

## **CHAPTER II**

### **LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK**

The objective of this study is to develop an interactive learning multimedia of 'English for Year VII Science Teachers' for biology teachers to facilitate them in studying English. In this part, the theory of the English for science teachers, their problems, the solution to the problems, and procedures in developing interactive learning multimedia are explained. Then the conceptual framework of the research will follow.

#### **A. Literature Review**

##### **1. English for Science Teachers**

Nowadays, science teachers in Indonesia need to learn English because they are demanded to teach their subject in English. The government has issued Act (no. 78 year 2009) that regulates the pilot for international standard schools or *Rintisan Sekolah Bertaraf Internasional (RSBI)*. Article 5 Verse 3 states that International standard schools can use English and/or other foreign languages that are used in the international forum as the medium of instruction for certain subjects. Those subjects include science.

In the '*Panduan Pembelajaran MIPA dalam Bahasa Inggris*' or 'Teaching Mathematics and Science in English Guide' (Ministry of National Education, 2010) it is stated that the English skills of the mathematics and science teachers who teach in the pilot for international standard schools must be

developed intensively and continuously since they were not prepared to teach in English.

Science teachers who study English are categorized as learners of English for Specific Purposes (ESP). Hutchinson and Waters (1987:19) define English for specific purposes as an approach to language teaching in which all decisions as to content and method are based on the learner's reason for learning. In this case, the science teachers also have a specific purpose that they study English, which is so that they can do their job as science teachers professionally. The science teachers need to learn specific English, i.e. classroom English and science terms. They need classroom English in order to be able to manage the classroom and the learning and teaching process well. They need to master science vocabulary in English because the materials need to be taught in English. Therefore, the content and method of the language teaching for the science teachers will also be different from the general or other English language teaching materials.

Basturkmen (2006:9) states:

Whereas General English Language teaching tends to set out from point A toward an often pretty indeterminate destination, setting sail through largely uncharted waters, ESP aims to speed learners through to a known destination. The emphasis in ESP on going from A to B in the most time- and energy-efficient manner can lead to the view that ESP is an essentially practical endeavour.

It can be concluded that the content and the method in teaching learners in ESP context are specific. The content and method used will depend on the learners' needs. For science teachers, the contents of the English language

teaching must include input texts that are in the science area and classroom English.

According to Harding (2007:8), ESP learners have further purposes in studying English. The further purposes that they have usually involve specific language skills. In this case, the further purpose of the science teachers in studying English is to be able to teach their subjects in English well. They also need more practical skills than other people who are learning English. They need to be able to conduct a good learning and teaching process in their class. This can be done if they master the classroom English and the science vocabulary or technical terms in English. Thus the science teachers belong to the learners of English for specific purposes. The position of the science teachers in ESP can be clearly seen in the picture from Hutchinson and Waters (1987) below.

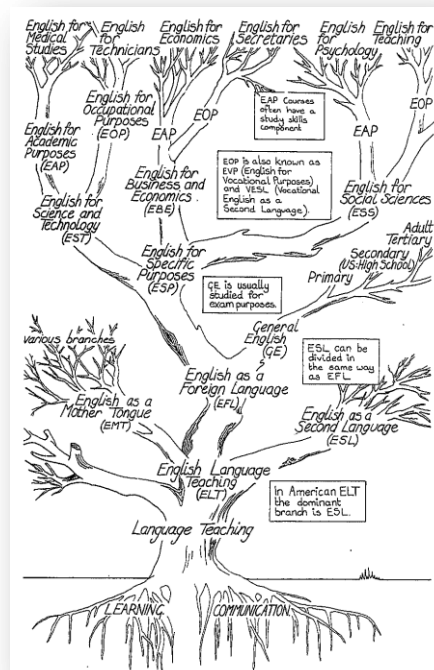


Figure 1: Tree of ELT (Hutchinson and Waters, 1987:17)

It can be seen that ESP has many branches. They are; English for science and technology, English for business and economics, and English for social sciences. Each branch also has other branches. The science teachers belong to the learners of English for occupational purposes. This is because they learn English so that they can do their job as a teacher professionally.

## **2. The current problems of the English for occupational purposes for the science teachers in Indonesia**

The science teachers in Indonesia still find it difficult to master English because the facilities that support them in studying and using English are not sufficient yet. A lot of efforts have been made by the government such as conducting in-house training and English for science teachers training. In addition, the government has also developed English for science teachers textbooks.

The training that has been provided is insufficient because it is usually held for a short period only. Learning language needs much exposure of the language. Straková (2007: 121) argues that the frequency available of the exposure to the language the learners are learning will influence the mastery of the target language. After the training ends, the science teachers do not get much exposure of English. Therefore, they cannot practise English much.

The English for Year VII Science Teachers book provided by the government is already good in some aspects. However, they are still insufficient because some of the aspects that the science teachers need are not provided there yet. For example, examples of how to pronounce technical terms are not provided

effectively. Another one is that the teachers will not have feedback from the book if they are not guided by an instructor. A good language material should meet at least most of the learners' needs.

Graves (2000: 153) mentions that good language materials should help learners develop specific skills and strategies and help learners develop specific language skills they need for authentic communication.

The books provided by the government develop specific skills and strategies to the science teachers. However, the activities in the books are limited. The teachers will only be given one chance for each activity. They cannot practise much. Once the activities are done, they will not go back and do the activities again. To help facilitate the science teachers practise English much and have more activities, they need a learning medium that can provide them much practice and more activities.

Another problem is that science teachers are busy people. They must teach at school in the day time. When they want to study English, they need an effective learning medium that can be used flexibly, which means they can use it at anytime and anyplace they want.

### **3. Interactive Learning Multimedia**

#### **a. Definition**

Roblyer and Doering (2010:170) state that:

multimedia simply means "multiple media" or "a combination of media". The media can be still graphics and photographs, sound, motion video, animation, and/or text items combined in a product whose purpose is to communicate information in multiple ways.

Reddi (2003) cited in Mishra and Sharma (2005: vii) proposes that:

multimedia can be defined as an integration of multiple media elements (audio, video, graphics, text, animation, etc.) into one synergetic and symbiotic whole that results in more benefits for the end user than any one of the media elements can provide individually” (Reddi, 2003).

According to Phillips (1997) cited in Mishra and Sharma (2005: vii), the term ‘interactive multimedia’ is:

a catch-all phrase to describe the new wave of computer software that primarily deals with the provision of information. The ‘multimedia’ component is characterized by the presence of text, pictures, sound, animation and video; some or all of which are organized into some coherent program. The ‘interactive’ component refers to the process of empowering the user to control the environment usually by a computer.

From the three definitions above it can be concluded that interactive learning multimedia is a learning media with pictures, sound, animation, and video which can be run and controlled by the learners themselves.

#### **b. The advantages of interactive learning multimedia**

According to Sheppard in Shank (2005: 4), the advantages of interactive learning multimedia are: alternative perspectives, active participation, accelerated learning, retention and application of knowledge, problem-solving and decision-making skills, system understanding, higher-order thinking, autonomy and focus, control over pacing and sequencing of information, and access to support information.

Alessi and Trollip (2001: 5) also state that materials using technology (interactive learning multimedia) have logistical benefits. The materials will be cheaply and easily distributed, conveniently used by the users, and less time consuming for studying.

From the advantages above, it can be inferred that interactive multimedia potentially give many benefits to the science teachers. The interactive multimedia will be a good facility for them. They can study actively when using the interactive learning multimedia. They can also apply their knowledge with it. They can learn English at anytime and anyplace they want. They will be able to learn English autonomously. And they can also practise English as much as they wish without being bored. The interactive learning multimedia is flexible to be used.

### **c. Effective interactive learning multimedia**

To develop an effective interactive learning multimedia, there are points that must be taken into account. According to Alessi and Trollip (2001: 12) there are two foundations of interactive learning multimedia.

It is important to understand the different theories of learning that underlie all instruction and learning environment. A good and effective learning multimedia must be based on the learning theories or principles that are suitable for the users. If an interactive learning multimedia does not accommodate the users' characteristics and learning style or preference, then it will not reach the goal of the users using it to study.

These are the learning principles and approaches:

1) Behavioral Psychology Principles

Behavioral psychology holds that giving certain stimuli or conditions to the learners will make the learners change their behavior in learning. For example educators can use rewards and punishments to make the learners have good behavior in learning because they are motivated.

2) Cognitive Psychology Principles

Cognitive psychology comes from the word *cognition*, which means the process of knowing. It concerns unobservable constructs, such as mind, memory, attitudes, motivation, thinking, reflection, and other presumed internal processes. Alessi and Trollip (2001: 19). There are many issues in cognitive psychology that are important for interactive learning multimedia. They are:

a) Perception and Attention

When the users of the interactive learning multimedia are operating the multimedia, their perception and attention must be positive. Those can be done if the information is clear and easy to receive. The position of the screen must be convenient for the users to see.

b) Encoding

Learning is best facilitated by a combination of complementary visual and auditory information so that the stimuli will be encoded well.

c) Memory

There are two principles to enhance memory. First, the principle of organization, it says that information is remembered better and longer when it is



organized. The second principle is the principle of repetition. It views that the more information is practised or used, the better and longer it is remembered.

d) Comprehension

This means the user or learner is able to state a word's definition, but also can use the word appropriately in speech and writing and being able to understand other people when they use the word.

e) Active Learning

The learner activities in the interactive learning multimedia do not have to be just between the learner and the computer. Interactive learning multimedia can be used in the class as well. One learner can have a discussion with the other learner or the teacher in studying with the interactive learning multimedia.

f) Motivation

Interactive learning multimedia can give motivation. According to Melone and Lepper cited in Alessi and Trollip (2001: 24), there are four relevant factors of motivation. They are challenge, curiosity, control, and fantasy. There is another motivation theory that suggests increasing motivation. It is called Keller's ARCS Motivation Theory. ARCS stands for four design considerations for creating motivating instruction. They are attention, relevance, confidence, and satisfaction.

g) Locus of Control

Locus of control means whether control of sequence, content, methodology and other instructional factors are determined by the learner, the program, or some combination of the two. Alessi and Trollip (2001: 27).

Locus of control also promotes autonomous learning. According to MacDougall (2008: 224) autonomous learning is

as a type of learning which is characterised by personalization, self-directedness and less *dependency* on the educator for affirmation, and which therefore enhances rather than hinders the capacity for constructive collaborative participation in the workplace.

h) Mental Models

Alessi and Trollip (2001: 28) state that a mental model refers to a representation in working memory that can be “run” by the learner to understand a system, solve problems, or predict events. Many components of interactive learning multimedia are potential to develop mental models. Those components are animations, video presentations, and computer diagrams.

i) Metacognition

Alessi and Trollip (2001:28) define metacognition as the awareness of one’s own cognition. In designing an interactive learning multimedia, components that can develop the learners’ metacognition should be provided.

j) Transfer of Learning

Interactive learning multimedia must facilitate components that can provide transfer of learning. The components can be simulation, case-based learning, and collaborative learning.

k) Individual Differences

Each learner has a different learning style. Interactive learning multimedia can give advantages to solve the individual differences.

### 3) Constructivist Psychology Principles

Constructivist learning theory maintains that knowledge is not received from outside, but that we construct knowledge in our head.

Second, effective interactive learning multimedia must follow the design principles. According to Alessi and Trollip (2001: 48), the categories that must be provided in the interactive learning multimedia are:

- a) Introduction to the program
  - Title page
  - Directions
  - User identification
- b) Learner control
- c) Presentation of information
- d) Help
- e) End of program

There are other design principles proposed by other experts. Mayer (2001) cited in Neo, M., et.al (2008: 659) proposes these design principles.

Table: 1 Mayer's Design Principle

No.	Mayer's (2001) design principles
1	Multimedia Principle: Students learn better from words and pictures than from words alone.
2	Spatial Contiguity Principle: Students learn better when corresponding words and pictures are presented near rather far from each other on the page or screen.
3	Temporal Contiguity Principle: Students learn better when corresponding words and pictures are presented simultaneously rather than successively.
4	Coherence Principle: Students learn better when extraneous words, pictures, and sounds are excluded rather than included.
5	Modality Principle: Students learn better from animation and narration than from animation on-screen text.
6	Redundancy Principle: Students learn better from animation and narration than from animation, narration, and on-screen text.

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No.	Mayer's (2001) design principles
7	Individual Difference Principle: Design effects are stronger for low-knowledge learners than for high-knowledge learners and for high-spatial learners rather than for low-spatial learners.

#### **4. Interactive Learning Multimedia in Research and Development (R & D)**

##### **a. Definition**

When people want to develop interactive learning multimedia, they are automatically dealing with research and development. Borg and Gall (1983:772) define educational research and development as a process used to develop and validate educational products.

##### **b. Products that can be developed with R & D**

The aim of research and development according to Borg and Gall (1983: 772) is:

to develop products, in this case to develop educational products. Those products includes not only textbooks, instructional films, and so forth, but also intended to refer to establish processes, such as method of teaching or a method for organising instruction.

Sugiyono (2009: 412) explains that the educational products that can be developed are for instance a specific curriculum for specific educational needs, teaching method, learning media, textbook, module, teacher competence, evaluation system, a classroom arrangement model, and management model.

Similarly, Sukmadinata (2006: 164) states that the products are not always things that can be touched or hardware such as books, modules, or classroom and laboratory facilities, but those products can also be software such as computer

programs for the media in the class, data analysis, library, laboratory, and other educational models.

From the explanation above, interactive learning multimedia can be one of the products designed for educational purposes following the R & D research design.

### **c. The steps in the R & D research design**

Borg and Gall (1983: 775) propose the steps for doing research and development. They are:

- 1) Research and information collecting
- 2) Planning
- 3) Preliminary form of products
- 4) Preliminary field testing
- 5) Main product revision
- 6) Main field testing
- 7) Operational product revision
- 8) Operational field testing
- 9) Final product revision
- 10) Dissemination and distribution

Therefore, if people want to develop an interactive multimedia for research, the steps of the research can follow the steps above.

#### **d. Procedures in developing interactive multimedia**

As mentioned earlier, there are many products that can be developed through research and development. Each product has its own characteristics and differs from the others. The steps in developing different products are not always the same. The steps proposed by Borg and Gall (1983) are the basic steps in developing products. However, different products need different steps which are of course still in line with Borg and Gall's steps.

There are many procedures in developing the interactive learning multimedia. Some procedures will be explained below and one will be chosen by the researcher as the procedure in designing the interactive learning multimedia. These are some different procedures in developing interactive learning multimedia:

1) Ten step Multimedia Development Model Frey and Sutton (2010: 494).

- Step 1: Define the instructional goals, objectives, and audience.
- Step 2: Review and investigate existing options.
- Step 3: Determine format, budget, and timeline.
- Step 4: Determine the content, activities, and assessment strategies.
- Step 5: Develop evaluation strategies, criteria, and instruments to determine the effectiveness of project.
- Step 6: Develop the flowchart, site map, and/or storyboard.
- Step 7: Develop a prototype.
- Step 8: Perform a formative evaluation.
- Step 9: Complete the design.
- Step 10: Perform a summative evaluation of product and process.

2) The research procedure proposed by Allesi and Trolip (2005):

a) Planning

This step involves the preparation of the research administration.

(1) Defining the scope

- (2) Identifying learners' characteristics
- (3) Determining and collecting resources
- (4) Obtaining client sign off

b) Designing

This step involves the preparation of developing the media.

- (1) Developing initial content ideas
- (2) Conducting task and concept analysis
- (3) Preparing script
- (4) Obtaining sign-off

c) Developing

This step involves developing the software.

- (1) Preparing the text
- (2) Creating the graphics
- (3) Producing audio and video
- (4) Preparing supporting materials
- (5) Assembling the pieces
- (6) Doing an alpha test
- (7) Making revisions
- (8) Doing a beta test
- (9) Making final revision
- (10) Obtaining client sign-off
- (11) Validating the program

3) The research procedure proposed by Lee and Owens (2004)

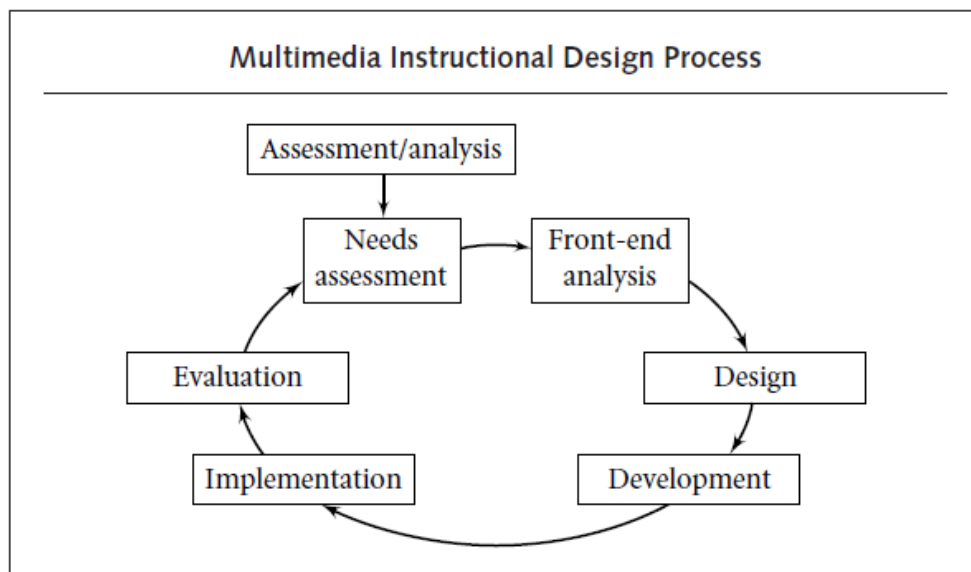


Figure 2: Multimedia Instructional Design Process  
(Lee and Owens, 2004: xxviii)

a) Analysis

This step includes the needs assessment and front-end analysis.

- (1) Analysing the learners' characteristics
- (2) Analysing the learners' needs
- (3) Analysing the materials

b) Design

This step involves designing the diagram of the interactive multimedia based on the result of the needs analysis.

c) Development

- (1) Making the interactive learning multimedia based on the diagram



- (2) Asking for expert's judgment of the first draft on the content validity and the face (multimedia) validity
- (3) Making revisions of the first draft
- (4) Finishing the second draft

d) Implementation

In this step, the researcher conducts a try-out of the learning multimedia to the users.

e) Evaluation

- (1) Trying-out the second draft to the learners
- (2) Making revisions of the second draft
- (3) Finishing the final draft

It can be seen that the different procedures above have similarities. The essence of those procedures are planning, designing, and developing the interactive multimedia. The researcher adapted the research procedure proposed by Lee and Owens (2004). The researcher chose to adapt the research procedure proposed by Lee and Owens because it is the most suitable procedure with the research condition. It is suitable for the researcher because the steps proposed by Lee and Owens are simple, clear, adaptable, and feasible to follow.

## **5. Review of Relevant Research Studies**

Many studies about interactive multimedia have been done past. Many of them show that interactive multimedia gives advantages to the learners.

Neo, M., et.al. (2008: 663) found that most learners state that multimedia elements help them understand the materials more easily. The interactive multimedia also helps them do their assignment because it provides visualisation and information. In addition, it also provides a fun element to the learning process and enhances their learning of the material.

In their research, Kamat and Shinde (2009:7) state that:

the students' perceptions on the use of multimedia and interactivity were very positive. Students said that learning with interactivity and multimedia was interesting and engaging; they also found this method of learning useful and favourable. Some expressed their desire to learn whole curriculum through Interactive Multimedia packages.

Based on the findings in the research studies above, interactive learning multimedia gives advantages to students in learning. Therefore, interactive learning multimedia can be one of the learning media that can be developed for the science teachers for studying English.

### **B. Conceptual Framework**

Based on the literature review, it is known that the science teachers need to study English in order to do their job well. They need a learning medium that can help them study English flexibly. One of the flexible media that they can use is the interactive learning multimedia. The interactive learning multimedia can give many advantages to the science teachers in studying English. First, it can be

flexibly used. Second, it is motivating. And last, it accommodates the aspects that are not yet accommodated by the government such as providing effective pronunciation and technical terms practice.

Therefore, the researcher developed a learning medium, which is the interactive learning multimedia for the science teachers, especially for biology teachers. The researcher developed it based on the R & D steps proposed by Borg and Gall and the procedures for developing interactive learning multimedia proposed by Lee and Owens because they are the most suitable for the researcher.

These are the steps the researcher employed in the research:

a. Analysis (Needs analysis)

(1) Analysing the learners' characteristics and needs

The researcher gained the information of the learners' needs and characteristics by conducting an interview.

(2) Analysing the materials

The materials that were developed as the interactive multimedia were analysed based on the learners' characteristics and needs. The materials that were developed for the interactive learning multimedia were based on the book developed by the government entitled English for Year VII Science Teachers.

b. Design

The researcher designed the diagram of the multimedia based on the materials and principles in making interactive learning multimedia.

c. Development

The researcher developed the interactive learning multimedia based on the diagram herself with Adobe Flash CS3.

(a) Asking for expert's judgment of the first draft on the content and the software.

After the first draft is done, the researcher asked for experts' judgment on the content and the layout of the multimedia itself.

(b) Making revisions of the first draft

The researcher revised the first draft of the interactive learning multimedia based on the experts' judgment.

(c) Finishing the second draft

d. Implementation

After the first draft is done, the researcher conducted a try-out on the second draft to the learners. After the second draft is done, the researcher did a try-out of it to the science teachers.

e. Evaluation

In this step, the researcher evaluated the interactive learning multimedia by giving a questionnaire and conducting an interview to the teachers. The researcher then revised the second draft based on the science teachers' feedbacks.

f. Finishing the final draft