

# 3D Design Of Chemistry Subject at UTeM : Atom Cubic

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**Abstract**— This research highlights the development of 3D approach in learning for chemistry subject. Chemistry is one of the compulsory subjects for all undergraduate students in science fields. There are a number of methods to deliver chemistry lessons especially in classes of basic molecular formation theories. Throughout the years, various teaching methods have been adopted to assist students to better understand in learning chemistry subject. Current knowledge delivery in education is dynamically changing to more flexible and reliable. This research attempt to alternatively present new ways of learning chemistry subject by using 3D approach to encounter the problems found from the survey and interview done.

**Keywords-component; 3D Approach, Chemistry**

## I. INTRODUCTION

This project will research about the design, development and effectiveness of the 3D animation for the teaching and learning of chemistry. This learning courseware project to assist students to a better and easier learning environment. This learning courseware will derive from the syllabus and the technique chosen in presenting the content is mind mapping. Teaching and learning based on computer had grown since forty years ago and the latest innovation is multimedia field [1]. Multimedia technology has expended the usage of computer from information processing tools to teaching tools. Multimedia technology has ability in delivering text, video, sound, animation and high resolution graphic. An information delivery effect created by combination of images, texts, and sounds has shown the significance everlasting compared to listened or read [2]. Combination of these elements will create an interesting presentation and make the information conveying more meaningful. Teaching media that using multimedia technology are able to get the student's attention, get the idea, and gain the complex information and help to prevent lack of time, size and space. Computer-based teaching media that has interactive can able the user to access the information from one segment to another without following the flow.

### A. Objectives

There are several ideas on the reason of developing this courseware. The objectives that included are:

- To develop interactive 3D approach for easy visualizing in the teaching of mechanical engineering Chemistry topic of Properties of matter.
- To choose suitable methodology for learning development
- To evaluate the effectiveness of teaching by using interactive 3D approach in the subject of mechanical engineering Chemistry through a case study with engineering students of University Technical Malaysia Melaka, UTeM.

### B. Scope of Study

The target user of this courseware is for first year student from faculty of Mechanical Engineering. Lecturer and students can use the courseware in helping them understand better in this topic. For lecturer, it is a great way to explore the subject of Chemistry together with their students and easy for them to teach their students by showing them how the atoms is combine in 3D animation.

For students, it is a simple way for them to learn with the interactive courseware that provide an animation, sound, picture and text. The scope of this project is to develop an interactive learning application using computer. Computer is the most common device technology in the world now. It has become the most important gadget to human and we can say every single house and school should have computer. The application also has a few modules, which are notes, quizzes, simple games and past year questions.

### C. Problem Statements

One of the problems when student learn chemistry is students do not understand the topic well because it needs students to imagine the formation of the structure and their arrangement. By developing this courseware, it is use to stimulate student's interest in some content of the learning and as a supplement in class teaching, the graphics and animation make the subject come alive, so that learning the subject is much easier, animation, voice and video clips are used to implement various teaching strategies such as tutorials, activities and games. Besides that, the simple animation can be use in this courseware to make the learning of content in the class more interactive.

## II. LITERATURE REVIEW

Multimedia courseware is believed as the most appropriate way to encounter the problem of student in visualizing [3]. The covalent bonding molecular structure

stimulating program definitely assists learners to gain more understanding in molecular structures [4]. 3D environments in a conventional academic course can be engaging and beneficial in improving learning capabilities. Traditional learning to 3D environments has improved the quality of student learning through effective integration of current module design. Beside that 3D model can be rotate around any axis, and panned or zoomed in any direction.

#### A. Multimedia Courseware

Multimedia courseware is a computer application for learning that combines several media such as text, image, audio, video and animation. [1]. Students sees the courseware as the other perspective towards common instruction, can support flexible learning pace, provide extra materials apart from being delivered in class and have sense of fun compared to formal learning process.

#### B. Courseware for visualization

Student's ability to learn is varied and inconsistent with one another. Some students capture better information and knowledge with specific presentation methods like audio and visual [11]. The different ability of people to learn and capture the information is actually related to their learning style which is defined as the way a person takes and processes the knowledge. As for this project, 3D model atom in way of animation style is using to present the subject. Visualization is the ability to view and utilize an image of partial form into another appearance. Hence, the courseware for this project must be able to support student's visualization ability. Multimedia courseware will be used as the tool for assisting students in visualizing. The ability to visualize has enabled the students to understand the topic better. The concept used in this courseware will helping students who is having difficulties in visualization.

### III. RESEARCH METHODOLOGY

The methodology used to develop a courseware is ADDIE (Analyze, Design, Develop, Implement and Evaluate) model. The ADDIE instructional design model is a basic model that holds true for any type of learning, including Web-based (Hall, 1997). ADDIE is a simple and includes all the components found in all other instructional design models. ADDIE is five-phase systematic model used to create sound instructional products for a variety of educational settings. Each phase represents a series of tasks that help to ensure development efforts stay on track, on time, and on target. Completing each phase satisfactorily increase the chance that the information presented ultimately remains relevant to the needs of the audience. Each phase of the ADDIE model is an important element of the instructional design process. In each phase, the instructional designer makes decisions that are critical for ensuring the effectiveness of the instructional experience.

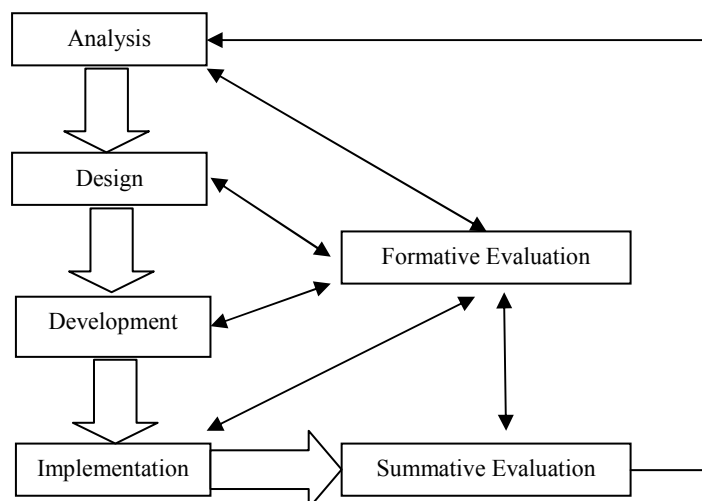


Fig. 1 The ADDIE Model

### IV. PRELIMINARY ANALYSIS

#### A. Questionnaire Result and Discussion

The research instrument consisted of a questionnaire and interview. The questionnaire was participated with 35 students from the faculty of mechanical engineering, University Technical Malaysia Melaka (UTeM),

The result of questionnaire and interview with chemistry lecturer and the students from the faculty of mechanical engineering, University Technical Malaysia Melaka (UTeM), shows that the topic of properties of matter is slightly difficult in visualizing the arrangement of the atoms in the cubic cells. Learning in conventional approach often use the whiteboard and textbook that only shows text and graphic to show the arrangement of the atoms in cubic cells. The arrangement of the atoms in the cubic cells are required learners' knowledge and mental image, so by using 3D technology approach is possible to applied to assist learners in the topic. This research addresses the impact of using 3D approach in teaching and its advantages over current approach. Besides, 3D model can be rotated around any axis, panned or zoomed in any direction. With 3D viewing also, students are able to position and recognize the object with relation to others scene, enabling a better and more complete visualization and interactive learning process.

TABLE I. MOST DIFFICULT TOPIC IN CHEMISTRY SUBJECT

Most Difficult Topic in Chemistry Subject	Mean (Student, n= 35)
Chapter 1 - Chemistry The Study of Change	1.57
Chapter 2 - Atoms, Molecules & Ions	2.14
Chapter 3 - Chemicals	2.26

Reaction	
Chapter 4 – Structure of Atoms	2.14
Chapter 5 – The Periodic Table	1.80
Chapter 6 – Chemical Bonding	2.26
<b>Chapter 7 – Properties of Matter</b>	<b>2.94</b>
Chapter 8 – Thermo Chemistry	2.63

Based on the survey, almost of the student were identified was having problems in the topic of using visualization. As shown in above Figure 2, most of the students having difficulties in chapter 7 with the highest mean is equal to 2.94 which is the subject is about how to visualize the arrangement of the atoms in a cubic cell and how to create formula of the atomic radius and the edge of the length.

## V. SCREEN DESIGN

This learning courseware consists of 4 main modules, which are concept module, visualizing module, exploring module, mind test module and searching module. The following section elaborates on the screen design of each module based on the flow of the system architecture.

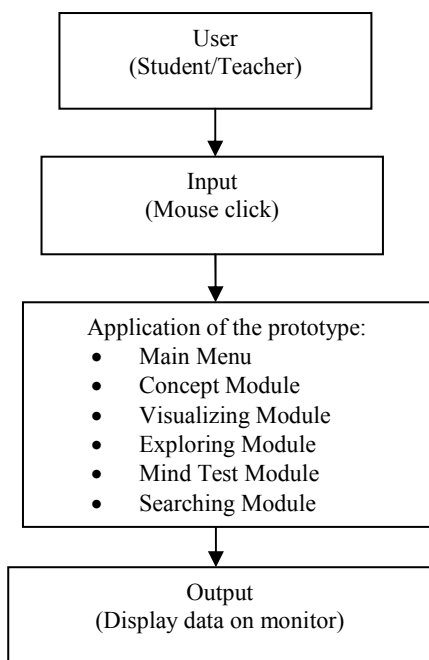


Fig. 2 System architecture of the Learning

### A. Concept of the learning subject

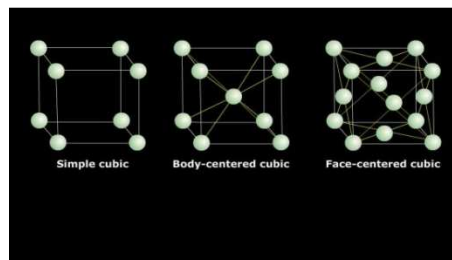


Fig. 3 Arrangement of the 3D atoms

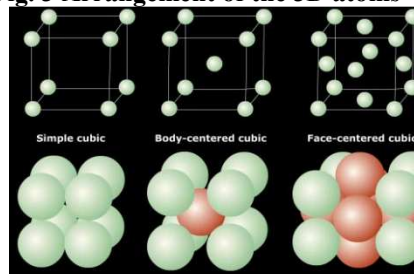


Fig. 4 The 3D atoms in each cell

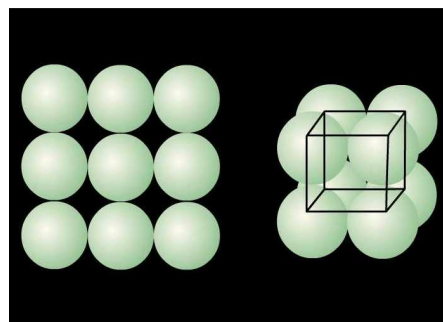


Fig. 5 Arrangement of the 3D atoms in a cubic cell

### B. The Module

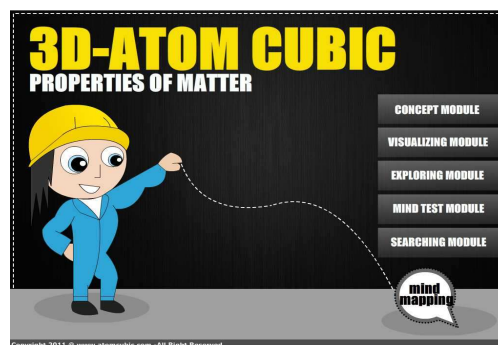
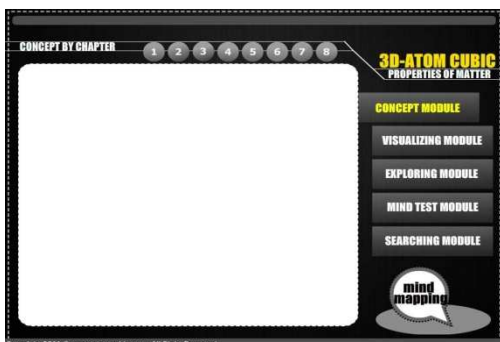
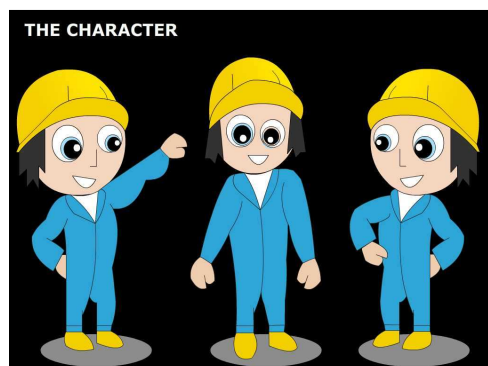


Fig. 6 Interface design of main module



**Fig. 7 Interface design of sub main module**



**Fig. 8 The Character to guide in the module**

The development of this Atom Cubic courseware only covers Properties of matters topic. All subtopic will be divided into several categories to make it easy and user friendly. All multimedia elements such as color, graphics, animations, sound, the model of 3D atoms, and suitable voice over need to be planned before it being transferred into digital form.

## VI. CONCLUSION

It is believed that, by developing the courseware for chemistry subject can have better access to that learning

style. Moreover, the survey and the interviewed results have revealed the students problem in visualizing for the topic of properties of matter, hence multimedia courseware with extra 3D element were included is believed as the most appropriate way to encounter this problem. Therefore, learning based computer is build to increase the efficiency the student ability of visualization with the aid of multimedia elements. Beside, 3D model atom assists learners to gain more understanding in molecular structure.

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