

## CHAPTER II

### LITERATURE REVIEW AND HYPOTHESIS

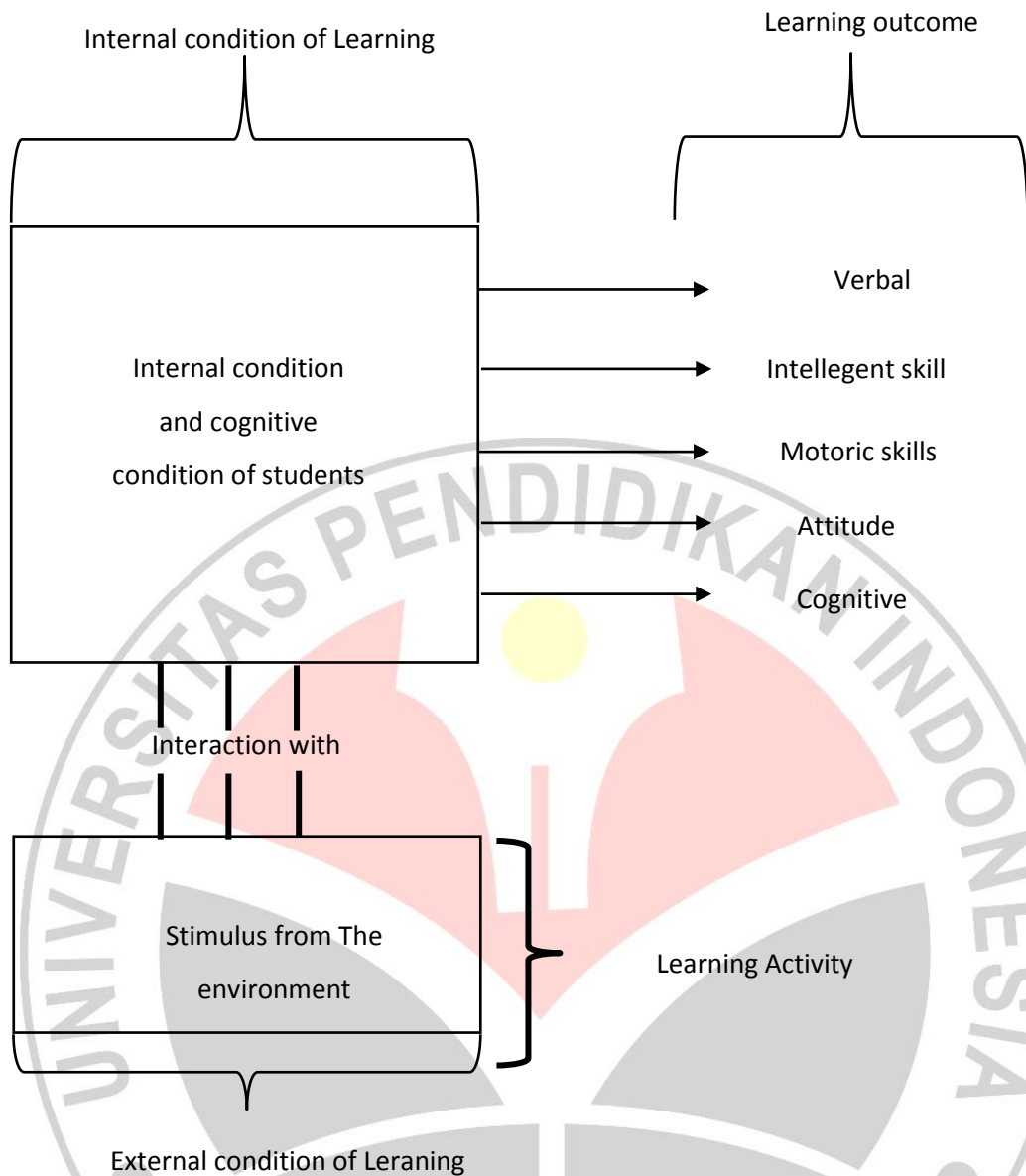
#### A. Learning and Instruction

Learning by Dimiyati and Mudjiono (2009) is an action and interaction. As a student behavior, learning only experienced by students. While, according to Sagala (2010: 11) learning is a component of science education with respect to the purpose and reference materials interactions, both be explicit or implicit (hidden).

It is often said that teaching is organizing student activities, learning in its broadest sense means any activity that is designed to help a person learn new ability and value. The learning process was originally asked teachers to learn basic skills, motivation, academic background, social background, and so forth. Readiness of teachers to get to investigate the characteristics of students in learning is the main capital delivery of learning materials and an indicator of the success of the implementation of learning (Sagala, 2010: 9).

According Dimiyati and Mudjiono (2009: 7) "learning is an activity programmatically teachers in instructional design, to make the students learn actively, which emphasizes the provision of learning resources." Article 1 of Chapter 1 of the Law on National Education System No. 20 of 2003 states learning is the process of interaction with educators and learners learning resources in a learning environment. Learning as a learning process that was built by the teachers to develop creative thinking can improve students' ability to think, and to improve the ability construct new knowledge as an effort to improve a good mastery of the subject matter. This shows that the learning process is a fundamental process in educational activities in schools.

From the learning students get the learning outcomes that are the result of an interaction that is undergoing a process of action learning to improve their mental and follow teacher that teaching students. To clarify the interaction, based on Gagne cited Dimiyati and Mudjiono (2009: 11) described that learning has three essential components, there are external condition, internal condition, and learning outcome. Gagne identifies five major categories of learning: verbal information, intellectual skills, cognitive strategies, motor skills and attitudes. Different internal and external conditions are necessary for each type of learning. For example, for cognitive strategies to be learned, there must be a chance to practice developing new solutions to problems; to learn attitudes, the learner must be exposed to a credible role model or persuasive arguments. Internal condition include motivational states and previously acquired knowledge and skill stored in long-term memory that are accessible for new learning. External condition, when deliberately planned and instituted, make up a set of events collectively called instruction (Gagne, 1977: 339). The components as an essential component of teaching and learning based on Gagne, condition of learning in the form of a scheme or the following chart.



**Figure 2.1**

**Essential Component of Learning and Instruction**

According to Warsita (2008: 62), instruction is one of the effort to make a students learn about something or make them learn in some activity. In other words, instruction is an effort to create one condition in order learning activity can be happened. Based on UU No.20 Year 2003 about Sisdiknas Chapter 1 article 20, instruction is process of students interaction with teacher and learning sources in one of learning environment. Instructional activity are designed to give learning experiences that involve mental process and physical through interaction between students, students and teacher, environment and other learning sources to reach

basic competences (BSNP, 2006). Learning experiences can be reached through a varieties of using learning approaches and focused on students condition and ability or we can called it leaner centered. Learning activity can be done if the students learn actively and has their own experiences . It will become meaningful for students if it is done in comfortable environment for them (Warsita, 2008:65).

Instructional activity should based on the learning theory that perspective on problem solving in difficulties of learning or learning problem, it should can overcome the problem in learning. Based on the problem that has been told about learning media, learning theory that appropriate with it are cognitivism theory and constructivism theory. Cognitivism theory reflects from behaviorism theory that has been dominated by information processing model in human memories. This theory according to Good & Brophy cited Warsita (2008: 69) see that instructional activity involve comprehension and reorganize from cognitive structure through information process and saving.

Different from cognitivism theory, constructivism theory as knowledge construction. This theory stated about responsibility of learning is on students hand. Thinking process is one of important things and as a main tools in learning activity. According to Warsita (2008: 78), The basic principals of learning based on constructivism theory are: 1) construct interpretation of students based on learning experiences; 2) build a learning as active process in knowledge construction, it is not only knowledge communication process; 3) objective of learning activity is problem solving; 4) Students Centered leaning; and 5) push the students to reach higher order thinking.

## **B. Learning Media**

Learning media comes from latin language and prular from medium words, so it can be define as medium and transfer a message (Sanjaya, 2011: 204). Learning Media according to Sadiman cited Warsita (2008: 122) is combination between materials and tools or combination of software and hardware. Learning media can be called as media that is used in goals and process of learning. Accorrding to Heinich, Molenda, and Russel cited Sanjaya (2011: 204) media is a channel of communication. Derived from the Latin word for “between”, the term refers, “to anything that carries information between a sources and receiver”.

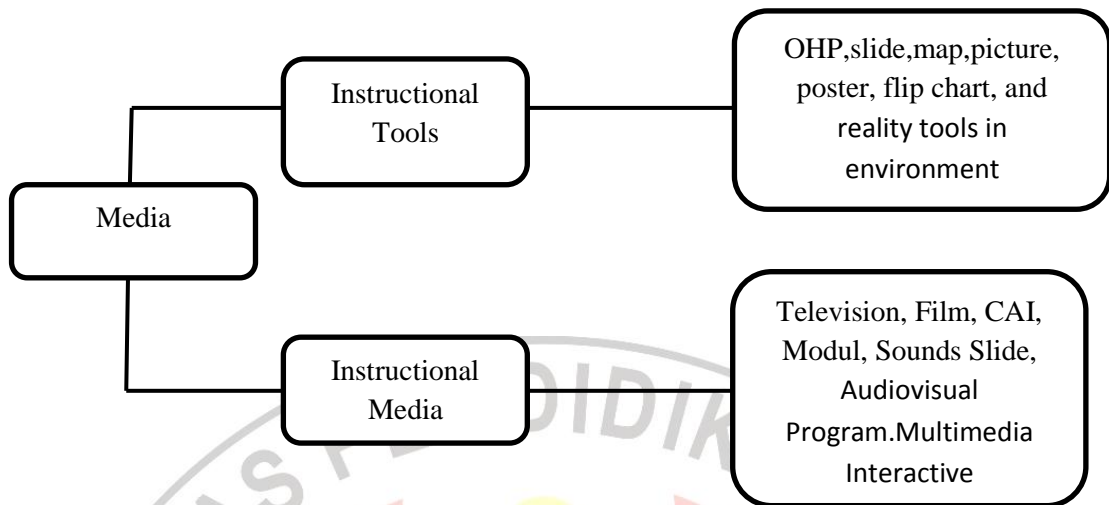
Actually, learning process also as communication process, where the teachers as a messenger and students as a recipients. A message that is sent by the teachers is learning material as a communication symbol either verbal or nonverbal, this process called encoding. The translation of those communication symbol by students called decoding. Nevertheless, there are some obstacle in communication process. It means that not all the message can be delivered by messenger successfully to the recipient and recipient can understand what recipient said. This is called the mistake in communication process. According to (Sanjaya, 2011: 205) there are several factor that causes communication mistake, *first* the lack of ability in messenger to deliver the information so the message that delivered is not clear for recipient. *Second*, the lack of ability in recipient for receive the message, so there is a mistake in message interpretation. So that, in communication process is needed a medium that has function to make delivery information process easier. That is a nature of learning media ,so learning media can be called as communication media that is used in learning contextual to reach the learning goals.

Learning media can be classified as several categories depend on point of view. Based on Sanjaya (2011: 211) learning media can be classified first, from its properties, such as: a) auditory media, the media that has only sound unsure or it can be only heard. For example, radio and recorder; b) visual media, learning media that can be only seen, it is not contain audio .For example, slide, picture, graphic media, photo, and etc; c) audiovisual media, learning media that contains

audio unsure and visual unsure that can be seen as like video recorder, film, audio slide. Second, from its ability to reach the recipient, learning media can be classified as: a) media that has large and simultaneously broadcasting ability as like radio and television. Through this media, students can learn material actually and simultaneously without using specific room; b) media that has limited broadcasting ability by spaces and times, as like slide film, video, film, and etc. Third, from the way or technique to use it, learning media can be classified as: a) media that can be projected, for instance film, slide, stripped film, and etc. This kinds of media is needed a special tools. For example film projector, slide projector, over head projector (OHP). Without supports from those tools, this media can't work properly; b) media that cannot be projected, as like pictures, photo, painting, radio, and etc. Beside those classification of media, there are media classified according to Rudy Brets cited by Sanjaya (2011: 212), there are seven classification of media: 1) audiovisual movement media, as like audio film, tv film, and etc; 2) audiovisual static media, for example film audio; 3) semi moving audio, for instance far audio; 4) visual movement media, as like silent film; 5) static visual media, for example printed pages, photo, microphone, silent slide; 6) audio media, as like radio, telephone, audio tape; 7) printed media, for example books, modular, and etc. Those learning media are classified based on its function and role in multimedia interface.

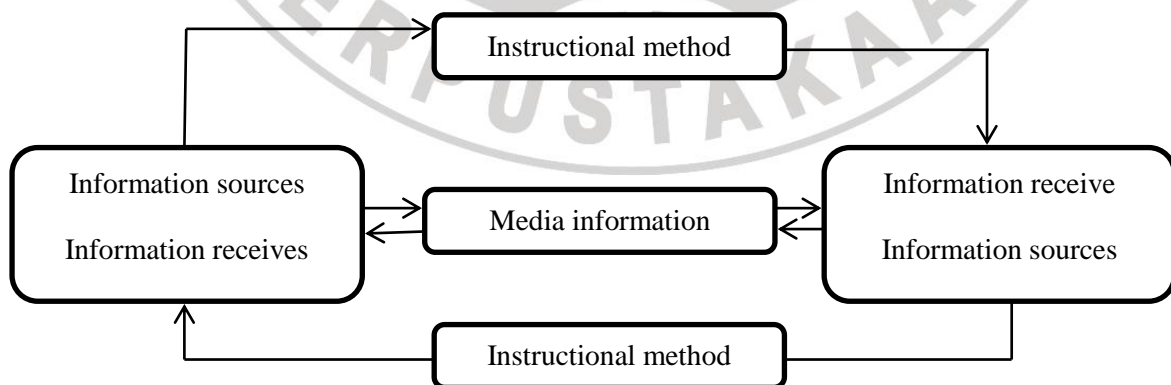
Besides that, the media can be classified as big media means that complex expensive and little media means that simple cheap. Learning media that include in big media are computer, film, slide, video program. While, for little media are sketch, picture, simple reality, and etc. From Klasek cited (Sanjaya, 2011: 212) classified learning media as visual media, auditory media, display media, real experiences and simulation, printed media, learning program, and learning trough computer or it often called computer Aided Instruction Program (CAI).

According to Anderson cited (Warsita, 2008: 124) media is divided into two categories. There are instructional aids and instructional media or learning media. In order make more detailed about the grouping of media will figure out on the diagram below.



**Figure 2.2**  
**Media Grouping**

Nowdays, Learning media is not as instructional tools for teacher anymore, but it has a function to carries message, chosen and developed systematically and used integrate in learning process. Based on Heinich & Molenda cited Warsita (2008: 128) media means as communication tools that carried out a message from sources to the recipient. Media contains message that has possibility for students interact with it directly. As figure out in the diagram below based on Wijaya cited Warsita (2008: 128):



**Figure 2.3**  
**Communication Process in Learning Activity**

Learning media as part of learning system has simple value as like has ability to: 1) make abstract concept become concrete; 2) brings the impossible object and dangerous, also hard to find out to the classroom; 3) Shows the object that has big or small size that cannot be seen by naked eyes; 4) shows the fast motion into slow motion or vice versa; 5) possibility in varieties observation; 6) Provide consistent information that can be repeated and saved; 7) Overcome the obstacle about time and rooms; 8) Give a chance to the user that they can control the speed of learning.

Based on research Sovocom Company from America, found that there is relationship between type of media with human memory to absorb and save a message, type of media with brains' ability in memorize of message. For instance ability of memorize in audio media 10%, visual (visual text) 40%, and audiovisual 50%. While, the ability to save the message based on audio media less than three days is 70%, more than three days is 10%, media visual (visual text) less than three days is 72%, more than three days is 20%, and audiovisual media less than 3 days is 85%, more than three days is 65% (Warsita, 2008: 126).

### **C. Virtual Laboratory as Learning Media**

Learning media usually use technology based computer. According to Seels & Richey cited Warsita (2008: 33) Computer technology is the way to produce and transfer sources of learning by using a tools that comes from microprocessor. Computer technology either hardware or software has a characteristic as follows: students learner centered; principals of cognitive knowledge are applied during development of this media, and etc. Computer technology also gives an opportunity for students to do self-learning in conceptual mastery. That is possible because computer technology has an ability to save and manipulate the alphanumeric data; shows some operation in right way; combine text, color, animation, sounds, video, and has an ability to provide interactive activity.

Using computer in learning as covered Computer Assisted Instruction (CAI) that using computers as one of integral parts of the learning system,



students generally involve in two ways interaction with computers through one terminal. While, the other one is Computer Aided Learning (CAL) that the use of computer in delivery of learning material, students actively involve giving a feedback. Some research has already done to measure how the interest of computer as learning media in learning process. Computer Assisted Learning (CAL) is learning helped by computer through computer-aided instruction, computer *simulation*, and etc. In a line with that, there are research from Kulik, Bergert, and William, 1983 cited from Munir (2012: 178) about how far the interesting of students in computer during learning process trough 48 students. The result is 39 students that using computer gain higher score than the students that using traditional method. This research also said that CAL has level of confidence 0.5 compare with learning process that using traditional method.

According to Chaeruman cited Warsita (2008: 35), computer technology or learning activity helped by computer media can possible the process of learning as follow: Students can active, *Constructive* means that students can combine the new experiences with their previous experiences, *collaborative* means that students can work together share the idea in one group of learning, *Enthusiastic*, *dialogue activity*, *contextual learning*, *reflective* means that students realize what they have already learnt and think what they have got as learning process inside them, *multisensory* learning can be delivered by using of 5 senses there are audio, visual, or kinesthetic; the last is *higher order thinking* means that train them to think in higher order thinking level.

Multimedia interactive is one of learning media based computer technology that combine and integrate all the media which consist of text, graph, photo, video, animation, music, narration, and interactivity that programed by using principal and theory of learning. The characteristic of this media based on Warsita (2008: 36) are: The idea is often delivers realistically in students contextual experiences, relevant with condition of students, and under controlled of user, also leaning is emphasize and organize according to the cognitive knowledge thus, the knowledge construct during students use the media.

One of multimedia interactive is simulation virtual laboratory that simulation program that more specific to the science experiment activity such as, biology, chemistry, and physics. This program provide the material and substance as like in laboratory, then students do the experiment based on the objective of experiment. After that, students can develop that experiment based on the clue or objective of experiment itself. And students are expected can explain certain concept or phenomena based on virtual experiment that has been done by them (Warsita, 2008: 141).

After that, students can improve their achievement. Simulation are most commonly used at secondary level that provide the students opportunities for observation, the development of concept, logical thought, posing of question and the selection of answer (Harlen, 1993: 146). According to Munir and Halimah Badioze zaman, simulation laboratory also include in one of the using CAL. In science learning, using of CAL can improve the students motivation twice rather than in traditional method (Munir, 2011: 179).

Virtual laboratory also was defined as "laboratory experiment without real laboratory with its walls and doors. It enables the learner to link between the theoretical aspect and the practical one, without papers and pens. It is electronically programmed in computer in order to stimulate the real experiments inside the real laboratories" (Babateen, 2011). The virtual lab can be defined as virtual studying and learning environment that stimulates the real lab. It provides the students with tools, materials and lab sets on computer in order to perform experiments subjectively or within a group at anywhere and anytime.

These experiments are saved on CDS or on web site (Herga and Dinevski, 2012). According to Munir (2011: 179), simulation laboratory or we can called it virtual laboratory is provide the easiness for students that will do the experiment activity based on real model that has already programmed by computer. Computer itself is not only as learning tools but also as learning sources.

Professionals confirmed certain characteristics of the virtual lab. Based on Babateen (2011), creating new intellectual model in education better than the real, and more beautiful than the imagination.

1. Knowledge-building and inculcate information.
2. Encouraging and guiding students.
3. Registering students' information and evaluating them automatically.
4. Performing experiments, which are difficult to be performed in the traditional lab due to its danger and high cost.
5. Reducing the learning time spent in the traditional lab.
6. Develop an exploration based on scientific assumptions and processes.
7. Permanently updated.

The characteristic of virtual experiment with real experiment are so different. There are the differences between virtual experiment and real experiment based on Saepuzaman (2011: 26).

**Tabel.2.1**

**Comparison Between Virtual Laboratory and Real Laboratory**

<b>Category</b>	<b>Virtual Experiment</b>	<b>Real Experiment</b>
<b>Abstract concept</b>	Can be figured clearly through modeling	Can't be figured out clearly
<b>Learning Process</b>	Beside can understand a concept through experiment, it can be also develop science process skill and higher order thinking	can understand a concept through experiment, it can be also develop science process skill
<b>Process and Implementation of Experiment</b>	Students can work individually and need a faster times	Students can work in group and need longer times
<b>Mobility and Range</b>	Mobility and range are unlimited in times and spaces	Mobility and range are limited in times and spaces
<b>Psychomotoric Aspect</b>	Lack to practice psychomotoric aspect of students	Can practice psychomotoric aspect of students
<b>Evaluation Aspect</b>	It is only evaluate cognitive aspect and thinking skill students	It can evaluate cognitive, affective, and psychomotoric aspect of students.
<b>Cost that is Needed</b>	Need a high cost to make learning software(virtual lab) but it is needed low cost for maintenance.	Need a high cost for buying experiment tools and maintenance.

Students use virtual laboratory to overcome some dangerous experiment, requiring demanding instrument, unobtainable, and etc (Bilek and Skalicka, 2009). Based on Andaloro (1991) cited in Roblyer (2006: 90), the field of science seems to include more simulation than any others area. However, more simulations are currently in developments to combine the control, safety, and interactive features of computer simulation with visual impact of picture of real-life devices and process. The following benefits of virtual laboratory or laboratory simulation for students based on Roblyer (2006: 91-92) are: 1) compress time, means that a simulation can make something happen in seconds that normally takes days, month, or longer. So, students can cover more variation of the activity in a shorter time; 2) slow down process, conversely a simulation can also model processes normally invisible to the human eyes because they happen so quickly; 3) get students involved, simulation can capture student's attention by placing them in charge of things and asking. It also allows users to interact with the program instead users seeing its output; 4) make experimentation safe, whenever learning involves physical danger, simulation are the strategy of choices. They can experiment with strategies in simulated environments that might result in personal injury to themselves or others in real life; 5) make the impossible possible, very often, teachers simply cannot give students access to resources or the situation that simulation can. By simulation, the students can see the light that is formed in lens so that they know the form of image comes from; 6) save money and other resources, simulation can save the cost to do the experiments but it depends on the subject. A simulated experiment may be just as effective as a learning experience, but at fraction of the cost; 7) allow repetition with variation, unlike real life, simulation let students repeat events as many times as they wish and with unlimited variation; 8) allow observation of complex process, real life events often so complex that they are confusing, especially to those seeing them for the first time. Simulation can control the complex process and this make it easier for students to see what is happening later when all the parts come together in the actual activities.

Interactive 3D virtual environments have great educational potential because they enable the active participation of students, research and management of virtual objects. Virtual laboratories reproduce the conditions of a real physics laboratory and enable learning through an interactive simulation and are a valuable tool for distance learning and lifelong learning of physics. Virtual laboratories allow the execution of experiments without teacher's presence; therefore students have a major role in their learning process.

According to Dalgano cited Herga *et al.* (2012) studies have shown that virtual laboratory is an appropriate tool with which physics students prepare for practical work. Virtual laboratory exercises are held in the virtual world. Virtual lab brings many advantages. We can perform dangerous experiments without endangering ourselves or others. Cover the time overlap for using laboratory room. Students can repeat the laboratory activity wherever they want. Simulations are affordable. Once developed, they can be done at no extra costs as many times as we want.

The results are always the same Herga and Dinevski (2012), in a line with the characteristic multimedia that learning media as part of learning system has simple value as like has ability to: 1) make abstract concept become concrete; 2) brings the impossible object and dangerous, also hard to find out to the classroom; 3) shows the object that has big or small size that cannot be seen by naked eyes; 4) shows the fast motion into slow motion or vice versa; 5) possibility in varieties observation; 6) provide consistent information that can be repeated and saved; 7) overcome the obstacle about time and rooms; 8) give a chance to the user that they can control the speed of learning (Warsita, 2008: 124-125). So, virtual laboratory is appropriate with physics subject that its scope comes from macroscopic until microscopic. Especially in optics topics that has microscopic scope is about ray of light and particle of things, something that cannot be seen by naked eyes.

#### **D. Achievement and Conceptual Mastery**

According to Gange cited (Dahar, 2006: 3), learning can be define as a process where an organism change their attitude as the impact of their experiences. In learning there is a differences indicator as knowledge, attitude, skill, information skill, and value. Those are called as achievement in students as an impact from learning activity. So, Learning is very important to form those indicator inside of the students.

Achievement of students generally can be categorize become 3 indicators, as follows: 1) learning effectiveness that can be identified from the conceptual mastery or achievement of students. 2) efficiency of learning activity can be measured from the time management and cost for this learning. 3) learning interest can be measured from the activity of students during learning process. Thus, achievement is a performance that indicated as capability that has been gained.

In Educational Indonesia Curriculum System, instructional or curricular objective using Benyamin Bloom classification for students achievement. Bloom cited Dimiyati & Mudjiono (2009: 174) classify the students achievement becomes three, there are cognitive, affective, and psycomotor. For example, if students before learning has 25% of their ability, after then they receive learning or treatment so they ability will be improved until 100%. Those cognitive, affective, and psychomotor are suitable with the objective of instruction. According to Bloom *et.al*, those indicators of learning have a strata. Emphasis to the content and process, for instance it emphasis fact, concept, and theory in certain subject. Also emphasis to the how students can solve the problem, tools of learning, and discover with process skill approach. Here there are the table with content and process in each indicator of learning (Dimiyati & Mudjiono, 2009: 177).

**Tabel.2.2**

**Instructional Objective and Indicator of Learning**

<b>Instructional objective</b>	<b>Content</b>	<b>Process</b>
Cognitive	Subject in the school and knowledge	Problem solving, discovery, and ect approaches
Affective	Value education	The value based on attitude
Psycomototric	Skill education	Psycomotoric movement

Affective indicator is about ability to control the emotional, attitude, value, passion, appreciation, and social. There are affective steps from the lowest to the highest or from the simplest to the complex, there are ability to receiving, ability to responding, ability to valuing, organization, and characterization by a value complex.

Psychomotor indicator is about skill achievement of students either manually or individually. The steps are perception, readiness, mechanism, guided responses, skill ability, adaptation, and organization. According to Dimyati & Mudjiono (2009: 175) psycomotoric indicator has six aspect, there are: 1) reflective movement, 2) fundamental movement, 3) perceptual ability as like hearing, seeing, 4) physical ability, 5) motoric ability, 6) non-verbal activity.

Cognitive indicator relates with students achievement in intellectuality. One of the students achievement in cognitive indicator is conceptual mastery. Mastery itself is comprehension and ability to use the knowledge. While, the word "Concept" according to Rose cited Dahar (2006: 62) is an abstraction that represent the objects, phenomenon, activities, and relation that has the same attribute. Based on Dahar (2006: 63) concept is mental abstraction that represents one of stimuli class.

Conceptual mastery is the strata where the students is not only know about knowledge itself but they has to be comprehended about it. It is indicated by their ability when they try to solve the problem, even it relates with the process itself or relates with new contextual situation. According to Bloom taxonomy that has

been revised, conceptual mastery covers a cognitive indicators C1 (Remembering), C2 (Understanding), C3 (Applying), C4 (Analyzing), C5 (Evaluating), C6 (Creating). The indicator of remembering and understanding can be called as lower thinking, while applying, analyzing, evaluating, and creating can be called as higher order thinking (Widodo, 2005).

Students achievement has influenced by some factor. According to Dimiyati & Mudjiono (2009: 94), there are:

1. Internal Factor

Internal factor comes from students itself. There are two internal factor inside the students. Physiology that is nature aspect and psychology that is in soul aspect. Physiology aspect relate with body organ and healthy, while for psychology aspect relates with intelegency, passion, talent, students motivation. According to Gagne said that the students who are learning has to be given a motivation in order the knowledge that has already received by them are very useful for them.

2. External Factor

External factor comes from outside of students. This factor has two aspect, i.e. social environment and non-social environment. Social environment of school are, teacher, school staff, classmates that can give a student's motivation for learning. Non-social environment are school building, houses, learning equipment, weather condition, and learning time that is used by students.

### **E. Different Gender**

Gender is defined by FAO as 'the relations between men and women, both perceptual and material. Gender is not determined biologically, as a result of sexual characteristics of either women or men, but is constructed socially. It is a central organizing principle of societies, and often governs the processes of production and reproduction, consumption and distribution' (FAO, 1997). If we talk about gender, we also talk about the sex in human that cannot be changed, that is female and men.



Those are female and male has the stereotype, according to Harlock cited Putri (2010: 24) that male or boys has a characteristic more masculine, ambitious, aggressive, competitive, has the high analysis ability, also leadership, and high confident. Beside that, the characteristic of women are more feminist, loves, peaceful, sensitive, and high ability in communication. Those are proven by the research from University California in Los Angles said that, women has more than 30% *corpus callosum*. *corpus callosum* itself connects the right part of brain to the left part of brain and it possible has a communication between them. If the corpus callosum has more in amount, so it make a possibility to the women has a good ability in communication. Estrogen hormone in women can activate the cell to work and produce more.

Both men and women use their lobes of their brain but in different composition. Men tends to use his left hemisphere of brain. Left hemisphere of brain in men develops more than women. Left hemisphere of brain here controlled the logical thinking, abstract things, numerical arrangement, analytical thinking. That is why male doing better in multimedia interface than women or girls in learning (Chuang, 2008). dr Camilla Benbow and colleague dr Julian Stanley tested a group of gifted children and found that boys good at math outnumbered girls by 13 to 1. Boys can construct a block building from two-dimensional plans easier and quicker than girls, they can estimate angles accurately and can see whether a flat surface is level. These ancient hunting skills are the reason men dominate areas like architecture, chemistry, physics, building, and statistics (Pease and Pease, 2008:124). According to Carter (2005), the perception of the subject of leaning especially in physics. That physics can be called as “Boys subject” because physics contain analytical, numerical, logical thinking that more tends to male students. While women has better develops in her right hemisphere of brain. Right hemisphere of brain that controls the intuitive, artistic, imaginative, holistic, and others task and visual (Wood, 2009).

Using computer in education for learning, in this cases girls students consider that computer is used to do something useful for them. Girls in multimedia interface or computer tends to visual design of multimedia itself,

while boys is tends to navigation and control the multimedia or computer itself (Passig and Levin, 2000). This statement is in a line with Turkle *et. Al* cited Johnson (2006) that boys consider the computer is something that has to be comprehended, while girls use a computer as tools to reach a goal or doing their task, and expected that computer can make them comfort. Also the research told male in learning using media or multimedia demonstrate better than female users did (Chuang, 2008). So, even female or male students has differences in multimedia interface, they actually construct their mind and develop their thinking. Besides that, The research said 84% of girls consider computer as a tools to reach their goals or tools to give them a freedom in creativity, while boys that agree with that, only 33% (Pease and Pease, 2008: 142).

Women brain is arranged to do the some tasks in the same time, can handle works or activity that needs a smooth movement in the small area, one of them is when she reads in computer screen (Pease and Pease, 2008: 121). In hearing activity, generally women has better ability than men, because women brain has an ability to separate and grouping the type of sounds and they can recognize it (Pease and Pease, 2008: 121). Not only that, but women and men has differences in receiving of visual information (Passig and Levin, 2000).

## **F. Optic Material**

### **1. Analysis of Material**

In KTSP curriculum, Optic topic placed on VIII Grade of Junior High School second semester with standard competences and basic competences below on the table:

**Table 2.3**

#### **Standard Competences and Basic Competences of Optic**

<b>Standard Competence</b>	<b>Basic Competence</b>
Understand a concept and application of waves and optic in daily product of technology	Investigate properties of light and its relationship with the shape of mirror and lens.

(BSNP, 2006)

Junior High School of Pribadi Bilingual Boarding School has a special curriculum as called national plus. Means that, they use KTSP as standard but they combine it with developed country curriculum as Turkey and Cambridge curriculum. So, there is a rich in content delivery. For instance, the teacher tells about the ray of refraction until detailed.

## 2. Description of Optic Topic

Optic topic as one of abstract topic that is taught in junior high school students. The material covers reflection, refraction, converging lens, and diverging lens. In this research the material that will be taught is refraction, converging lens, and diverging lens.

Refraction is the phenomena of change in direction, or bending of light when it passes from one medium to another is called refraction. Refraction also has laws of refraction there are ; 1) the incident ray, the refracted ray , and the normal at the point of incidence all lie in the same plane; 2) light passing from a less optically dense medium into denser medium toward the normal; 3) light passing from an optically denser medium into a less dense medium bends away from the normal. The ray is refracted from one substance to the other substance with different refracted index and density of its particle, so it causes the form of image in every substance that rays refract.

Converging lenses is a thin lens that is able to converge (bring together) to a point parallel beam of light passing through it. Some rays will pass without deviation, through the center  $C$ , of the lens.  $C$  is called its optical center. The line which is pass symmetrically through the optical center of the lens is known as the parallel axis of the lens. All rays close to and parallel with the principal axis, converge to a point of  $F$  on the axis called focal point or the principal focus. The distance between the focal point and the optical center,  $C$  is termed the focal length  $f$  of the lens. Ray diagram of converging lens are: 1) the incident ray parallel to the principal axis passes through the focal point,  $F_1$ . 2) the incident ray which passes through the optical center,  $C$  is not deviated. 3) the incident ray passing through  $F_2$  becomes parallel to the principal axis. While, the diverging

lens is the lens that has ability to diverge (spread out) the light beam. The special ray of diverging lens are: 1) light ray parallel to the principal axis is refracted so that it appears to come from the principal focus behind the lens. 2) a ray directed towards F on the other side of the lens bends, so that it becomes parallel to the principal focus. 3) a light ray passing through the optical center travels without changing its direction. The special image that is formed by diverging lens is Virtual, upright, diminished.

An optic topic that is explained has relationship with other subject in science. For instance in biology, optic topics can be integrated with the human body, there are the structure of human eyes. Also in chemistry, optic topics can be integrated with the structure of particle that arranged in each substance. It can causes the differences of image which is formed by light rays that travels from two different medium.

### **G. Hypothesis**

The research hypothesis in this result as following:

$H_0$  : There is no differences of students conceptual mastery improvement between boys class and girls class by using virtual laboratory media on optic topic.

$H_1$  : There is differences of students conceptual mastery improvement between boys class and girls class by using virtual laboratory media on optic topic.