

CHAPTER I

INTRODUCTION

A. Background

Every instructional design is underpinned in some way or other by a theory of learning and a way of “knowing” or “seeing” the world. While learning theory describes and attempts to explain how people learn, the main aim of instructional design is to provide guidance on the practical task of designing learning experiences (Moseley, 2005). Many educational researchers developed better learning theory following condition and problem happened in recent educational issues. One of learning theory investigated in this research is learning theory based on learning dimensions belong to R. J. Marzano, an American educational researcher.

Marzano (1992) launched a theory-driven meta-analysis of educational instruction using categories which specific and functional enough to provide guidance for classroom practice. This theory is presented as taxonomy to help teachers and others design educational objectives, curricula and assessment. The basic components of Marzano’s theory-based taxonomy consist of knowledge domain, cognitive system processes, metacognitive system and self system. The components have connection one to each other, in which the self system controls the metacognitive system and the metacognitive system controls the cognitive system. Each component also operates on the retrieved content of individual’s knowledge domains.

Marzano’s new taxonomy for the first time was introduced in 1992 in his book with the title *A different Kind of Classroom*. The taxonomy was known as learning dimensions. There are five learning dimensions that have been explained by Marzano. They are attitude and perceptions, acquire and integrate knowledge, extend and refine knowledge, use knowledge meaningfully and productive habits

of mind (Rahmat, 2007). These dimensions recently become a base instructional in many school in America, the continent where Marzano lived. All of dimensions constructed base on requirement of thinking process.

Thinking process is regarded as activity of working memory. Working memory is all conscious cognitive processing occurs, can handle only a very limited number possibly no more than two or three of novel interacting elements (Paas, 2003). In other hand Sweller (1988) explained that working memory can be used to measure cognitive processing capacity required before the first move while the production list can be used similarly for processing that occurs during and after the first move. If there is task which impose cognitive system maintenance of learner then will turn up the cognitive load.

Cognitive load consist of three kind loads, they are intrinsic load, extraneous load and germane load. Intrinsic load is load in which information processing that has high interconnection simultaneously in working memory to construct cognitive scheme. Cognitive scheme is a cognitive construct that organized the elements of information according to the manner with which they will be dealt. Whereas extraneous load is load caused by learning design or organization of teaching material, it caused activity of working memory do not connect directly on construction of scheme. The last is germane load is load in cognitive scheme constructing. This load existed because learner gets the experience of intrinsic load or extraneous load. Germane load contributed in connecting new information with other information in long term memory (Hindriana, 2012).

From Hindriana's statement in previous explained about germane load, known that to get new information whether happen in learner's cognitive system is it will be connecting with old information in long term memory in order that can be saved in long term memory too. The old information from long term memory can come from another subject or material in previous lesson. So to obtain new information and it can be saved in long term memory or in the lesson can be called meaningful information teacher or informer can use connected teaching as

an approach to support its process (saving new information to long term memory or making new information as meaningful information). Connected teaching is the one of integrating teaching model. Integrating teaching models endeavor to combine some subjects or material which can relate one to each other (Fogarty, 1991). Using connected teaching as an approach or model can support constructing of new information also can be extending its information and finally learner can be facilitated in transferring information to solve the problem easily. In extending information it is suitable with learning dimensions belong to Marzano (dimension 3: extending and refining knowledge) and to get information meaningfully it is supported in dimension 4: Using knowledge meaningfully. So, connected teaching and instructional framework based on dimension of learning are assumed can support constructing information in long term memory or making information as meaningful information.

This study analyzed cognitive load student which extrude their cognitive system in connected teaching using instructional framework based on learning dimensions. Author applied this study into biology learning, especially in excretory system topics which is reputed as a difficult enough topic in biology because it relate complex with another topics such as digestion system, endocrine system also regulation system even with another subject like chemistry in explanation kind of interstitial fluid or explanation of physic in pressure complete the explanation about excretory system. In the classroom teachers often deliver a small part of excretory system topic. This problem will cause the students lack of cognitive system processing, so it can make a little amount of the constructed scheme in their cognitive system and finally cause the learning process will not be meaningful.

So, using connected teaching approach is an effort to avoid the problem above. Connected teaching automatically will increase the complexity of excretory system topics and it will conduct cognitive system to construct cognitive scheme and also it can be supported with instructional framework based on learning dimension. Meissner (2013) concludes design of demanding tasks

requires: 1) Adequate levels of intrinsic cognitive load; 2) Reduction of extraneous cognitive load and 3) Enhancement of germane cognitive load. Its requirements explain briefly that managing cognitive load is important to be concern. In addition its can fulfill the needs of information to process in learner's cognitive system then construct to be cognitive scheme which can become a meaningful knowledge.

Base on cogitation above, the prior challenge of this research was to present the effects of instructional framework base on learning dimensions in excretory system topics with connected teaching and it is assessed by cognitive load of the learner. Because of that, this research used experimental method to compare the effects between instructional learning base on learning dimensions and conventional instruction.

B. Problem Statement

The problem that focused in this research was as follow "*How are cognitive load of senior high school students on connected teaching of excretory system using instructional framework base on learning dimensions?*" this problem was then break into several research following questions:

1. *How is intrinsic cognitive load of senior high school students in control class and experiment class on connected teaching of excretory system?*
2. *How is extraneous cognitive load of senior high school students in control class and experiment class on connected teaching of excretory system?*
3. *How is germane cognitive load of senior high school students in control class and experiment class on connected teaching of excretory system?*
4. *How is correlation among each cognitive load indicators (analysis information skill, mental effort and interdisciplinary thinking skill) in control class and experiment class on connected teaching of excretory system?*

C. Research Purpose

The main purpose of this research is to identify student's cognitive load on connected teaching of the excretory system topic with instructional framework based on learning dimensions.

D. Problem Limitation

In order to make more focus in doing the research, the problem will be limited on follow these aspects:

1. Type of connected teaching used in this research includes intra-disciplinary and interdisciplinary which connected concepts in excretory system will be connected to other concepts such as circulatory and digestive systems and also to several relevant concept in physic especially about fluid (hydrostatic pressure) and topic in chemistry especially about electrolyte and non-electrolyte, liquid ions equilibrium and solution (precipitation and buffer).
2. Excretory system topics in animal which will be delivered in this research are only in fish, insect and worms. These topics are used to expand the topic of excretory system or to enrich and refine the concepts of excretory system.
3. Learning dimension that implemented in experiment class are dimension 1 (attitude and perception), dimension 2 (acquire and integrate knowledge), dimension 3 (extend and refine knowledge) and dimension 4 (use knowledge meaningfully).

E. Research Assumptions

Instructional framework base on learning dimensions consist of knowledge domain, cognitive system processes, metacognitive system and self system moreover the material of learning is delivered in connected learning its can accommodate the needs of cognitive system to construct cognitive scheme whereas meaningfully knowledge (long term memory). Because of those

cognitive load of student overall will decrease except germane load because it is the load of constructing cognitive scheme itself.

F. Research Hypotheses

H_{0-1} : *There is no significant difference of intrinsic load in experiment group and control group.*

H_{1-1} : *There is a significant difference of intrinsic load in experiment group and control group.*

H_{0-2} : *There is no significant difference of extraneous load in experiment group and control group.*

H_{1-2} : *There is a significant difference of extraneous load in experiment group and control group.*

H_{0-3} : *There is no significant difference of germane load in experiment group and control group.*

H_{1-3} : *There is a significant difference of germane load in experiment group and control group.*

G. Research Significances

1. Theoretical Significance

As a reference to encourage the application of connected teaching using instructional framework based on dimensions of learning as an alternative instructional framework that help to produce efficient learning also as a reference to encourage educator to consider student's cognitive load in learning.

2. For teachers

To encourage the practice of promoting student's cognitive load in everyday learning with connected teaching using instructional framework based on dimensions of learning.

3. For students

Connected teaching using instructional framework based on learning dimensions facilitate students to construct knowledge in their cognitive system using element interactivity from another topics or another subject so the knowledge become more meaningfully and can be saved in long term memory, so because of that students will only focus in their intrinsic load and germane load and will be not or just a little extruded of extraneous load.

H. Writing Organization

Chapter I is introduction of research which is consists seven subchapters, they are research background (A), problem statement (B), research purpose (C), problem limitation (D), research assumption (E), research hypothesis (F), research significances (G) and writing organization (H). Chapter II comprehensively discusses theories used in this research, which include cognitive load (A), connected teaching (B), characteristics of excretory system topic (C) and instructional frame work based on learning dimensions (D). Chapter III presents the operational definition (A), research location and subject (B), population and sample (C), research method (D), research design (E), learning strategy (F), research instrument and its development (G), technique of collecting data (H), data analysis (I), research procedure (J) and research flow (K).

Chapter IV include the findings and discussion of the study which organized into two subchapters based on the design of the study into: research result (A), and discussion (B). Finally in chapter 5 include conclusion (A) and recommendation (B) of the study complete this paper.