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FOREWORD

It is our great pleasure to present the ninth volume and first issue of the ESTEEM Academic Journal UiTM (Pulau Pinang): a peer-refereed academic journal devoted to all engineering disciplines. Since the beginning of the year, a number of articles have been sent to us, some of which are still under review in their first or second phase and the first five of them are being published now. Article submissions came from UiTM campuses across the country, with topics covering most, if not all, of the subfields of electrical, mechanical, civil and chemical engineerings. We celebrate our good fortune in having a strong group of people who created the opportunity for this volume to be born and who made it happen.

First and foremost, we would like to extend our sincere appreciation and utmost gratitude to Associate Professor Mohd Zaki Abdullah, Rector of UiTM (Pulau Pinang), Associate Professor Ir. Bahardin Baharom, Deputy Rector of Academic Affairs and Dr. Mohd Subri Tahir, Deputy Rector of Research, Industry, Community & Alumni Network for their unstinting support towards the successful publication of this volume. Not to be forgotten also are the constructive and invaluable comments given by the eminent panels of external reviewers and language editors who have worked assiduously towards ensuring that all the articles published in this volume are of the highest quality. A special acknowledgement is dedicated to all committees, publication department, and many other relevant parties for making this volume a success. Their affective commitment and close cooperation have facilitated the realization of this volume. Last but not least, our greatest thanks go to all the authors for their interest in publishing their work with us. Their manuscripts are an expression of their commitment towards research and development which, in due course, would benefit the local, national and international communities. Hence, we would like to extend our warm invitation to all researchers who are actively involved in the field of engineering to publish their work with us.

Dr. Chang Siu Hua
Chief Editor
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ONLINE OBE-CQI TOOL FOR ENGINEERING PROGRAMMES

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ABSTRACT

In Malaysia, the Engineering Accreditation Council (EAC) has directed all engineering programmes especially at tertiary institutions to apply and implement outcome based education (OBE) in their teaching and learning system. One of the elements in the implementation of OBE is monitoring of the continuous quality improvement (CQI) of the courses every semester. Presently, the delivery format of the CQI reporting in most universities mainly uses close-loop method which is very much paper-based. The effect of using paper-based task in the process of gathering and filling information for CQI reporting purpose is a long and tedious one. This long process would incur time wastage, disorganisation and confusion in the data collection, sharing process and security of the documents. Based on these issues, an online OBE-CQI tool has been designed whereby the usage of client (instructor)-server method is to enable the instructor to transfer the details of CQI content into the server via network. Besides the interaction between server and instructor, the graphical user interface (GUI) is designed as a component to control all activities of filing the details of the CQI report such as CQI-Authorised, CQI-Possible Issue, CQI-Possible Solution, COs and POs overall marks score. From the results obtained by implementing the system (tools), all the CQI information stored in digital format becomes more systematic and easily accessible anytime in the network.

Keywords: outcome based education; continues quality improvement; assessment tools; electrical engineering; design.

1. INTRODUCTION

Outcome Based Education is an education system that emphasizes outcome measurement rather than curriculum input coverage (Abidin, 2009). OBE is also a process that involves the restructuring of curriculum, assessment and reporting practices in education to reflect the achievement of high order learning and mastery rather than on the accumulation of course credit. Within OBE, there is a certain set of beliefs and assumptions about learning, teaching and systemic structures within which activities take place. Outcomes are clear learning results that learners have to demonstrate significant learning experiences at the end of the

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programme. In order to obtain the desired outcomes, teaching components and activities should be well organised, planned and continuously improved (Spady, 1998; Spady & Willian, 1991).

OBE concept has been applied in many countries and the Malaysian Engineering Accreditation Council (EAC) requires the mandatory implementation of OBE as a part of the accreditation requirements (EAC, 2007; Abdullah et al., 2009; Takriff et al., 2011) and needs academic achievement measurements of every student during each semester. The importance of measuring elements as stated in the Board of Engineering Malaysia (BEM) accreditation manual (EAC, 2007) consists of five accreditation criteria. One of the criteria is the Quality Management System (QMS). The key function of QMS is to oversee and monitor the overall achievement of the programme education objectives (PEO) (EAC, 2007). The programme education objective is defined as the expected achievement of graduates in their career and professional life a few years after graduation (EAC, 2007). The important linkage in the PEO elements is course and programme outcome mapping (CO-PO) which is closely related to the students' performance scores. These COs and POs scores, obtained at the end of semester, can be added as a measurement element in the CQI report. Based on the CQI report, the instructor can then take further action and provides solutions to the courses that yield less satisfactory results.

The different stages of the education process reflect the progress of the students' achievement of the desired learning outcome. Thus, their feedback on the learning process that they have gone through is valuable information for generating the CQI report (Basril et al.,2004). The CQI feedback system is similar to a close loop feedback control, centred on the student undergoing the education programme (Shor & Robson, 2000). The input process such as the assessment of students' scores which are mapped to COs-POs of the course is evaluated every semester in order to ensure that the output such as student achievement outcomes is matched with the desired or standard score. Each CQI report of the courses is repeated for every cycle of the semester and kept manually for a longer time based on paper-based entry (Abdullah et al., 2009; Takriff et al., 2011; Basril et al., 2004; Shor & Robson, 2000; Amiruldin & Hamid, 2009) .

Mansor et al. (2008) has developed OBE measurement tool which is known as 'Non-Exam CO-PO versi FKE' to assist the lecturers in designing the evaluation criteria and measuring the student performance outcomes. The advantage of this tool is it provides the performance plot to enable the lecturers to see the improvement that should be done for the courses. The performance plot can be used as guidelines for future action plan to improve students' assessment results which need to be provided during Continuous Quality Improvement (CQI) report preparation. However, this tool is designed only to evaluate those non-examinable courses such as case study and mini project. OBE evaluation tool for non-examinable courses has also been designed by Hashim and Hashim (2010) to evaluate the performance of final year degree project (FYP). The measurement tool known as Project Sensor Performance Evaluation Course Tool (PRO-SPECT) is designed based on Excel software. Four evaluation sections which are embedded in the measurement tool will address the COs and POs. The CO-PO mapping of the respective FYP evaluation will display the distribution of COs and POs automatically to enable their relationship observation. Abidin, Anuar & Shuib (2009) has introduced a computerised method to find CO attainment which focuses on examinable courses by using Microsoft Excel software. The direct measurement method developed

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provides a structured way to further review and analyse the attainment outcomes for each course based on formal assessment such as final exam, test and project. The system has been found to be very helpful because an action plan to improve any weakness can be identified and implemented in the following semester.

Based on the previous OBE measurement tools, it can be seen that most of the designs carried out to obtain measurement criteria of COs and POs score and for CQI report it has been generated in paper-based which does not allow effective monitoring. With regard to this issue, online CQI tools have been initiated to ensure the effectiveness of CQI report for degree engineering courses in Faculty of Electrical Engineering at Universiti Teknologi MARA Pulau Pinang (UiTMPP). This paper discusses the systematic method based on online system to collect and monitor CQI reports on any courses in the programme. The system has been tested in the Faculty of Electrical Engineering at the UiTMPP.

2. SYSTEM FLOW AND DESIGN

The overall online collective continuous quality improvement system is divided into two stages which are graphical user interface as a part to interact with user (instructor) and server as a primary function to store and retrieve data as requested by the user (instructor). The concept of the system is shown in Figure 1. The GUI is designed to facilitate instructor to access and store data which is related to CQI. Three (3) sections are needed to be completed by the instructor in order to access data in the server. The first section has "User Login" verification and only the selected instructor or course coordinator is allowed to access the system. The "Programme Parameter" in the second section consists of intake identification, type of offer programme in the faculty and several courses which are related in the programme. This section is to enable the instructor to access CQI data in the server with proper direction. The final section is "Database Area". In this section four (4) parameters such as "CQI Possible Issue", "CQI Possible Solution", "CO(s) marks" and "PO(s) marks" are provided as CQI items insertion. After the three (3) main elements are completed, the instructor is allowed to upload the CQI data into the server. Figure 2 shows the overall flow of the system.

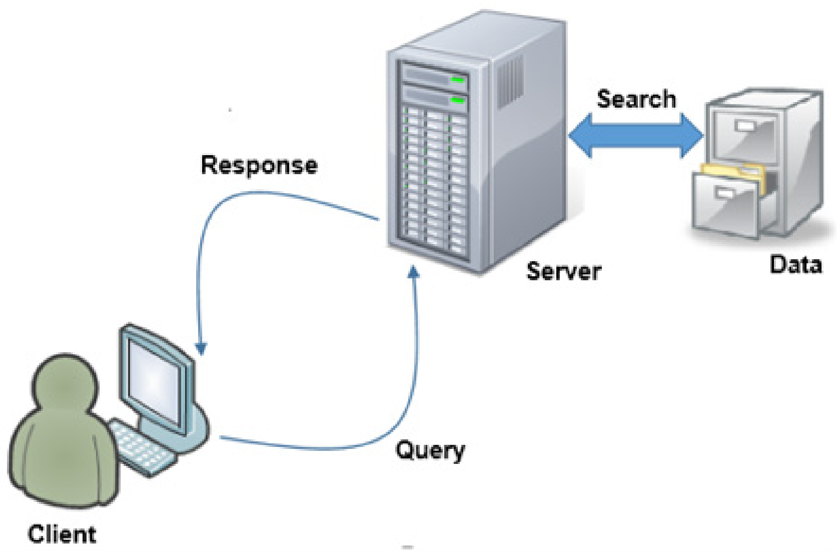

Figure 1: Client (Instructor)-Server Interaction

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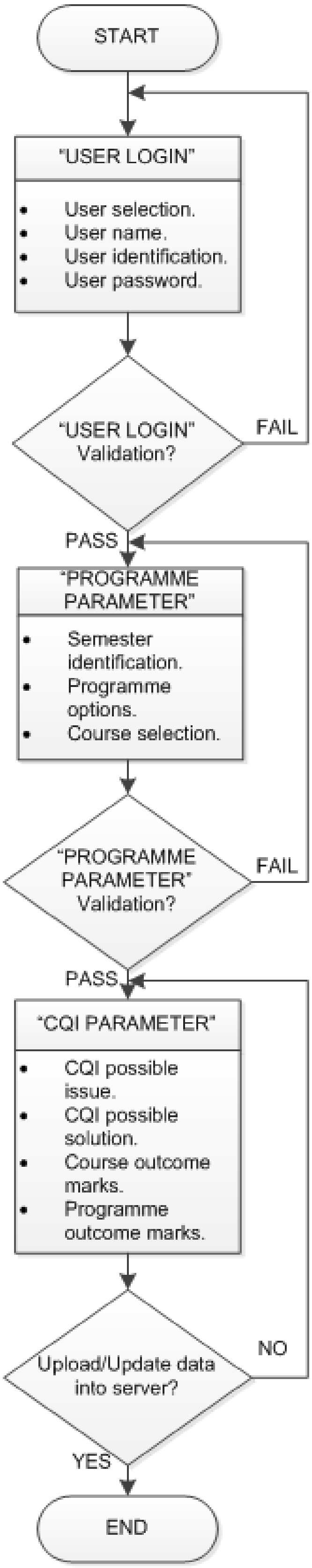

Figure 2: System Flowchart

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The GUI tools in this system are designed according to Microsoft Visual C# so as to reduce complexity of usage. The instructor only requires little experience to understand and employ the system for CQI data insertion. Figure 3 shows the main page on the system which the instructor needs to insert the correct details as requested by the system. The instructor is also required to choose correct user selection before keying in the details in the login section. The user selection comprises three (3) categories which are i) coordinator course/subject, ii) coordinator programme and iii) administrator. For CQI details insertion, the subject/course coordinator is required to select one of the radio buttons.

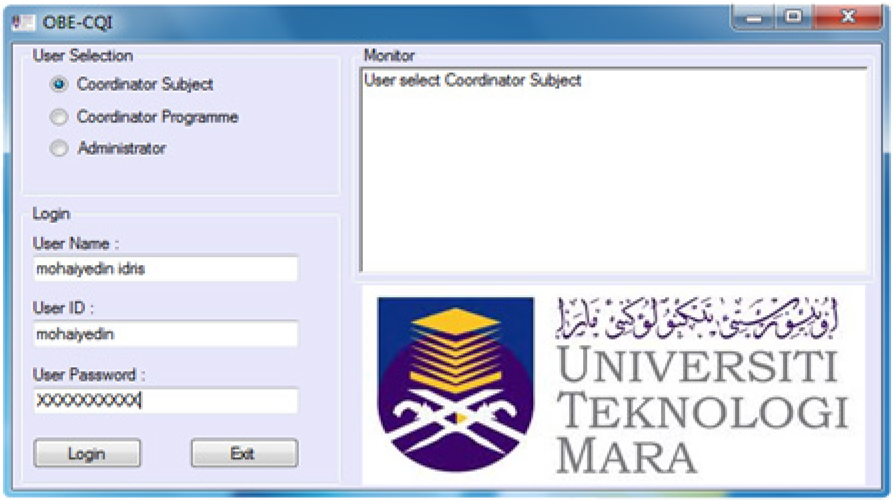

Figure 3: Main Page of CQI System

Once the details required by the system are accepted, the CQI insertion area will perform automatically as shown in Figure 4. In this section, the parameter settings such as select semester identification which is related to semester intake, programme and version are needed. The system will automatically display the list of corresponding courses when the "Refresh" button is executed. Each CQI report which is stored in the server can be displayed by executing the "View" button. For uploading or updating the CQI information, it can be performed by using "Add" or "Update" button. The system also provides printing option for the instructor to keep the details of CQI report.

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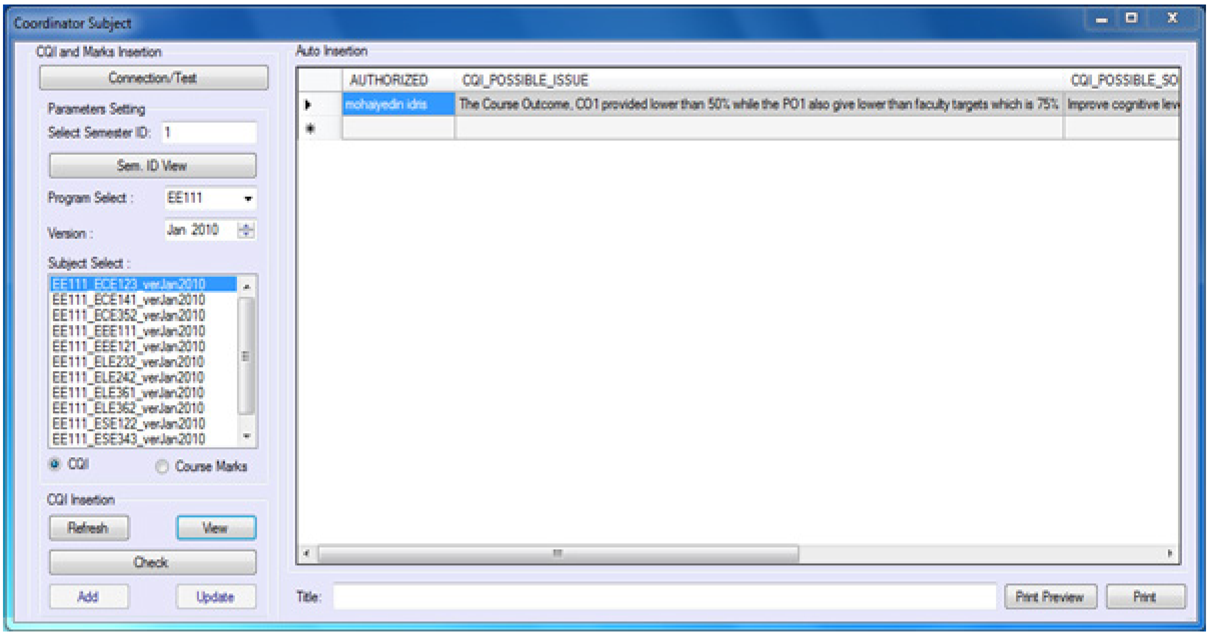

Figure 4: CQI Data Insertion

The online CQI system which is designed also consists of internal setting such as user login, intake, programme and course configuration. These configurations only allow the programme coordinator of the faculty to be setup in order to enable the coordinator course to access the system. Figure 5 shows the overall windows form as designed in the online CQI system.

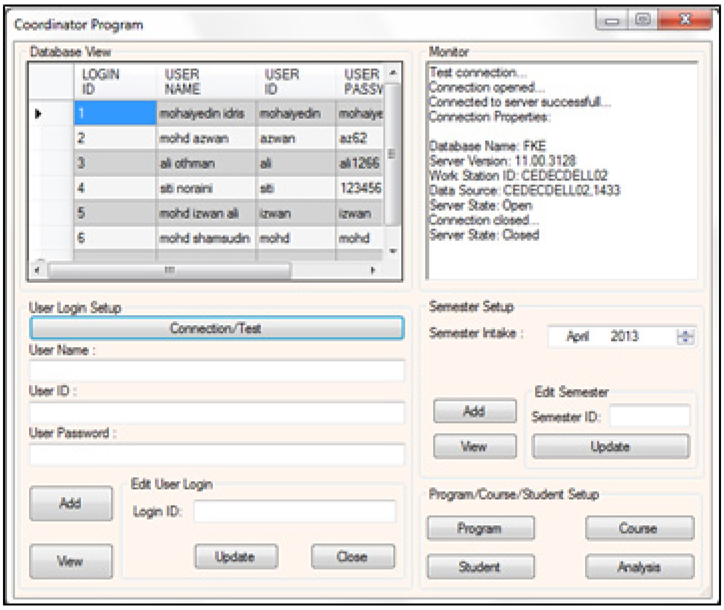

Figure 5(a): Internal Windows Form Setup Configurations: User Login and Semester Setup

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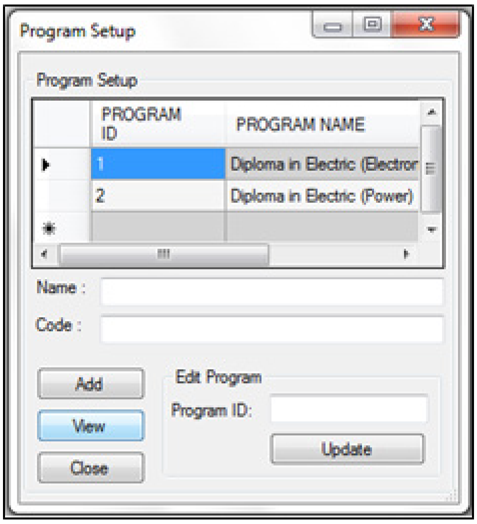

Figure 5(b): Internal Windows Form Setup Configurations: Programme Setup

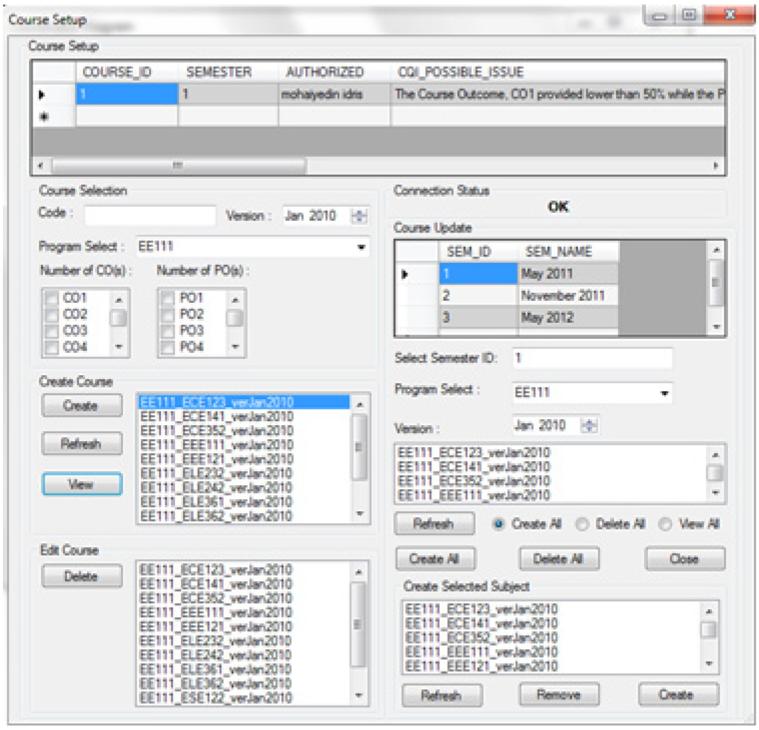

Figure 5(c): Internal Windows Form Setup Configurations: Course Setup

3. SYSTEM PERFORMANCE

The online CQI system has been tested for diploma and degree electrical engineering programme at UiTMPP. The faculty offers three (3) diploma programmes and one (1) degree programme which are, for diploma i) Electrical Engineering (Control and Instrumentation), programme code EE110; ii) Electrical Engineering (Electronic), programme code EE111 and; iii) Electrical Engineering (Power), programme code EE112), while for degree, Electric and Electronic Engineering, programme code EE220.

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In early of 2009, all diploma programmes in the faculty have applied OBE and in January 2010 each assessment in the courses is required to be measured at the end of every semester. The degree programme commenced in November 2010. The system used by the faculty to provide the COs and POs scores of the course is known as COPOMeT (Course and Programme Outcome Measurement Tool). Figure 6 shows the sample results of overall student performance which is obtained using COPOMeT tools. Table 1 shows the CQI report detail parameters which utilize the designed tool and Figure 7 illustrates the sample results which are analysed using the online CQI tools.

STUDENT COPO OVERALL PERFORMANCE

OVERALL PERFORMANCE - COURSE OUTCOMES

ASSESSMENT	CO1	CO2	CO3							
QUIZ	0.5	2.0	1.0							
ASSIGNMENT	1.5	2.0	1.5							
TEST	2.0	2.5	2.0							
MINIPROJECT	1.0	1.5	1.5							
LAB										
FINAL EXAM	1.2	4.0	3.5							
CO COURSE PERFORMANCE ACHEIVEMENT	6.2	12.0	9.2							
CO COURSE PERFORMANCE TARGET	8.3	15.8	9.5							

OVERALL PERFORMANCE - PROGRAM OUTCOMES

ASSESSMENT	PO1	PO2								
QUIZ	1.5	1.5								
ASSIGNMENT	1.5	2.0								
TEST	2.0	2.5								
MINIPROJECT	2.0	2.0								
LAB										
FINAL EXAM	2.0	3.0								
PO COURSE PERFORMANCE ACHEIVEMENT	9.0	11.0								
PO COURSE PERFORMANCE TARGET	9.2	15.8								

Figure 6: Overall Performance for Electrotechnology Course (Mohd. *et al.*, 2011)

Table 1: CQI Parameters

Authorized	Mohd Adilwafi
CQI Possible Issue	• The Course Outcomes (CO1, CO2 and CO3) archive the faculty KPI which are higher than 70%. • Programme Outcome 2 (PO2) accounted for 69.62% which is slightly lower than the faculty targeted KPI. From this result shown, the below than expected outcome is caused by the weakness of the students' ability to express ideas, either written or verbally in the Electro technology subject.
CQI Possible Solution	Provided more assessment such as individual laboratory report writing and mini-project design and presentation in order to satisfy PO2 performance score.
CO1 Mark	74.70%
CO2 Mark	80.00%
CO3 Mark	96.84%
PO1 Mark	97.83%
PO2 Mark	69.62%

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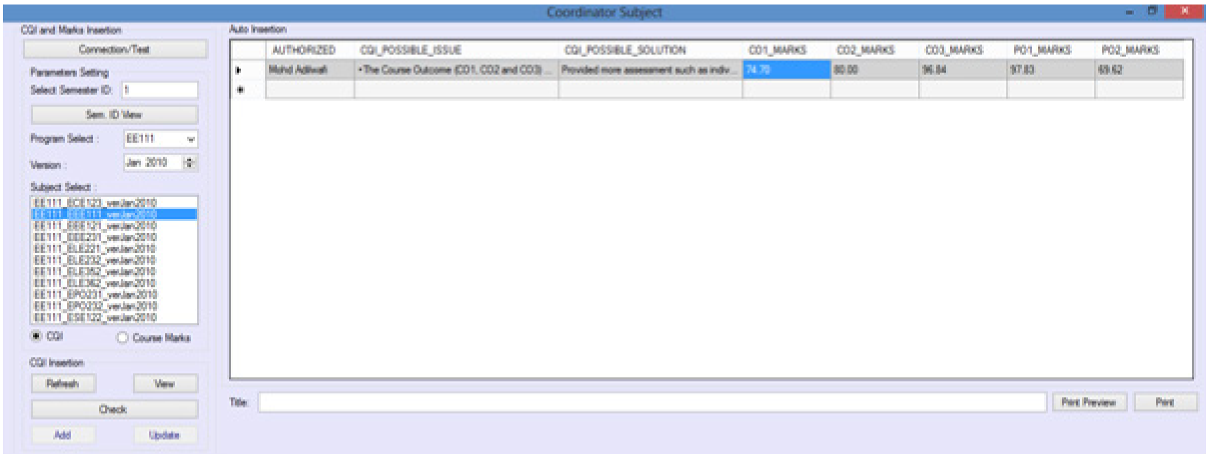

Figure 7: Online CQI Report Sample From the System

The GUI (as shown in Figure 7) is designed using Microsoft Visual C# and consists of nine (9) active buttons such as i) Connection/Test; ii) Semester ID View; iii) Refresh; iv) View; v) Check; vi) Add; vii) Update; viii) Print Preview and ix) Print. All these active buttons consist of different operations and have their own complex background processes which have been hidden out of view by the users. Figure 8 shows the sample code of "Connection/Test" active button.

```
Form2 frm2 = new Form2();
string Coord_String =
     "Data Source =" + frm2.TextBox4.Text.ToString() + ",1433" + ";" +
     "Network Library=DBMSSOCN" + ";" +
    "INITIAL CATALOG=" + frm2.TextBox6.Text.ToString() + ";" +
     "Integrated Security=" + frm2.TextBox5.Text.ToString() + ";" +
     "User ID=" + frm2.TextBox2.Text.ToString() + ";" +
     "Password=" + frm2.TextBox3.Text.ToString();
SqlConnection Coord_Conn = new SqlConnection(Coord_String);
try
{
    Coord_Conn.Open();
    richTextBox1.SelectedText = "Test connection...\r\n";
    richTextBox1.SelectedText = "Connection opened...\r\n";
    richTextBox1.SelectedText = "Connected to server successfull...\r\n";
    richTextBox1.SelectedText = "Connection Properties:\r\n\r\n";
    richTextBox1.SelectedText = "Database Name: " + Coord_Conn.Database.ToString() + "\r\n";
    richTextBox1.SelectedText = "Server Version: " + Coord_Conn.ServerVersion.ToString() + "\r\n";
    richTextBox1.SelectedText = "Work Station ID: " + Coord_Conn.WorkstationId.ToString() + "\r\n";
    richTextBox1.SelectedText = "Data Source: " + Coord_Conn.DataSource.ToString() + "\r\n";
    richTextBox1.SelectedText = "Server State: " + Coord_Conn.State.ToString() + "\r\n";
}
catch (SqlException h)
{
    richTextBox1.SelectedText = "Error in connection...\r\n";
    richTextBox1.SelectedText = "Error type: " + h;
}
finally
{
    Coord_Conn.Close();
    richTextBox1.SelectedText = "Connection closed...\r\n";
    richTextBox1.SelectedText = "Server State: " + Coord_Conn.State.ToString() + "\r\n";
}
```

Figure 8: Background Process Code

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4. CONCLUSION

The process of producing CQI reports in paper-based form among many Malaysian universities is ineffective as it poses many shortcomings in the collection, sharing and security of the data. Thus, a more user-friendly and reliable supporting tool which is geared towards improved online continuous quality improvement has been developed to facilitate the instructor/lectures to do the CQI report conveniently. The system provides two (2) different environments in the same window interface for the instructor to access the system, which are CQI data insertion area for course coordinator and CQI parameter settings which can be accessed only by the programme coordinator. All the background operations of the system are hidden and only the general function components are displayed. Microsoft SQL Server 2012 which is used in the system provided multiple user/instructor to be assessed simultaneously through intranet network. Adding or updating CQI report inside the database through the system can only be restricted by respective course coordinators. Thus, the security of CQI report can be protected and the system will also automatically display the instructor's name at authorized section when the CQI report is updated. However, the CQI detailed analysis after the completion of their study is not supported by the system and can be recommended as a future undertaking in order to improve the CQI online system.

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