills of students increased to a high level with average 72.9. The difference level means there was the increasing skill of student by using website learning tools. The analysis result also indicated that sig value $0,000 < 0,05$, means that the variability in the pre-test and post-test value is different. A comparison of the two test result indicates that the learning tools effective to increase the student skills.

Discussion

The development learning model should do by gradually and start from collecting data. Website learning tools developed based on problems in conventional learning. Many facts in classical learning were found in laboratory class that students were independent to do the stage work or practice their skill but only work by direction of laboratory assistant. The lack of assistant caused the student delayed to tackle their duties. On the other hand, website learning tools potentially are developed with supporting of campus facility to access the internet. Learning tools by website combined many technologies WordPress, enrichment website, and technical information.

The learning of Building Material and Testing Subject changed of the stage and presented on figure 19.

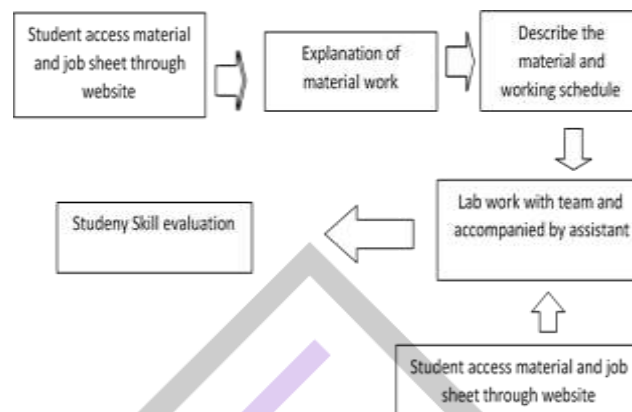


Fig 19. Learning stages of building material and testing subject by using website

The learning tools are effective to increase skills of the student. The access of media is visually easier to understand[20]. Information and communication technologies in the educative process has been divided into two broad categories; ICTs for Education and ICTs in Education. The first kind refer to the development of information and communications technology specifically for teaching/learning purposes, while the ICTs in education involves the adoption of general components of information and communication technologies in the teaching-learning process[21]. Overall, this study strengthens the idea that using ICT will change the situation for teaching, learning, and collaboration between colleagues.

The instructional impact of developing learning media with this website is the achievement of students' knowledge and skill in testing building materials. The impact of companions is that web-based learning provides an opportunity for learners to interact and discuss on many occasions, even outside the laboratory. The forum features allow for the development of discussions between teachers and students as well as among students.

The improvement of students' ability is supported by the capacity of teachers in providing learning opportunities for students to learn actively. Therefore the students can discuss learning topic and work together by doing experimentation in learning activities.[22]

IV. CONCLUSION

This study has shown that development of website learning tools consists of five stages. There are five-step process; there are analysis, design, develop, implement, and evaluate. The analysis step resulted that learning condition with conventional model and learning process was ineffective. The purpose of design stages is to prepare the design of learning tools using website. In develop step, the feature of tools and instrument created. Implementation of the tool held in main field testing for 40 students and resulted well student response. Evaluating step is an analysis of student skill and the effectivity of tools. The research has also shown that learning media based on the website is effective to increase student ability. Pre-test value is 25.27 or low level, and post-test value is 72.9 or high level. The activity of student and teacher were active and indicated that media is feasible to use in learning. Learning media based on the website is effective to increase student skill. The activity of student and teacher were active and indicated that media is feasible to use in university.

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