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Database Development to Enhance Procedures for Open Ended Laboratory

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Abstract

In the globalization era and fast development in areas of science and engineering, the development of computer-based technology has become one of the contributors to national development. Biochemical and Chemical Engineering Laboratory, Department of Chemical and Process Engineering, Faculty of Engineering and Built Environment, UKM has applied the self-learning approach through Open Ended laboratory. To continue with this learning method, such experiments should be done repeatedly for a decision, other than a lot of time had been provided to choose an appropriate title. A study on the development of database for open ended laboratory procedure was carried out to overcome this problem. In this study, the software used isMicrosoft Visual Basic (VB) version 6.0 with Malay Language as the main language, VB application which is very suitable for developing such a database. This database was produced by providing a home, open-ended laboratory site and page title list to choose the titles of the open-ended laboratory. Based on survey results, the database for open-ended laboratory procedures was developed which provide information on the topics of open-ended laboratory was conducted as well as cordial user. Finally, comparisons are made between the resulting databases with existing database.

1. Introduction

Outcome Based Education (OBE), which is implemented at the Faculty of Engineering and Built Environment since the Session 2005/2006 (Mohd Jailani et al. 2006) has opened a space for a variety of teaching and learning approaches in order to achieve the desired learning outcomes. In order to incorporate the aspects of knowledge which usually contains a certain structure and content of teaching and learning, it is very difficult to provide all aspects of skills such as communication, teamwork, critical thinking, innovation and creativity in a limited lecture time.

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Therefore, the requirements of the assignment that gives students the opportunity to develop generic skills and lifelong learning are vital experience of teaching in the new approach in the era of OBE (Webb 2007).

Traditional approach based on the guided assignments is no longer sufficient in the context of OBE based. This traditional approach causes students loaded with a lot of laboratory reports to make the course considered as bland and easily viewed by students and frequent cases of plagiarism in laboratory reports. Therefore, new approaches that enrich students’ curiosity and foster a culture of innovation and creativity must be introduced to ensure achievement of learning outcomes. The proposed innovative approach requires active participation in learning activities to ensure that the targeted learning outcomes achieved. Based on these requirements, Open Ended laboratories, (OEL), is introduced to students in three sessions since the first semester of 2007/2008 as a practical task requires students to solve problems. OEL emphasis on self learning, creativity and innovation among students with the measurement of communication and team work as a result of this joint effort (Noorhisham & Norliza 2011, Norliza et al. 2011).

According to laboratory safety manual from the Department of Materials Science and Engineering at Louisiana State University (2010), laboratory procedures is one of a list that contains guidance on measures which it is used in the laboratory to do research with a more secure and guided safety in a laboratory. Based on reports Nor Hisham et al. (2009), OEL procedures is one of the tasks of compulsory courses for the Department of Chemical and Process Engineering, Universiti Kebangsaan Malaysia (UKM). Among the things to do, the students are provided with the objectives and scopes of the laboratory work, as well as provide a procedure for each of these OEL titles. At present a database for evaluate OEL procedures is not available. Starting from semester one 2008/2009 session, until the second semester of 2010/2011 session, there were almost 29 titles have been performed. Therefore, a study on "Development of Database for the procedure of listing OEL titles is done in order to simplify the process. Through the development of this database, using Visual Basic software version 6.0, it will make it easier for users to identify a suitable OEL title based on the main topics given.

This paper describes the development of the database with Visual Basic software and using Malay Language ‘Bahasa Melayu’ as the main language, to enhanced Open Ended laboratory procedures.

2. Methodology

In developing a programming using Visual Basic (VB), several steps were needed to produce relevant Graphical User Interface (GUI). Therefore, the basic usage of Visual Basic has been shown and the functions of each component are described. The flow chart of the OEL database procedure is shown in Figure 1.

![Flow chart for the OEL database](image)
3. Results and discussion

The results of the development of this database, is shown by the ability to program a simple coding followed by relevant graphical user interface.

3.1. Graphical User Interface

Graphical User Interface (GUI) is based on the procedures specified in the method, i.e. Figure 1. To facilitate the users to use this GUI, the display interface analogous results are stated.

3.2. Logging In

![Log in page]

Figure 2 refers to the log in page “Log masuk”, and is one of the security measures to safeguard stored data from being hacked by unscrupulous person. Log in page is using a security measure which requires the user to enter his/her name “Nama pengguna” and password “Katalaluan”.

3.3. Main Menu

If logged in into the database is successful, the "Main Menu” “Menu Utama” display as in Figure 3 will appear as "Main Menu". This is one of the GUI of considerable interest, which aims to introduce the topics of study, the programmer and supervisor for this study.

![Main menu page]

Figure 3. The main menu page

3.4. Identification Procedures OEL

Based on the page "Main Menu", the GUI as in Figure 4 will be appeared when the command button Start “Mula” is clicked. It is the first step to use the databases. Through this GUI, there are four options for users that link
Introduction “Pengenalan”, User “Panduan”, Start “Mula” and Back “Kembali”. When the link Back button is pressed the display will revert to the “Main Menu” or else the GUI in Figure 5 is display.

Figure 4. OEL Page

The GUI of "Terms of databases" “Syarat- syarat Penggunaan pangkalan data” will emerge as in Figure 5. In this GUI it has described the steps to be taken by the user before running OEL procedures, i.e. the user must ensure that the price of materials and apparatus are reasonable, proposal of OEL related topics have been delivered and received approval from the lecturer. In the display "Terms of databases" also, there are three types of links that link Back "<<kembali”, Next "Seterusnya>>" and links MAIN MENU “Menu Utama”. If the user chooses to return to the "main menu" as in Figure 3, then the user must select the link "Main Menu", while if the "<<Back" button is pressed, then the user chooses to return to the previous screen display "Open Laboratory -ended ".

Figure 5. Site terms of use databases

If the link "Next>>" is clicked, the display as in Figure 6 will appear. Figure 6 is a GUI of the check box for the prices of materials and apparatus.
Figure 6. Check Box the prices of materials and apparatus

When the link is clicked, the user will enter the check box regarding the statement in the current GUI display. Then the display as in Figure 7 will appear. In this link there are three links that link “NO” “TIDAK”, “YES!” “YA” and “<<Back” “Kembali”.

Figure 7. Box delivery review proposal

Then the users will move to the next check box which is confirmation from the lecturer, as show in Figure 8. In this check box, there are three links that is ”NO” “TIDAK”, ”YES” “YA” and link ”<<Back” “KEMBALI”.

Figure 8. Box review lecturer permission

3.5. Database Applications for Existing Title in List

The next step is for users to get a list of OEL titles. The GUI as in Figure 9 will appear.
Then the users must enter the main topic by scrolling the title box in Figure 9. For example, if the users enter the title of "Chem-E-CAR". Then the display as in Figure 10 will emerge.

In Figure 10, when the "ENTER" key on the keyboard is pressed, the GUI as Figure 11 will appear which shows that the title is existing in the database.

When the link "OK" is pressed on the message box, the query box displays like Figure 12 will appear as "Does the title have the same materials and apparatus?" “Adakah tajuk mempunyai bahan dan radas yang sama”, with two types of button "YES" “YA” and "NO" “TIDAK”.
Figure 12. Box question "Does the title have the same materials and apparatus?"

When the button "NO" is pressed the user will get message box "Congratulations!" "Tahniah", will appear as in Figure 13, which allowed users to conduct OEL on selected topics.

Figure 13. Box message "Congratulations!"

Then the user will be asked about the experimental method as in Figure 14. In the box there are two key questions which are "Yes" "YA" and "No" "TIDAK". When the "No" is pressed, then the user will get message box "Congratulations!" As shown previously in Figure 13.

Figure 14. Box question "Is the title of this OEL has the same testing methods?"

When the GUI in Figure 14 is pressed to the link "Yes" "YA", then another GUI will emerge as in Figure 15 in terms of box warnings not to conduct the OEL with similar materials, apparatus or method.
3.6. Comparison with the Database In Manual Mode

The main comparative factor between databases and manual methods is time saving. Through this database, the users will not need to check thoroughly the laboratory title. In addition, through this database, the stored data is more secure than the manual method, which are at risk of destroy due to stolen files, fire or flooding. However, the operational data through the database software may be interrupted if a technical problem occurs compared to manual methods. These comparisons were summarized in Table 1.

<table>
<thead>
<tr>
<th>Database</th>
<th>Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saves time</td>
<td>Takes a long time</td>
</tr>
<tr>
<td>The data is stored safely</td>
<td>Data has lost potential</td>
</tr>
<tr>
<td>Easy</td>
<td>Relatively trivial</td>
</tr>
<tr>
<td>Operating data is interrupted</td>
<td>Operating data is uninterrupted</td>
</tr>
</tbody>
</table>

3.7. Advantages and Disadvantages of Generated Database

Each of the resulting design and development will have advantages and disadvantages factors. The development of the database generated in this study also has its own advantages and disadvantages. Among the advantages of the resulting database development is that it can help users find a list of laboratories OEL titles that have been carried out in a short time, which is the main objective of the study. In addition, the instructions in the resulting database are also easy to understand and operate, especially for those who are not familiar to operate the computer. Another advantage is that the resulting database is not complicated. Therefore, the resulting database is very simple and user friendly. Instructions are given in Malay Language, so it is very easy to follow compared to other database, which use English Language as the main instruction. In addition, the resulting database also has a good security system, whereby required the user to enter "Username" and "Password" in order to use the database. This situation can protect stored data from hackers.

The resulting database has its own advantages and disadvantages. Among the weaknesses of the resulting database is that the user must enter the exact title with the title which has been recorded, beside that a title must be type by using a capital letters. If the user does not do so, then the probability of getting the wrong information is high. In addition, the resulting database is constraint to only one language which is Malay Language. It would complicate the situation if the user is less familiar with the Malay language as an example of foreign students who want to use the database. In addition, the resulting database for user “Name” and “Password” is limited to certain courses. Advantages and disadvantages of the resulting database were summarized in Table 2.
Table 2. Advantages and disadvantages of database

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of use and laboratory</td>
<td>Need to enter the exact title</td>
</tr>
<tr>
<td>not complicated</td>
<td>Tied to particular languages</td>
</tr>
<tr>
<td>Easy to understand</td>
<td>Limited user name and password</td>
</tr>
<tr>
<td>Good security</td>
<td></td>
</tr>
</tbody>
</table>

3.8. Data Update for List of OEL Title

Another characteristic of any software is the ability to be updating the data in the database. Update the data is important to ensure that the database used to operate all the time and not limited to the previous topics included. For the development of the resulting database, there are two things to be done to update the data, which are using the Visual Data Manager (Management of visual data) and update using programming code.

3.8.1. Visual Data Manager

Visual Data Manager is a standard approach by user to update the database through modification in the management of visual data. Applications must be opened by using Visual Basic 6.0. The procedure to update the data as follow; firstly is to open "Ads-In" GUI, as shown in Figure 16 and the application of "Visual data manager" should be selected.

![Figure 16. Applications of "Visual Data manager"

When the "Visual data manager" is selected, it is empty. Next the user must open the file in which data is stored. by selecting "File", "Open database", "Microsoft Access" and then choose where the data is stored. To update the data, the link will use the command either "Add", "Update" and "Delete".

3.8.2. Programming Code

Among the things to be done by the user is to update the data is by manipulating the programming code in the Visual Basic. These topics should be included in programming for updating the data.

3.9. Example of Organization Use Database

According to Fanjoy et al. (2001), Food and Drug Administration (FDA) is one of the leading organizations in the USA. FDA has conducted research on imported food to see if food is allowed to be imported into the USA or not. The data obtained should be kept as a reference in the future. The data were collected in a database known as
the Food Testing Laboratory Database (FTLD). This database is Microsoft Access application which contains 546 records of companies that carry out food tests.

4. Conclusion

Based on the study objectives, it can be concluded that the study of database development OEL procedures using Malay Language “Bahasa Melayu” were successfully completed by using Microsoft Visual Basic 6.0. This study has been successfully completed by achieving all the objectives of the study. A test for the database was done by inserting a number of related topics which appears to be successful titles in the display if there is data storage. On the other hand, if the titles were not in the database, users are allowed to conduct the experiments. To ensure correct output, the user must enter the exact title, using capital letters.

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References


