CHAPTER I
INTRODUCTION

1.1 Background

Education is one of the determinants of human resource quality which predetermined through education objectives. To support the educational objectives, one of the Indonesian government policy implemented is the fulfillment of minimum budget 20% for the educational sector from the national budget which is usually called as APBN, but the result is at the stake. It can be said that education issues in our country are not caused by the limited budget, but the problems are how to perform an appropriate curriculum among schools with all supporting instruments, programs, and education policy effectively and significantly. As the result, the output of educational sector most likely to raise human quality.

According to the Regulation No. 20, The year 2003 on National Education System aims at developing student potentials in order to become a man that has faith and being fearful of God Almighty, noble, healthy, knowledgeable, skilled, creative, independent, and becomes a democratic and accountable citizen. Consequently, the prevailing national curriculum should embody all specified resources to achieve the purpose of national education system. In other words, to achieve educational goals, modifications in teaching and learning in science learning should be as effective as possible. For an example, development of methods, strategies, instructional material in which enables to construct student-oriented knowledge.

In science learning, the student considered chemistry as a difficult topic which sometimes discourages them in keeping up studies in chemistry (Sirhan, 2007). In the similar study, Taber (2009) suggested chemistry is a very conceptual subject, and most of the concepts are abstract. While concrete things can be seen or manipulated by the student senses are materials or chemicals is a small part of learning chemistry. However, chemistry is a subject that refers to a lots ideas, but in fact, they are not easily demonstrated.

Although chemistry syllabus incorporates with a lot of abstract concepts, the concepts are important for further studies either chemistry or other sciences. Therefore, the necessity of good representation level of abstract concept must be suited to the characteristics of that topic. This is the reason why Johnstone (1991) suggested chemistry must be taught with a specific and suitable representation level: macroscopic, sub-microscopic and symbolic.

One study, Tienand Osman (2014) stated that chemistry teaching macroscopically in which chemical process of changes can be observed directly. It is different in performing the nature Phenomenon of any abstract concept can be visualized microscopically. For an example stated by Taber (2009), chemical changes. It can be readily shown to students but the problem is the explanations depend upon highly abstract concepts, ideally to teach this topic involves an approach with sub-microscopic entities.

Another representation level delivers a message with the symbolic sign of certain matter, such as chemical symbol, formulae, reaction equations, and chemical calculations. Accordingly, the teacher needs to provide the best representative levels in way of delivering the concept of chemistry that associated with its characteristics. Thus, the increase of the students' performance of chemistry, representation level has a significant role.

The abstract concept in learning chemistry makes students difficult to learn (Samba and Eriba, 2012). It is not surprising that students learn chemistry failed. The failure of students' performance of chemistry was caused many reasons and it has been proved by earlier studies. Teachers' competence is one of that reason (Agogo and Onda, 2014; Mailumo et al, 2009; Koebler, 2011). Both teachers and students not only have a significant role in poor performance of students in learning chemistry (Mailumo et al, 2007) but also there is an interaction between teachers and students to the failure of chemistry (Mahajan and Singh, 2005). Another cause is concept difficulty (Agogo, 2003: Agwai, 2008).

Some studies have shown the difficulty level of chemistry concept varies. Chemistry syllabus that considered difficult to learn is Reduction and Oxidation, Chemical Equilibrium and Mole according to Finley et al., 1982. According to the latest study, Tien, and Osman, 2014 rated electrochemistry. Surprisingly

studies, Hajah, 2008; Schmid et al., 2009 stated acid and base. Chemistry teachers not only considered chemistry syllabus were difficult to teach, but also students acknowledged it difficult to learn. Therefore, the teacher should apply an approach that is suitable, convenient, practical and not likely to cause students' misconception.

Not only the difficulty level of chemistry syllabus, but there was some perception towards factors that affect the poor performance of learning chemistry. Uchegbu et al. (2015) in their study of teachers' perception of the impediments to chemistry teaching in secondary schools in Imo State, Nigeria stated that 82.15% of respondents agreed teachers' factor inhibited the effectiveness of chemistry teaching, while students' factor 82.13%. Another similar study was reported by Agogo and Onda (2014) suggested that 64.70% of the respondents agreed with chemistry teachers are less qualification. While 31.60% of the respondents acknowledged teacher's qualification have no influence toward the perception of students' difficult concept. To bridge this issue, teachers should respond it by providing creative solutions, for example by utilizing information technology.

A great concern has been given by educators on availability and development of multimedia. Arkun and Akkoyunlu (2008) stated multimedia has affected education systems, learning environments, instruction materials and learning methods. Computer-based learning makes the learning process more enjoyable and active through interesting presentations of scientific concepts, including picture (visual), sounds (audio), and text (narration).

Educators should utilize computers as an instructional media in the classroom. Computer-based learning allows educators to facilitate students' construction of knowledge in different ways; exciting, visible and practical method. However, multimedia as instructional materials can instruct students individually. This differs from conventional learning used to experience with many students. (Krishnasamy, 2007). As results reported by Akcay et al. (2006) that computer-based-learning process was more successful than traditional learning toward the gain of students' achievement.

Approaches were taken in the design process of the learning environment depend on the learning theory that they based on. It may be behaviorist or cognitive learning theories. Mayer and Moreno (2002) suggested the key to the design of cognitive load theory in the development of any instructional messages should be designed which enables in turning down that chances of learner's overloading of the cognitive system.

According to Mayer and Moreno, (1998), the design of effective multimedia most likely presented through words and pictures elements. In the further study, they suggested presenting too many words and pictures would lead to overloaded and limited thoughts, consequently, some of the elements are not processed further (Mayer and Moreno, 2002). They also believed that all multimedia messages are not effective. Hence, the need to design multimedia message should apply meaningful learning. Its implications, each of cognitive process should be thoughtfully planned such as selection of relevant words and image, the arrangement of that feature become coherent representations, and integration of its corresponding.

Multimedia materials that were used in learning environment seem to be a natural as well as good science teaching practice, promotes opportunities for an active learning, contextual-oriented instruction, and visualizes the difficult concepts. Talib et al. (2005) suggested that computer animation was considered a highly reliable application in creating the computer-based learning environment. They also highlighted that challenge of making computer animation relies on teacher's ability.

The ease of accessibility of computerized multimedia has made educators simply view and interact with the representation of phenomenon and process (Plass et al., 2012). For an example, the multimedia is a simulation. Simulation is multimedia products that equipped with an animated feature that is able to navigate as an instructional media. This multimedia designed in the representation of molecular phenomena and natural processes that emulate as if it were original so that the symptoms observed and seen by the (Ardac & Akaygun, 2004; Honey & Hilton, 2011). Consequently, students will be given to having

opportunities to be an active learner and discern the pattern that built by their own investigations (Lindgren & Schwartz, 2009).

Plass et al. (2012) in their study of investigating the effectiveness of computer simulations for chemistry learning, suggested design principles related to their specific empirics of their projects should be thoughtfully considered in the design of simulations for low prior knowledge learners. That is an initial knowledge of which students have in beginning study of chemistry or other subjects.

Inquiry learning is a model of learning which enables students to get the deeper understanding, has broader perspective through various of sources of information that would be successfully implemented if this learning assisted by multimedia. Kuhlthau, (2004) stated guided inquiry equips students with abilities and competencies to address the challenges of an uncertain, changing the world and meets many requirements of the scientific approaches through engaging, motivating and challenging learning.

Students interact with simulation will be engaged with a process of scientific reasoning. It caused by animation capabilities in facilitating students' enhancement in determining problem definition, defining hypothesis, experimenting, and initiating of any interpretation (de Jong & van Joolingen, 1998; Kim & Hannafin, 2011). Accordingly, simulations not only assist students to understand about scientific phenomena but also advance them having an inquiry and problem-solving skills.

Plass et al. (2012) suggested that there was consistent evidence, integration of simulation with explanatory and graphs enhanced students' achievement of chemistry. In addition, they also suggested that Fidelity of Implementation (FOI) should be thoughtfully considered in effectiveness studies of multimedia learning. This is very important for the continuity of the learning process should be pursued under appropriate conditions and support. All forms of intervention and interference in the study avoided, it implies to the effectiveness of the study. Therefore, researchers should have to more control its implementation.

Based on the above explanation, It is clear, the researcher intends to design and develop interactive multimedia in accord with the learning environment.

Although the production of interactive multimedia based on the needs assessment, the necessity of effective and efficient multimedia is the point of this research. Accordingly, it will be a breakthrough in helping the shortage of visualization facilities in the learning environment. With a great expectation on the creation of this product, researcher highlight the title of this research is "**The development of interactive multimedia towards the most difficult chemistry syllabus in senior high school**".

1.2 Problems Identification

Referring to the background of this research, the problems could be identified asfollows:

1. Students' difficulty level in learning chemistry syllabus in senior high school.
2. Teachers' difficulty level in teaching chemistry syllabusin senior high school.
3. The majority of abstract concepts in learning chemistryin senior high school.
4. Students' perception towards the failure factors of poor performance in learning chemistry.
5. Teachers' perception towards the failure factors of student's poor performance in learning chemistry.
6. Non-conformance in election on representation levels while teaching chemistry syllabus.
7. Overloaded and limited thought while learning chemistry due to multi features of multimedia product.
8. Coherence and integration of visual and verbal presentation of the appropriate multimedia.
9. Intervention and interference factors while doing implementation of the multimedia in effectivity study.
10. Ineffectiveness of computerized product usage in the learning environment.

1.3 Problems Limitation

According to the identification of the problems, the problems of this research limited to as following:

1. Students' difficulty level in learning chemistry syllabusin senior high school.
2. Teachers' difficulty level in teaching chemistry syllabusin senior high school.
3. Students' perception towards the failure factors of poor performance in learning chemistry.
4. Teachers' perception towards the failure factors of student's poor performance in learning chemistry.
5. Election of actual representation level in teaching chemistry syllabus.
6. Analysis of multimedia usage at classroom in learning chemistry and analysis of developed appropriate multimedia.
7. Ineffectiveness of computerized product usage in the learning environment.

1.4 Problems Formulation

Referring to the problems limitation, the problems formulationof this research stipulated as following questions:

1. Which chemical syllabusesare considered the most difficult by the students?
2. Which chemical syllabusesare considered the most difficult bythe chemistry teachers?
3. What the student's perception of the failure factor in studying chemistry?
4. What the chemistry teacher's perception of the failure factor in studying chemistry?
5. How the teachers' views on the election of the representation levels in teaching chemistry syllabus in senior high school?
6. How the eligibility level of both content and design of interactive multimedia?

7. Is there any difference of the student'slearning outcomesbetween interactive multimedia-assisted guided inquiry learning than direct instruction in learning chemical equilibrium?

1.5 Research Objectives

According to the problems formulation, the objectives of this research are attempting to find out:

1. The most difficult of chemistry syllabus regarded by the students.
2. The most difficult of chemistry syllabus regarded by the chemistry teachers.
3. The students' perception of failure factor in studying chemistry.
4. The teachers' perception of failure factor in learning chemistry.
5. The teachers' views on the election of the representation levels in teaching chemistry syllabus in senior high school.
6. The eligibility level of both content and design of interactive multimedia.
7. The difference of the students' learning outcomes betweeninteractive multimedia-assisted guided inquiry learning than direct instructionin learning chemical equilibrium.

1.6 The Benefits of Research

After completing this research, the benefits are probably would be obtained as follows:

1. Helpful forresearch which relates to chemistry teaching material based on difficulty level in learning chemistry syllabus in senior high school.
2. Helpful for chemistry teachers to solve the students' difficulties in learning the most difficult chemistry syllabus by providing suitable representation or approaches.
3. Useful for chemistry teachers or educators to develop multimedia as the recommended teaching tutorial according to the favorbly representated by sub-microscopic.

4. To ensure that multimedia is most probably could be used as the substitute if the school lacks of laboratory facilities.
5. Efficiency of chemical reagents and materials in the chemical laboratorywhich could be replaced by animation or simulation in the interactive multimedia.
6. Informed that in solving chemical problems, teachers should ensure students have basic mathematical skills that support in solving the problem.

1.7 Operational Definition

In this research, it is important to explain operationally the characteristics of the variables according to that topic which aims at avoiding misinterpretation.

1. Referred to Guided Inquiry (GI) learning model in this study is a scientific approach carried out with a focus on developing students' ability to formulate problems, to make a hypothesis, and to solve the problems through a series of experiments guided by the teacher using interactive multimedia.
2. Direct Instruction (DI) in this study means the teachers have a major role in teaching and learningprocess of chemical equilibrium without using multimedia.
3. Student's learning outcomes in this study were the extent of students' cognitive ability towards chemical equilibrium taught by using interactive multimedia assisted-guided inquiry learning model.
4. PUSTEKOM Multimedia(PM) is the undeveloped multimedia regarding chemistry equilibrium which is created by the Ministry of National Education.
5. Interactive Multimedia (IM) is a computerized instructional module. A comprehensive and systematical module in learning chemical equilibrium based on ITC-delivered electronic system which performs animated and simulated instruction.

6. KTSP is an abbreviation of Kurikulum Tingkat Satuan Pendidikan (school-based curriculum), this curriculum was nationally implemented since the year 2016, and most of the Indonesian schools both public and private still apply this curriculum. The achievement of the cognitive levels is the focus of this curriculum.
7. K-13 is an abbreviation of "Kurikulum 2013" (Curriculum of 2013) is a nationally piloted curriculum of government which focuses on the achievement of the cognitive, attitude and psychomotor competence.