A Preliminary Study on the Graphic Development for Lab Instrumentation Model

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ABSTRACT The subject of instrumentation is an essential subject that needs to be mastered by students for long-term continuity of research-related learning. Thus, exposure to the subject of instrumentation was introduced as early as the introductory stage. This subject needs a more comprehensive figure and visual to understand the basic concepts in the use of this instrument. Therefore, the effectiveness of learning and teaching about instrumentation can be integrated with teaching aids in the form of an instrument model designed to facilitate students to understand this subject. This paper presents a preliminary study on the graphic development of the instrumentation model (GCMS). This might make the teaching and learning process more exciting and enhance through practical work.

KEYWORDS: Teaching aid; GCMS; gas chromatography; teaching and learning; student activity.
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Design Study

INTRODUCTION

The instrumentation subject was introduced at the basic level as a first step in providing students with a more competent understanding of analytical chemistry. One of the most significant developments in the analytical world in this industrial revolution is the development of intelligent machining technology where control of the analysis process, percentage yield, and material separation occurs in the machine integrated with computer systems (Webster & Clark, 1995; Bakeev, 2010).

It differs from other chemical syllabus concepts. Learning methods instrumentation requires a combination of research, description, internal framework of how the analysis machine works, and identifies the results of the material studied through computer transformation in computers (Baird, 2000; Burtis & Bruns, 2014). There are various approaches to teaching instrumentation subjects such as animation techniques, pictures, and conventional methods (Gorghiu *et al*., 2009; Rasteiro *et al*., 2009; Jensen, 2011; Limniou *et al*., 2007).

However, strengthening the understanding in the form of a "hands-on" approach is still rare. Whereas, both at the industrial level and the world of research require practical skills to use the instrumentation. The whole work step laboratories also partly depend heavily on operating efficiency system integration that has been systematized in computer settings, including data information stored, analysis reports, and resulting graphs Limniou *et al*. (2007). With the laboratory instrumentation model's assistance, excellent learning experience, and comprehension of certain concepts will be much better, enabling students and researchers to visualize the instrument much better.

Making a more practical model in 3D form will make it easier for students to understand the concept of instrumentation more easily. It also provides a specific and interesting approach. Porter *et al*. (2016) stated that the increased accessibility to this technology would allow teachers and students

to develop personalized analytical tools to explore several inaccessible topics to more traditional instruments, thus increasing teaching and learning effectiveness. Therefore, this research focuses on the instrumentation model's design, which is intended to provide a more practical approach to understand machine concepts working. This model may help more researchers who have difficulty understanding how instrumentation operates, and it would support students and researchers who are new to the instrument.

BACKGROUND THEORY

ADDIE Model

To achieve the overall objectives of this project. There are 5 phases that will be carried out during the ongoing project, however, since this paper at the preliminary level only two phases will be reported at this stage.

The phases are the analysis phase, the design phase, the development phase, the implementation phase and the evaluation phase as shown in figure 1:

The following is an example how equation is written given as:

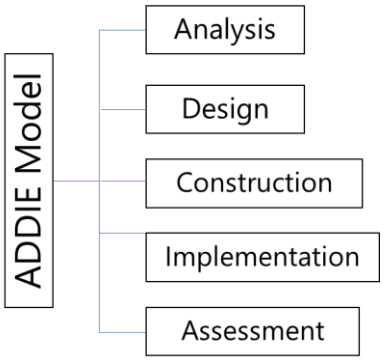


Figure 1. ADDIE Model

The ADDIE Model was proposed by Nawi (2017) According to the previous research this applied model was successfully makes the teaching and learning process more interesting and helps students understand some knowledge easily.

METHODOLOGY

Analysis Phase

The analysis phase is an important stage in the design process of the proposed design. Researchers have discussed the selected Models. The contents of the discussion are: (1) Formation of specific objectives; (2) Suitability of materials to students and as a learning tool; (3) Selection of design.

Design Phase

The ratio of the instrument model takes into account the storage facilities, mobility and learning environment. Basically, the design was almost the same with the original instrument that used in the lab. However, a few blocks diagram storage was added at the bottom area of the model to make it easier for instructors to explain some of the fractions in the model

RESULT AND DISCUSSION

Before moving on to the 3D design, a recommended size for the GCMS instrument framework was introduced as shown in Figure 2.

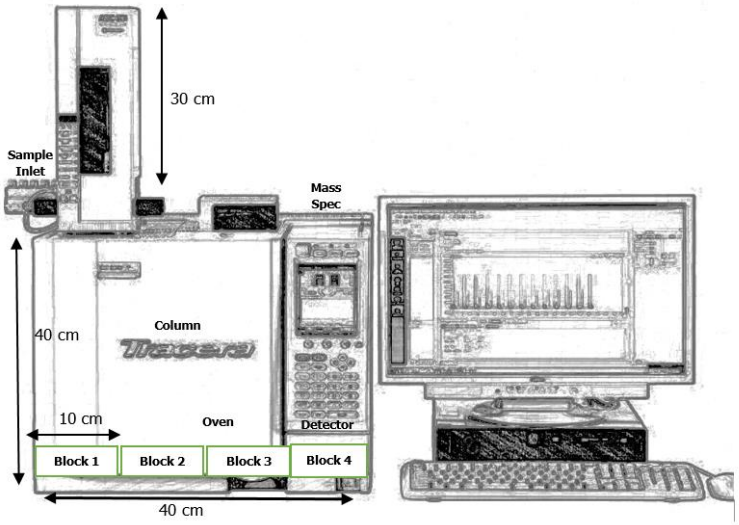


Figure 2. A proposed size of the GCMS instrument model.

Table 1. This project has been proposed for further action based on the following criteria.

Aspect overview	Criteria	
	Suggestion	**Additional Notes**
Model Design 3D sketch	With Proposed Size	Additional block diagram added in the instrument
Production of Design Project	Several types of models considering such as cost, ease of use and suitability	3D printed/steel/Pvc/ Plywood Model

Table 1 was developed based on the certain criteria that has been discussed. The first step is to adapt some appropriate items from the existing learning environment. There are four main components identified as important factors for students to understand how the instrument works. The overall view (as shown in Figure 3) and the components itself were planned to be included in the model instrument as proposed in Table 2.

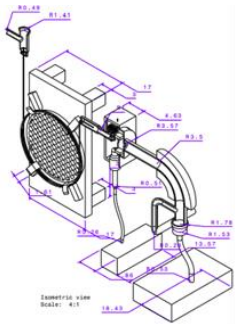
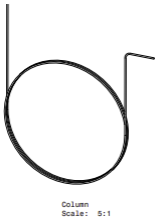
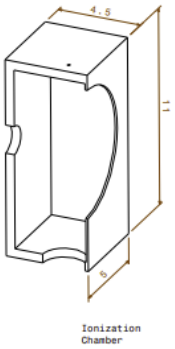
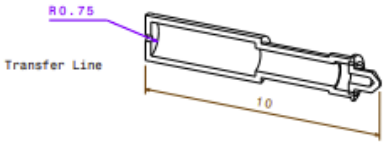
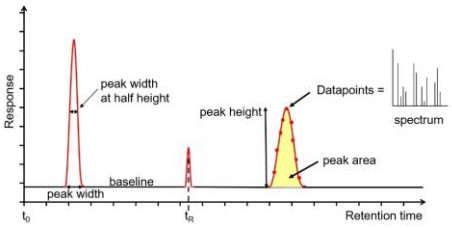


Figure 3. Overall view of the GCMS instrument model

Table 2. This project has been proposed for further action based on the following criteria;

Block Diagram	Criteria	
	Block	Description
Column Packed		
Ionization Chamber		All the concepts and functions of each block diagram are tag to make easily demonstrated to the student.
Transfer line		The effective way to zoom in the specific part at the element
Gc Chromatogram		

CONCLUSION

This study was conducted in the beginning of developing teaching aids (ABM) GCMS Model for instrumentation project. At this stage, the scope of work and product are still in the process of being refined from time to time. A growing research group supports the assertion that the use of teaching aids in the form of models can increase students' level of interest for something that is technical in nature to be understood. Further study is needed in continuing this technical work to achieve the objective that has been set.

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TRANSACTIONS ON SCIENCE AND TECHNOLOGY

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