**PE – 1**

# DEVELOPMENT OF VIRTUAL LABORATORY HYPERMEDIA BASED ON ATOMIC PHYSICS AT SMAN 1 PINRANG

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**Abstract**

The development research of hypermedia was conducted which aimed to produce hypermedia and learning instrument of virtual laboratory based on atomic physics material. The subject of the study was 38 students grade XII IPA 1 at SMA 1 Pinrang. The development procedure referred to four-D model consisted of definition phase, design phase, development phase and dessimination phase. The result of the study revealed that (1) the virtual laboratory hypermedia consists of virtual trial package to determine the value of e/m electron (Thomson experiment), Rutherford experiment and Hidrogen Atomic Emission Spectra gained valid and reliable result. Each of hyperrmedia display comprised of navigation, program instruction, hyperlink and several other facilities to allow users to run the program.(2)the learning instrument in form of lesson plan, the textbook, and student's workbook presented in softcopy of CD autorun product was valid and reliable. (3) the student's activities during the learning process were above 81,12%, show that the learning conducted was able to make students active. (4) the student's perceptions percentage was 89,80 % which shown that students were very agree on Physics Virtual Laboratory Hypermedia basis. This hypermedia can be used in offline or online situation.

**Key words**: Activities, hypermedia, perception and virtual laboratory.

## INTRODUCTION

Educational world are currently faced a rapid development of information and communication technology. Its existence has been able to change the way a lot of people doing everyday activities become easier, effective and efficient. One of the benefit in these technologies is enabling people to be able to communicate without being limited by time, distance and place. In addition, communication is also no longer just limited to sound, but can be done by simultaneously with writing and drawing.

To realize the process in laboratory experiments, teachers must consider the availability of space, materials and equipment. Students of class XII High School is so very difficult to understand the concept of physics, especially to understand abstract concepts material. This is because the laboratory equipment is very expensive and the risk posed if there is an error in the experiment. By experiment process aspect of product, process and attitude of students can be developed (Samsuddin, et. Al., 2012) .Therefore, one solution to overcome this problem by using learning hypermedia based of a virtual laboratory. Virtual laboratory utilization is expected to increase the activity of students so that learning becomes easier, interesting and interactive and able to motivate students to study this material, either individually or in groups.

In the 21 century learning, almost all of schools have internet connection, its provided

students and teachers to access learning material easier. Not only in computer laboratory area but also in all of school area we can use the internet network.Learning activity can be done individually or group way by using Information and Communication Technology (Sutrisno, 2012)

This study was conducted to address the following issues:

a. How are the caracteristics of virtual laboratory hypermedia on atomic physics material?
b. How are the characteristics of learning instrument on atomic physics?
c. How are student's activities in learning by using virtual laboratory hypermedia, does application of virtual laboratory able to improve the efficient of learning physics?
d. How are student's perceptions in learning by using virtual laboratory hypermedia, do students agree with the aplication of virtual laboratory hypermedia?

## RESEARCH METHOD

### A. Types of Research

This study uses a model of four-D includes the step of definition phase, design phase, development, and deployment. But in this case, the research is only done through the development phase.

### B. Definition Phase

The purpose of this phase is to establish and define the terms of learning includes a preliminary analysis, students, tasks, concepts, and specification of learning objectives.

### C. Design Phase

The purpose of this phase is to prepare a prototype device based learning Lab-Vir hypermedia comprising the steps of selection of hypermedia, format selection, and preliminary design.

### D. Development Phase

The purpose of this stage is to produce a learning device that has been revised based on input from experts and revised after using trial class . before using in the actual class, this hypermedia was testing in the trial class , XII IPA 2 SMAN 1 Pinrang amounted to 12 people. Simulation is intended to train observers to observe the activities of students during the learning process.

### E. Subject Research

The subjects were students of class XII IPA 1 SMA 1 Pinrang who were 39 people in the academic year 2014/2015.

### F. Research Instrument

The instrument used in this study were the validation sheet of learning, evaluation questionnaires hypermedia expert, expert evaluation of materials, instruments of students activity, perception questionnaire students towards learning Physics Lab-Vir-based hypermedia.

### G. Data Analysis Techniques

Data obtained from the expert assessment, analyzed with coding, then described qualitatively and depiction of the continuum data to determine the categories of assessment. Next, calculate the content validity of the CVR (Content Validity Ratio) and CVI (Content Validity Index). Rate valid if the CVR or CVI in the range of values from 0 to 1, as follows:

$$CVR = (n_e-(N/2))/(N/2) \quad \text{(Lawshe, 1975: 567)} \qquad (2)$$

Specification:
ne: The number of validators that provide essential values (good or very good)
N: Number validator

The validity of every aspect of using CVI equation as follows:

$$CVI = CVR/\Sigma n \qquad \text{(Lawshe, 1975: 572)} \qquad (3)$$

Specification:
n: Number of items from every aspect

If the statement is valid, followed releabilitas analysis using the following equation:

$$r_{11} = (k/(k-1)).(1-(\sum\sigma_b^2/\sum\sigma_t^2) \quad \text{(Arikunto, 2006: 196)} \quad (4)$$

$r_{11}$ : reliability of the instrument
k : the number of grains statement
$\sum\sigma_b^2$ : total variance
$\sum\sigma_t^2$ : total variance

Reliability values obtained in consultation with the reliability value table. Instrument said to be reliable if obtained reliability count is greater than the reliability of the table.

## RESULT AND DISCUSSION

Tasks analysis outlined in LKPD which must be completed by students during the learning process .From these tasks, students actively perform virtual experiments and evaluate their understanding of the material being studied.

Design phase, selection and use of hypermedia in the form of an abstract depiction of the circumstances, in accordance with the objectives, concepts, environmental conditions and facilities as well as the time devoted to learning needs. Various software used in the manufacture of medium-Vir Lab is that AutoPlay Menu Builder to display the autorun.exe as the initial display when the CD is inserted into the computer and hiperlink Physics simulation software to adapt downloaded from *The King's Center For Visualization in Science* (KVCS) http: //www.kcvs.ca. The dominant software used is Lectora Inspire to program display settings Lab-Vir and to publish the virtual laboratory that contains *hypertext* be HTML form. By *hiperlink* to otherwebsite. This media is called *Hypermedia* (*contain of hypertext and hyperlink so that we can use while offline and online* according to the Edson's definition) .Development of Lab-Vir can solve the problems of learning experienced by students more easily and does not require a lot of cost and time.

This figure is the *autorun* shown of hypermedia.


**Figure 1.** *hypermedia autorun*

Lab-Vir programs are made, contains material which is equipped with an image, animation, and interactive simulations. The completeness were helping students to understand the atomic physics concept. figure 1 shows the view-Vir Lab program of determine e/m of electrons (Thomson Experiment) substances used.

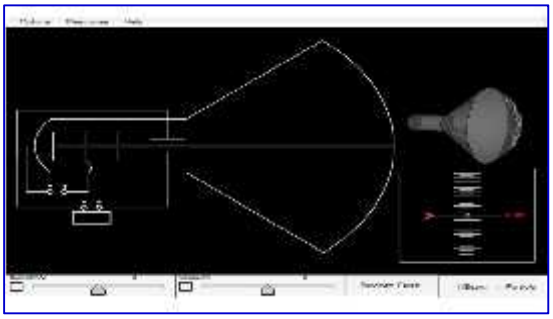


**Figure 2.** Thomson Experiment Virtual Laboratory

In a virtual experiment of Thomson Experiment begins with choosing the value of current and voltage, so we can see the movement of particle . By manipulating the value of current and voltage we can obtain the relationship of some variable. Entering the number current and volatege in zero deflection angel, will determine the value of e/m an electron by using equation:

$$\frac{e}{m} = \frac{E^2}{2VB^2} \quad \text{.....(5)}$$

Furthermore, Figure 2 shows the display program Translucent Power Lab-Vir rutherford experiment.

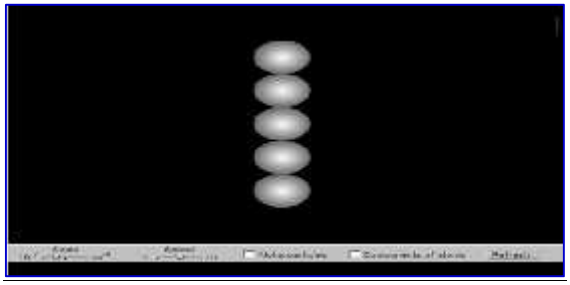


**Figure 3.** Rutherford Experiment Virtual Laboratory

In a virtual experiment of Rutherford Experiment begins with incrising the scale of atomic and the speed of alpha particle, we can see the principle of rutherford experiment so we ca make conclusion to descibe the Rutherford Atomic Model.

Figure 3 shows the display program virtual laboratory of Hidrogen atomic spectra..

**Gambar 3.** hidrogen atomic spectra virtual laboratory

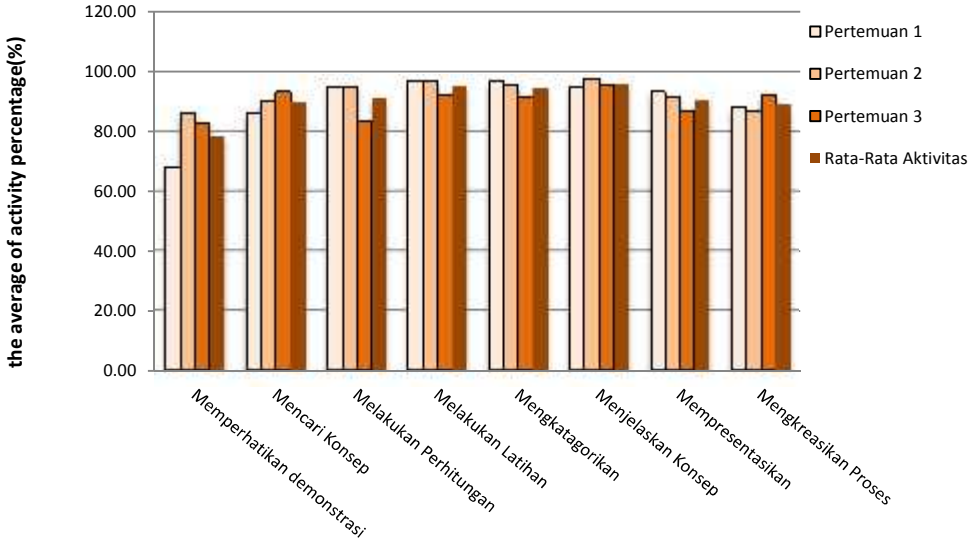
In a hidrogen atomic spectra begin by moving the electron from the initial track to the other track so that, the moving of electron will absorb or emit of light by specific wavelenght or frequency. We can determine the value of wavelenght by using equation:

$$\frac{1}{\lambda} = R\left(\frac{1}{n_0^2} - \frac{1}{n_1^2}\right) \quad (6)$$

In the development of learning instruments, lesson plan completed with an important specifications list as a guide teachers to give assessments. LKPD equipped with introductory material to provide students basic knowledge before doing the virtual experiment. Students Instruments activity describe activities during the learning process. According to Yusufhadi (2008), students who are very slow and fail to understand the material learning due to unsuitable teaching style of teacher and studing style of students.

Validation of experts conducted by two experts, hypermedia expert and material expert. Based on the assessment of learning by the validator, the results obtained are valid and reliable for any given statement, it indicates that the hypermedia Lab-Vir, RPP, LKPD, instrument activity, students perception questionnaire. The learning instrument can be applied in the classroom, as to enhance learning in the classroom physics necessary learning instrument such as lesson plan, modules and worksheets students (Chodijah, et. Al., 2012).

Activity of students in the pilot phase as follows:




**Gambar 4.** Students activity

Based on an assessment of each meeting observers found that the activity of students in the top 80% which shows that hypermedia-based learning Lab-Vir provide opportunities for students to move. Lab- vir based learning hypermedia provide opportunities for students to explore, so it allows them to always move, not only listen and record as revealed by Cengiz (2010) that the Lab-Vir accompanied by the appropriate learning can involve students in learning. Perception analysis results of students towards learning Physics Lab-Vir-based hypermedia can be seen in Table 1 below:

**Tabel 1.** Results of Analysis of Perception of Students

| No. | Indicators | Indicators Average Percentage (%) |
|---|---|---|
| 1 | Facilities Lab-Vir Presentation Model | 92,5 |
| 2 | attractions Learning by Using Hypermedia Lab-Vir Presentation Model | 94,5 |
| 3 | Activity Learning by Using Hypermedia Lab-Vir Presentations Model | 81,12 |
| | **Rata-Rata** | **89,37** |

According on Table 1, obtained the perception of students towards learning Physics Lab-Vir-based hypermedia above 89% which shows that the students were very agree on their lessons. Perception students after learning by using hypermedia Lab-Vir shows results strongly agree, no students who was passed judgment didn't agree on any proposed criteria. Students interested in learning hypermedia simulation display, easy to run an interactive simulation, easy to understand the subject matter, and enjoy learning with the helpness of the hypermedia lab-Vir.

This is consistent with research of Yulianti, et. al., (2012) that the application of Lab-Vir-

based learning can improve the ability of affective students describe the feelings, interests, and attitudes towards the teaching process. Furthermore, Daesang, et. al., (2013) found that the perception of an impact on the performance of students. The better their perception towards learning, the better the performance. The use of appropriate hypermedia can increase the perception of students so that they were motivated to learn.

Although the results of this study demonstrate the perception and activities of students in the category of strongly agree and well, include attention to the demonstration activity, looking for concepts, perform calculations, categorize, explain, present, and the creation process. It cannot be claimed that the virtual experiment is more effective than the real laboratory experiments. Instead, virtual experiments conducted on the grounds of limited equipment, considerations of time, the subject matter is an abstraction.

Irfan (2012: 7) has developed virtual laboratory to know the activities and perception of students. He was founding the value of activities was above 80 percent and the average of students perceptions was 91,03 percent. Irfan was using multimedia but it could not used in online or link to the other website.

## CONCLUSION AND SUGGESTION

Virtual laboratory hypermedia characteristics produced three experiment, namely Thomson experiment, Rutherford Experiment and Hidrogen Atomic Spectra. In addition, the hypermedia Lab-Vir developed learning program with five main menus in every discussion are competence, material, interactive (virtual experiments), practice, and reference. Characteristics of hypermedia-based learning Instruments Lab-Vir includes lesson plan, LKPD designed with the intention of combining classroom sessions with experimental sessions using Lab-Vir. Related materials in a virtual experiment is included in the learning device that can be studied independently by students. Hypermedia contains of hypertext and hyperlink to the other website. It can be used while offline or online to the internet.

Activity students reached 81,12%, indicating that learning process is able to activate students. Perception percentage was 89,80% of students showed that students were very agree on Physics Virtual Laboratory Hypermedia basis and the result of LKPD shows that, students could answer the questions suitable of learning purpose. This hypermedia can be used in online or connect to the internet that contain some hyperlink to the other website and able to download material book and guide book.

## REFERENCES

Arikunto, S. (2006). *Prosedur Penelitian: Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta

B & Peter Mahaffy. (2012). *The King's Centre for Visualization in Science. (online). (http://www.kcvs.ca*, Diakses 1 Januari 2015)

Cengiz, T. (2010). The Effect of the Virtual Laboratory on Students' Achievement and Attitude in Chemistry. *International Online Journal of Educational Sciences*, 2 (1), 37 – 53

Chodijah, St., Ahmad Fauzi., &Ratna Wulan. (2012).Pengembangan Perangkat Pembelajaran FisikaMenggunakan Model *Guided Inquiry* yang Dilengkapi Penilaian Portofolio pada Materi Gerak Melingkar. *Jurnal Pendidikan Fisika Indonesia*, 1 (2), 1-19

Daesang, K., Dong-Joong K., &Woo-Hyung W. (2013). Cognitive Synergy in Multihypermedia Learning. *International Education Studies*, 6 (4), 76-84

Irfan, (2012) *Pengembangan Perangkat Pembelajaran Berbasis Laboratorium Virtual pada Materi Fdualisme Gelombang Cahaya Kelas XII IPA SMA Tut Wuri Handayani*. Makassar: Universitas Negeri Makassar

Lawshe, C.H. (1975). *A Quantitative Approach to Content Validity.* Chicago: Personnel Psychology

Samsuddin, A., E. Suhendi., R. Efendi., & A. Suhandi. (2012) Pengembangan *"Cels"* dalam Eksperimen Fisika Dasar untuk Mengembangkan*Performance Skills* danMeningkatkan Motivasi Belajar Mahasiswa. *Jurnal Pendidikan Indonesia,* 8 (1), 15 – 25

Sutrisno. (2012). *Kreatif Mengembangkan Aktivitas Pembelajaran Berbasis TIK*. Jakarta: Referensi.

Yulianti, D., Khanafiyah, S., &Sugiyanto.(2012).Penerapan *Virtual Experiment* Berbasis Inkuiri untuk Mengembangkan Kemandirian Mahasiswa. *Jurnal Pendidikan Fisika Indonesia*, 8 (2), 127-134

Yusufhadi (2008). *Model Pembelajaran Ciptakan Proses Belajar Mengajar yang Kreatif dan Efektif*. Jakarta: Bumi Aksara