

## **SUPPORTING PHYSICS STUDENT LEARNING WITH WEB-BASED ASSESSMENT FOR LEARNING.**

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### **Abstarct**

Quasi-experimental research has been conducted to determine the effectiveness of the model of WEB-based Assessment for Learning (AFL). Research with posttest only control group design involves 113 freshmen at the UM Department of Physics as the study sample. All groups get the same syllabus and teaching materials. Controlled group got traditionally assessment, home work on problem solving. Experimental group could access umeac.com, the website that prepared to hold the WEB-based AFL. AFL activity for this group are as follows. 1. Working preflight before the first face-to-face in a week. 2 Working selftest and discussion forums after the first meeting in every week. 3 Work on self-assessment and formative tests after the second meeting in every week. The results showed that WEB-based AFL was effective to improve the mastery of basic concepts of physics.

**Keywords:** *assessment for learning, WEB-based, concept mastery of physics*

### **Introduction**

Assessment has been recognized as important factor in conducting effective learning (Popham, 1995: 7, Dunn et al. 2004: 16). Assessment can help teachers understand the strengths and weaknesses experienced by students in learning and decision making in learning (Lambert& Lines, 2000: 122). Assessment also provide feedback to students about their learning progress and steps taken to achieve a predetermined competence (Harlen,2003: 20, Cowie & Bell, 2002: 82). The importance of continuous assessment in the learning emphasized explicitly in the Minister of National Education No. 20 of 2007 on Education Standards Assessment (Regulation of the Indonesian Minister of National Education No. 20, 2007).

Today teaching and learning problems is the lack of assessments that provide immediate feedback on the progress of learners, known as assessment for learning (AFL) (Black & William, 2009, Khumaidi, 2005). Today's assessment is more dominated by summative assessment (assessment of learning) compared with formative assessment / AFL (Yorke, 2003). Preliminary results of Kusairi (2010) showed that some of the things that led to the difficulty to implement AFL are 1) a large number of students, 2) AFL takes

time in preparing and implementing instruments, 3) implementation of the AFL requires special skills, 4) lack of automation systems/software developed to support the AFL. Implementation of the AFL, which requires the provision of realtime feedback by teachers is difficult without the support of adequate tools and technologies (Sorensen & Takle, 2005, Denton et al., 2008).

In an effort to prepare qualified physics teachers, AFL and analysis to obtain information for the strengths and weaknesses of students learning physics is required. This is because the characteristics of the physics subject matter that abstract and tiered (Ornek et al., 2008: 30). The subject matter at the beginning is a prerequisite for studying the next subject matter. If a student was having trouble at the beginning of the material and do not get help, it is likely students will experience difficulties when studying the next material. If learning difficulties do not get treatment, the achievement of students will be low (Dufresne&Gerrace 2004, Wagner & Vaterlaus, 2012).

One innovation that can be done to support the implementation of the AFL is the utilization of information and communication technologies, especially the WEB. Heinrich et al (2009) and Denton et al (2008) reported that the use of e-tools AFL help manage tasks and save time. The use of quizzes and feedback modes to help students better mastering the concepts Nagel & Eck (2012) and encourage students to become independent thinkers (Whitelock, 2007). The implementation of self-assessment in the AFL also reported a positive effect on student learning (Basnet et al., 2011). Peat and Franklin (2002) also reported the use of self-assessment quiz is liked by the students and help them learn better. So far the use of a comprehensive Web-based AFL in a learning not yet reported, especially learning physics.

Kusairi (2013) have developed a model of WEB-based AFL to support teacher and students carry out the basic physics lectures better. The model has the following characteristics. 1. Provide opportunities for students to know the purpose of learning. 2. Provide information on the faculty of the prior knowledge possessed by students. 3. Provide a forum for students and faculty to discuss it. 4. Provide opportunities for students to practice understanding the concepts learned. 5. Provide students the opportunity to conduct self-assessment. 6. Provide information on mastery of the material and the difficulties experienced by the students after the class ends. Model of WEB-based AFL is

accessible to students outside the lecture. Model of WEB-based AFL is integrated with face-to-face learning with activities such as preflight tests, discussion forums, selftest, self assessment, and formative tests.

This study aimed to examine the effectiveness of the Model of WEB-based AFL that have been developed. Some questions are as follows. 1. Are there any differences between the groups using these model and groups using traditional assessment? 2. Is the student scores on the WEB based AFL effect on student concept? 3. Is the frequency of student activities in the Model of WEB-based AFL effect on their mastery?

### **Methods**

To test the effectiveness of the model of WEB-based AFL that have been developed, quasi-experimental research design with posttest only control group design One hundred and thirteen undergraduate students that take a basic physics course be sampled in this study. They consist of Physics Education Program' students and Physics Science Program's student. Students from offering B (physics education) and Class N (Physics science) are designed as an experimental group, while students from offering C and offering M are design for controled group. The number of students is the experimental group are 59 people and the number of students in the control group are 54 people. The research design can be described as follows.

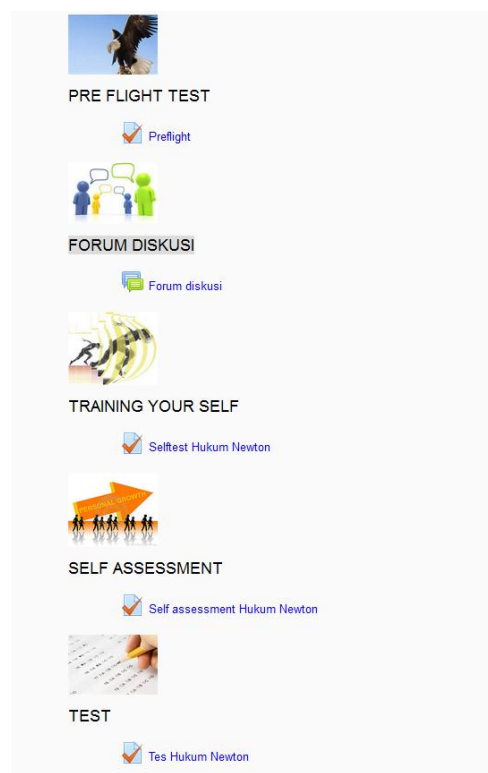
Experiment Group	X	O1
Controled Group		O2

Students on the experiment group and control group learner with the same syllabus. They also studied with the same reference book. They attend facetoface course two times a week. Teaching material and the order of presentation is not much different because the lecturers follow lesson plan and guidelines developed jointly. Students of the experimental group led by the researchers, while the control class students are guided by researcher colleagues. Teaching content involved in this study include motion in one dimension, two and three-dimensional motion, Newton's laws of motion, application of Newton's laws of motion, energy and labor, as well as the momentum.

Students of the control group and the experimental group get different treatment in terms of the assessment conducted by a teacher. Students on the control group get conventional assessment in the form of problem solving tasks given in the form of a

homework assignment. These tasks were collected in the next week, these tasks will be corrected by the teacher and returned to the student. Tasks, where students have difficulty, generally will be discussed before next meeting.

Students in the experimental group receive treatment in the form of assessment for learning is based on web technology. They can access internet sites UMEAC.COM outside the face-to-face course as they complement structured tasks. Within a week they had to do the preflight test, self test, self-assessment, and the formative tests. They were also given the opportunity to ask or discuss matters relating to the subject matter on the discussion forums. In umeac.com, student also given lectures objectives for each lecture material and how to achieve these goals by means of assessment for learning is based on web technology. Links related to the tasks that must be performed by the students can be seen in the image below.



Implementation procedure of WEB-based AFL in the learning process is as follows. 1. Before entering the lecture on a kind material, students are asked to access the preflight. Preflight contains items that related to misconceptions experienced by students. If students are having problems with an item in the preflight, the lecturer will discuss it in class. 2. Immediately after the first meeting in a week, students can access discussion

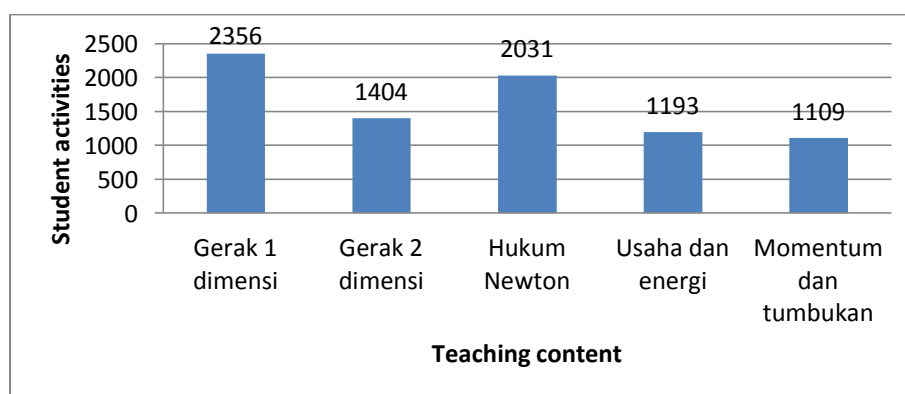
forums and self-test. The discussion forum is intended to allow each student to discuss the matter on the week, while self-test contained items that can be used by students to practice physics problems. 3. Immediately after the 2nd meeting of the week, the students have a duty to assess themselves through self-assessment and doing the test called formative tests.

The study was conducted for 5 weeks or ten meetings covering material Motion in one dimension, Motion in two and three dimensions, Newton's laws of motion. Applications of Newton's laws of motion, Energy and Work, and Momentum and Impulse. In general, students do not have problems with this model of Web-based the AFL, but some technical difficulties can occur between them. 1. Students lost password, 2. Students dropped out of the network while taking a test, and 3. The pictures on the tests can not be accessed if the network is weak.

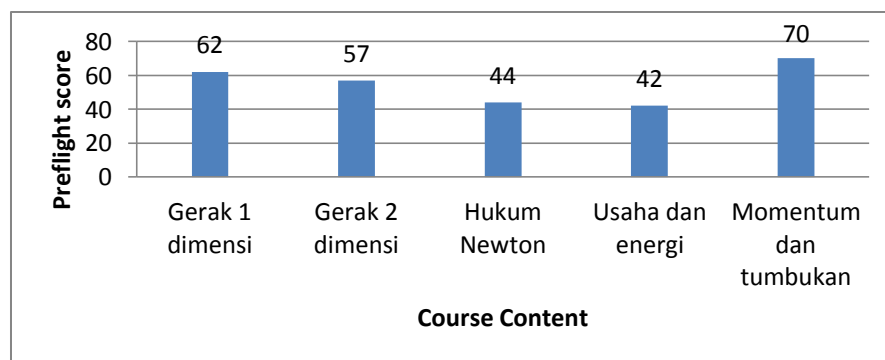
The main data in this study are data on student mastery of the physics related to the concepts learned. This data was collected by conducting written test on students involving 30item multiple choice test. Tests involving experts validity guaranteed. Prior to further analysis, it is also ensured that the tests used meet internal consistency. Data mastery of this concept will dikomparasikan using t-test in SPSS software.

## Result and Discussion

The results of the trials for several weeks showed that the activity of the students tend to decrease. In the first week, there were 2356 activities undertaken by all students. At 5 weeks decreased to 1109 activity. Decreasing the amount of activity in the use of the model can be caused by a decrease in student interest and other factors such as students have more current using the model. Student activity data can be seen in the following figure.

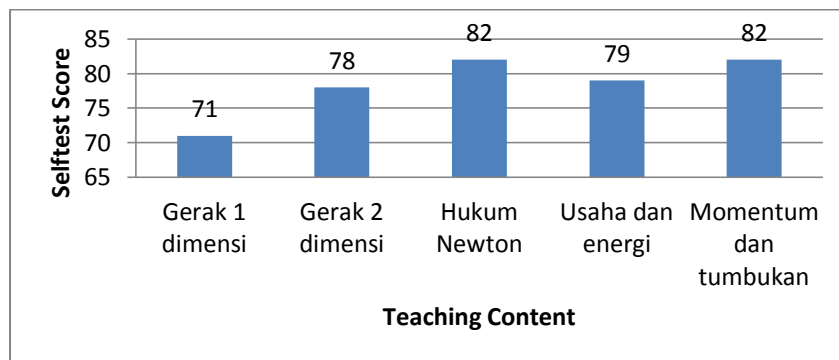


Preflight is a quiz that associated with a trend of misconceptions that experienced by the students. Usually preflight is a true-false test. Preflight can be activated several days before the first of two lectures in one week. If students do preflight and send (submit it) they will get a feedback of scores obtained. Explanation has not yet earned by students in order that students will be motivated to prepare their learning. For teacher, the results of preflight is the feedback that will be followed in the course they complement. Here are the average scores of students in connection with the service preflight from week to week.



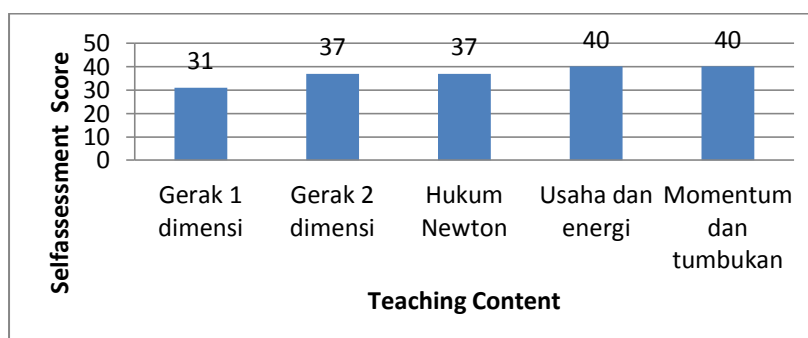
The mean score of preflight shows that for every teaching content, mostly students always have misconceptions. Misconceptions can be detected by looking at the low mean score on some matter of the preflight. Next, is the task of the lecturer to engage the student difficulties in face to face meetings.

As soon as the students and teacher are conducting the first face-to-face meetings in a week, a teacher activate self-test link. These links are provided in the hope students can independently test their mastery of concepts learned. Usually self-test are true-false test or multiple choice test. Immediately after doing self-test, students will get feedback in the form of a score and an explanation of the matter. Students can repeat the self-test if necessary. If students have difficulty relating to the self-test, the students were also given the opportunity to discuss in forum for each teaching content. The mean response of the students to the self-test can be seen in the image below.



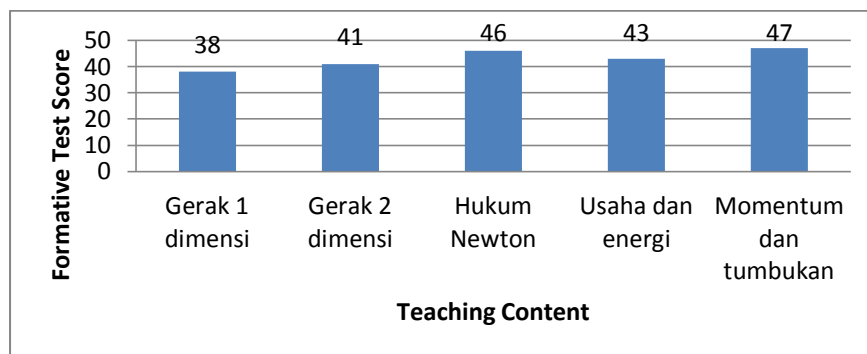
The results of self-test scores is quite good considering the students are given the opportunity to repeat this self-test maximum of one time. So, basically this link is only intended to allow the students stimulated to learn and discuss. However, the results showed that the frequency of the students in the use of discussion forums is very low.

Self-assessment is one link in umeac.com developed to allow students to do self-assessment with regard to their learning. Self assessment ask student whether they are not yet understand, need other help, understand, or can teach other about sub content. Self assessment can be completed by students immediately after the second face-to-face meeting of each week. It is necessary to increase the autonomy and responsibility of students in their own learning. For faculty, this may be a reversal of how much students have confidence related to student mastery of the material. Here is the average student answers related to self-assessment.



Self-assessment scores 75-100 has the meaning that students have mastered the material and can help others. Score of 50-75 means that the student has mastered the material. Scores of 25-50 indicate that students still need help and a score of 0-25 indicates a student does not understand the material at all. Average in the graph indicates that students generally still not confident with his ability in mastering the course material.

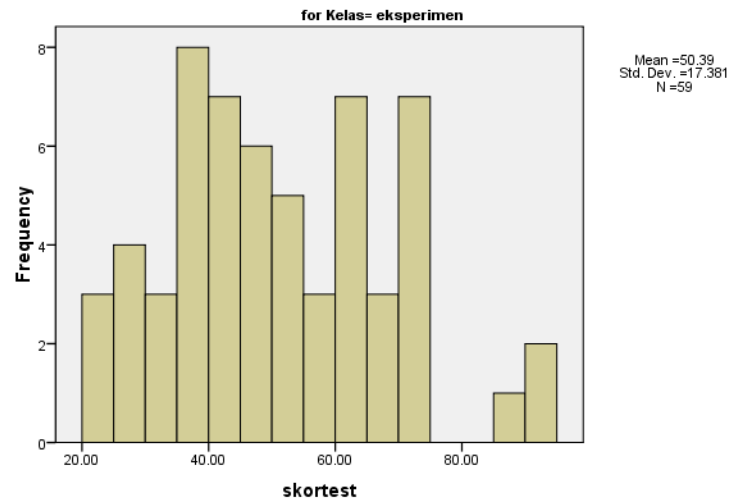
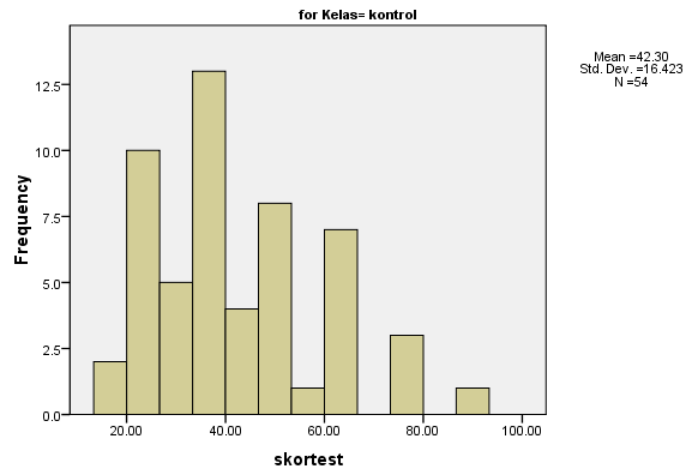
Formative test is one link in umeac.com which aims to test student mastery of the material in a lecture before the others learn the lecture material. Formative tests are also given by the lecturer immediately after the second meeting of each week. Formative tests can only be accessed once the limited time in hopes students will not cooperate in working it. The following figure shows the mean score of the experimental group students formative tests.



Formative test results show that the bulk of the students still have problems with mastery learning content. Students are expected to achieve mastery when they reach the formative test results of more than 80. The low yield is expected to give feedback to the students to learn better and give feedback to the faculty associated with the conduct of the course is done.

After treatment in the form of assessment for learning is web-based technology, measurement of student mastery of the basic concepts of measurement carried out in the experimental group and the control group by giving multiple choice questions. Here are the measurement data the experimental group and control groups





The control group had a mean of 42.29 with a standard deviation of 16.4, while the control group had a mean of 50.36 with a standard deviation of 17.38. Statistically, it can be shown that the data came from a population that is normally distributed and homogeneous. T-test results also showed a significant difference between the experimental group and the control concept of the control group. There is the influence of the use of WEB-based AFL models the student achievement of the basic concepts of physics. Students who learning with the WEB-based AFL model has a better mastery of concepts compared to students experiencing traditional assessment

The results of data analysis showed that treatment of WEB-based AFL effectively to improve student mastery of the basic concepts of physics. This is consistent with the findings of a meta-analysis of Black & William (2009) which states that generally

assessment for learning can help students to learn better. Implementation AFL is a form of learning how to learn (Lambert & Linn, 2000), information about the successes and failures of the individual will increase the level of student motivation as a result of student mastery of the basic concepts to be increased. These results are also consistent with studies of the importance of feedback in a timely and specific learning (Min and Jaw-Kuen, 2012, Cowie & Bell, 2002, Nagel & Eck, 2012).

Overall WEB-based AFL model has adopted key elements of assessment for learning (William, 2007). Preflight test is a way to know the difficulties of student lecturers and follow these difficulties in learning. The discussion forum is also a need for discussion or implementation of good communication between students and faculty and among students. Self-assessment is a vehicle for students to reflection about its efforts in learning. While the self-test support students to always be active in learning. Learning goals and how to achieve the learning objectives are also part of the model that allows students to learn. Finally formative test is how teacher provide feedback to students related to the learning objectives in some teaching content. The results obtained in this study is consistent with some findings related to the use of e-tools in the assessment (Hatzia Apostolou & Paraskakis, 2010, Heinrich et al, 2009, Denton et al, 2008, Lowry, 2005).

WEB-based AFL model has been successfully addressing the problems of assessment in which teachers are difficult to provide feedback that is timely, specific, and individual (Kusairi 2010, Khumaidi, 2009). WEB-based AFL model also helps teacher to fulfill duties as specified in the Regulation of the Minister of National Education No. 20 of 2007 on Education Standards Assessment (Regulation of the Minister of National Education No. 20, 2007). In this case the model has been to develop an appropriate instrument, has been implemented on the student, providing feedback to students and follow up on student difficulties. This is done in a sustainable manner in the learning.

Although the model has been significantly shows its effectiveness compared with traditional assessment strategies, the value of the average student in this study is still a problem. WEB-based AFL model has not managed to deliver students to achieve mastery in learning. Mean scores of students are about 50 percent. This needs to be followed to obtain further examine whether the measuring instruments used need to be repaired, or if students have problems in learning physics. The study of the implementation of

standardized tests in the department of physics (Supriyono, et al, 2014) also showed that the students also have a mastery of the physics department of the basic concepts of physics that low.

The results of this study also need to get further study given the treatment in this study only a few meetings. There needs to be a wider study involving more students and a longer treatment duration. Quiz material in this model also needs to be developed further by collaborating with the results of other studies.

The results also show that the difference in scores AFL tasks affect the development of the basic physical ability than the intensity or absence of diligent students in doing the task. If the student try hard to learn from the feedback provided by the model, such as working in earnest self-tests and formative tests, it is helping students to develop basic capabilities physics. Seriousness of students in using the model also needs to be studied further AFL remember though students lack confidence in doing self-assessment, but very minimal student who utilize discussion forums.

Some possible reasons why students are not active in the discussion forums are as follows. 1. Students who do not master the material well are less likely to express difficulty in faculty and friends. 2. Students are difficult to express the problem in lecturer or other students in writing. 3. Students are too busy to meet the demands of the task AFL and do not have time to use the discussion forum. 4. Students have difficulty in accessing the internet.

WEB-based AFL model can be a solution for lecturers to provide a good learning on college campuses. However, this model requires support in the form of easy internet access for both lecturers and students. Technical problems related to internet access will become an obstacle and additional jobs for lecturers. WEB-based AFL model need to be developed and validated web well before use by students. If it has been running, it is difficult for lecturers to improve the instrument on the model given time is critical.

Some students feel that the tasks in this model is pretty much AFL, time consuming, and makes students depressed. This is especially true in the formative tests and subsequent preflight. By the time the students are still working on the formative tests, has emerged link for preflight nengerjakanbeikutnya meeting. But this is certainly not a problem if the student has a high motivation to learn. WEB-based AFL model is expected

to eventually be able to change the student to be more autonomous and more responsible for their own learning.

### **Conclusion and Recommendation**

The conclusion of this study are as follows. 1. WEB-based AFL model is effective to help students improve mastery of basic physics concepts. 2. High student scores on tasks AFL effect on increasing mastery of the basic concepts of physics. 3. Frequency of students in using the WEB-based AFL model does not significantly affect student mastery of the basic concepts of physics.

Here are recommendation relating to the implementation of model of WEB-based AFL and advanced research to do. 1. Given the use AFL is effective and significant on the mastery of basic concepts of physics students, teacher are encouraged to use and further develop models of webthis model. For the teacher of physics, the model has to be adopted and adapted to local needs, those of other lecturers, the model can be adapted, but the instruments need to be developed and assembled in the model. It is advisable to first develop a model before the lecture took place. 2. Given the importance of efforts to provide feedback to the students, this model needs to be disseminated. There needs to be training for lecturers to use and develop WEB-based AFL model. 3. Undertake research to assess the effectiveness of the WEB-based AFL model with more number of students. 4. Undertake research with treatment time duration is longer. This model is encouraging autonomy and responsibility for student learning. It took long enough for students to get used to study regularly and discipline as well as reflect and are responsible for their own learning. 5. Need to develop a model that involves primary diagnostic test diagnostic learning difficulties of students, in the course include the basic physics of diagnostic misconceptions. In the models that have been developed can only involve multiple choice questions. In the future, the model is expected to be integrated with the matter in the form of a three-tier or isomorphic meaningful so as to provide more specific feedback about the difficulties experienced by students. 6. Need to develop models on self-test feedback that helps students learn better. Feedback and remediation to assist difficulty of students in the WEB-based AFL model is only in the form of text. For some students remediation and scaffolding text may not be enough to help their plight. Model remediation can take the

form of animation or video making it clear to students. 7. There needs to be further research to examine other aspects in addition to mastery of the basic concepts of physics. Aspects such as self-regulating aspect, self-efficacy, and other psychological aspects that may be affected by the implementation of the model is based on web technology AFL needs to be studied further.

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