

Implementation of Electronics Principles course module in a virtual learning environment

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Implementation of Electronics Principles course Module in a Virtual Learning Environment

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Sub Theme: ODL in a changing world

Abstract:

This paper presents the use of the Virtual Learning Environment (VLE) as the sole means for delivering content and most of the assessments for a course taken by 73 students studying a variety of degrees in Electronic and Information & Communication Technology. It is a case study developed from data gathered through a demonstration of the teaching and learning materials available, face to face tutorials, Library & e-library, learning management systems and tutorial assistance via telephone or email. The perception of difficulty in learning electronics and telecommunication courses via distance is in general. However, the basic familiarity with the course subject, the less difficulty they anticipate.

Keywords:

Virtual Learning Environment (VLE), Learner perspective of virtual lab work, LO (learning outcome), ODL (open distance learning) Learner expectation, Learner Satisfaction

I. Introduction:

Tomorrow's learning must be time flexible, independent of geography, competitive cost, learner-centered with less emphasis on lecture style, high-technology, incorporating new media and computer applications, culturally diverse, adaptable to the needs of the global marketplace, growth oriented from the perspective of the individual & organisations, and contemporary material that is relevant to the times [1,2,3,4]. The module on electronics principles has been taught for many years as a traditional lecture course, but is now delivered almost entirely online. The bulk of the content delivery is through learning portal known as Wawasanlearn or LMS (Learning Management Systems), which comprise power point slides, an audio-video recording of the lecturer to demonstrate the key concepts of electronics and assignment file, self-tests quizzes and which are supported with handouts. The online activities are accessible at any time, and can be paused, rewind, replayed etc. under the control of the student. The online resources also include video clips and animations, video contributions from an external expert, three online summative assignments, links to selected external resources, and forums for queries (the tutor answer general queries on the course content and course-coordinator (cc) monitor the forums in LMS). We presented electronics principles course twice using the same approach.

Electronics principle is a middle level of a basic major course for Bachelor of Technology in Electronics and Bachelor of Technology in Information and Communication Technology programme. The course is developed with its intentionally objectives and the compatibility of the course materials to the learning outcomes and their suitability with regards to the target students, assessment questions and activities suggested was excellent. In this paper we are presenting the case study developed from the data gathered through a demonstration of the teaching and learning materials available, face to face tutorials, Library & e-library, learning management systems and tutorial assistance via telephone or email.

II. Virtual Learning Environment (VLE)

The virtual learning Environment in Wawasan Open University (WOU) consists of Moodle based course Management System which we call WawasanLearn or LMS (Learning Management System). It is a software application that uses computer programs to organise the coursework and to also monitor records and progress of students [5]. *WawasanLearn* guide through all the stages of learning cycle (e.g., assess, learn, reinforce, support and validate) to create the most effective learning tool. LMS is based on Moodle which is a free web application that educators can use to create effective online learning sites.

LMS consists of following modules:

- **Assignments**

Assignments enable CCs to grade and give comments on uploaded files and assignments created on and off line.

An assignment is where CCs set a task, maximum numbers of files, maximum size that student can upload with a due date and a maximum grade. Students will have to upload file(s) (such as a word document) and will have the options to delete their previous files in order to complete the assignment. The date they upload their file is recorded. Afterwards, you will have a single page on which you can view each file (and how late or early it is), and then record a grade and a comment. Half an hour after you grade any particular student, Moodle will automatically email that student a notification. Since our Online Assignment Submission System (OAS) provides security feature and is customised with an electronic extension form (T-EX), this module is used to practice any ungraded exercise for our students.

- **Forums**

This is where asynchronous discussions take place. When you add a new forum, you will be presented with a choice of different types - a simple single-topic discussion, a free-for-all general forum, or a one-discussion-thread-per-user. Currently, there are 10 pre-defined forums (all standard forums for general use) in a course at *WawasanLearn*:

- 5 Tutorials Forums
- 2 Forums for tutor (1 forum between CC and tutor; 1 forum for tutor announcements)
- 1 Forum CC's announcement
- 1 General Group Forum
- 1 Public Forum

- **Quiz**

This module allows you to design and set quiz tests, consisting of multiple choice, true-false, and short answer questions. These questions are kept in a categorised database, and can be re-used within courses and even between courses. Quizzes can allow multiple attempts. Each attempt is automatically marked, and the teacher can choose whether to give feedback or to show correct answers. This module includes grading facilities. You can also set the dates for when you want the quiz to be available to students.

- **Units**

A unit delivers content in an interesting and flexible way. It consists of a number of pages. Each page normally ends with a question and a number of possible answers. Depending on the student's choice of answer they either progress to the next page or are taken back to a previous page. Navigation through the lesson can be straight forward or complex, depending largely on the structure of the material being presented. Although available this module can be confusing for students since student need to spend a lot of time and could be a bit frustrating to finish a lesson.

– Glossary

The glossary module enables participants to create and maintain a list of definitions, like a dictionary. The two types of glossary are the dictionary-style glossary and the FAQ-style glossary

– Survey

The survey module provides a number of predefined survey instruments that are useful in evaluating and understanding your class. Currently they include the Constructivist On-Line Learning Environment Survey (COLLES) and the Attitudes to Thinking and Learning Survey (ATTLS) instruments. This module can be used early in the course as a diagnostic tool and at the end of the course as an evaluation tool. The module already has a set of questions that can't be altered so it is rarely been used

WOU's learning management system (LMS) is a platform to support interactions between the tutor, Course Coordinator and students as well as hosting supplementary course materials, online quizzes, updates and announcements to complement the course conduct. Besides that, one can find the following elements in *WawasanLearn*:

- Tutor-marked Assignments (TMA) for each course.
- Guides, procedures and links to Online Assignment Submission (OAS) System.
- Online forums on a course-by-course and tutorial group basis.
- Real-time chat with the Course Coordinator, tutors and students at appointed

Studying in the virtual learning environment requires great commitment. Once students are enrolled in a course, they will need to complete assignments and examinations according to a specific schedule. In the course presentation, the course materials given to students as scheduled and the LMS populated with power-point slides, online resources for the students before the semester begins. The course module together with the text book provided formed an adequate support for students' learning. The Learning Management Systems (LMS) enables students to use interactive features such as bulletin boards, video conferencing, and on-line discussion forums. This system guides them through all stages of their learning cycle, organize course, and keep track of their records and progress. Tutors reminded to monitor and interact with the students more closely to nurture a cordial rapport and support in learning. In both presentation tutors participated in the LMS actively and most of the queries attended to within 24 hours. LMS activity graph also indicate that students feel happy with the LMS activities and responses from tutors and the course-coordinator. The Fig.1 below is evident that the students were actively using the LMS throughout the semester, even right up to the week before the final examination. The highest view achieved was 420 times in the month of March. Most of the viewings and activities were focused on the Public Forum where students and tutors and the CC participated. The usage of websites, usage of electronics applets and virtual lecture series from distinguish lecturer also used extensively.

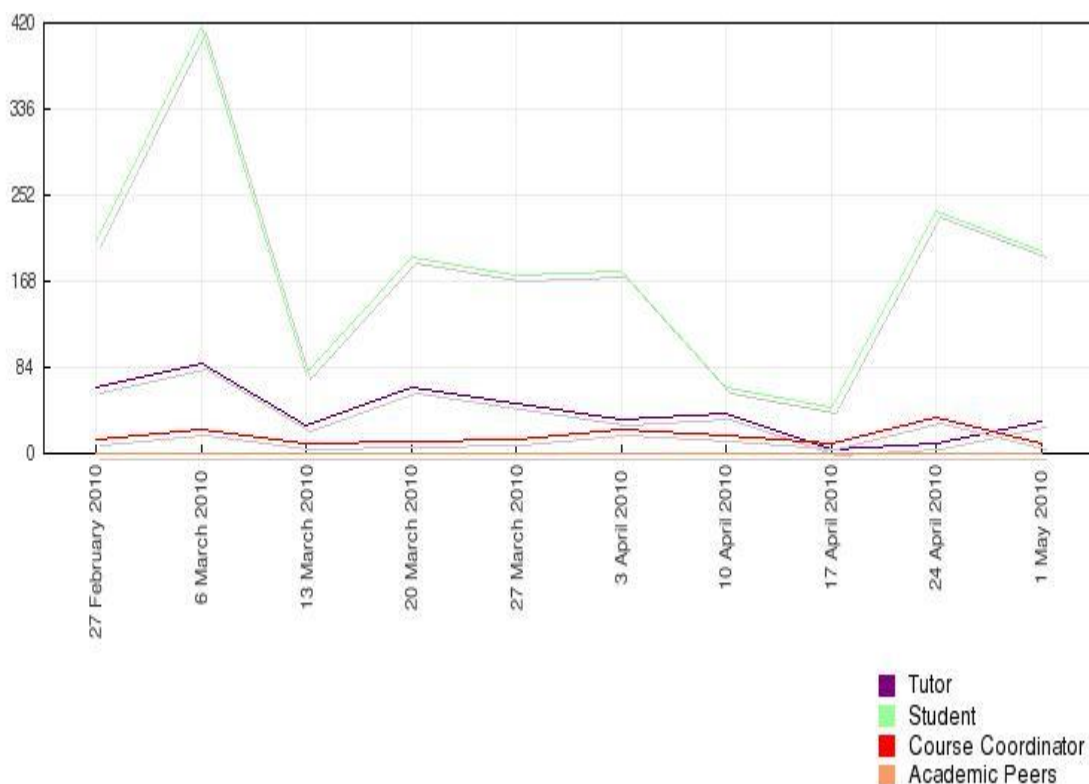


Figure 1: Graph of LMS Activities for the whole of Semester

III. Laboratory Implementation

Virtual access to experiments offers distance educators another tool to integrate a strong laboratory component within science and technology courses. Since virtually all modern electronics instrumental analysis in industry now use devices operated by a computer interface, remote control of instrumentation is not only relatively facile, it enhances participants' opportunity to learn the subject matter and be exposed to "real world" contents.

Most modern analytical instruments are intimately controlled by computer, thus making access by remote control possible. Several others have already reported using the commercially available *LabVIEW* software system for controlling instrumentation and acquiring data in an in-class teaching environment [6-15].

The development in IC technology has revolutionized the field of electronics. Complex electronic circuits are available off-the-shelf as IC chips. It is now easier to build electronic subsystems and systems with the available ICs. The best way to study electronic circuits is by simulating the circuits using PSPICE. It is freeware and students can easily download and install at their device and they can practice anywhere.

The Simulation Program with Integrated Circuit Emphasis (SPICE) circuit simulation tool was first developed in the early 1970s. It was written in the FORTRAN programming language and was intended to support the early data entry methods of this period. SPICE was immediately valuable to allow circuit designers to analyze circuit systems, in particular as the complexity of circuits began to expand with the arrival of the first integrated circuits. It is certainly one of the most important tools for all the electronics courses.

SPICE has evolved with many advances in numerical analysis methods for accurate and fast computation and has appeared in many commercial forms. SPICE has been ported to many platforms and the version that operates over the Windows operating system is PSpice. Fig.2 shows the view of schematics which is used to design the circuits for various systems & subsystems.

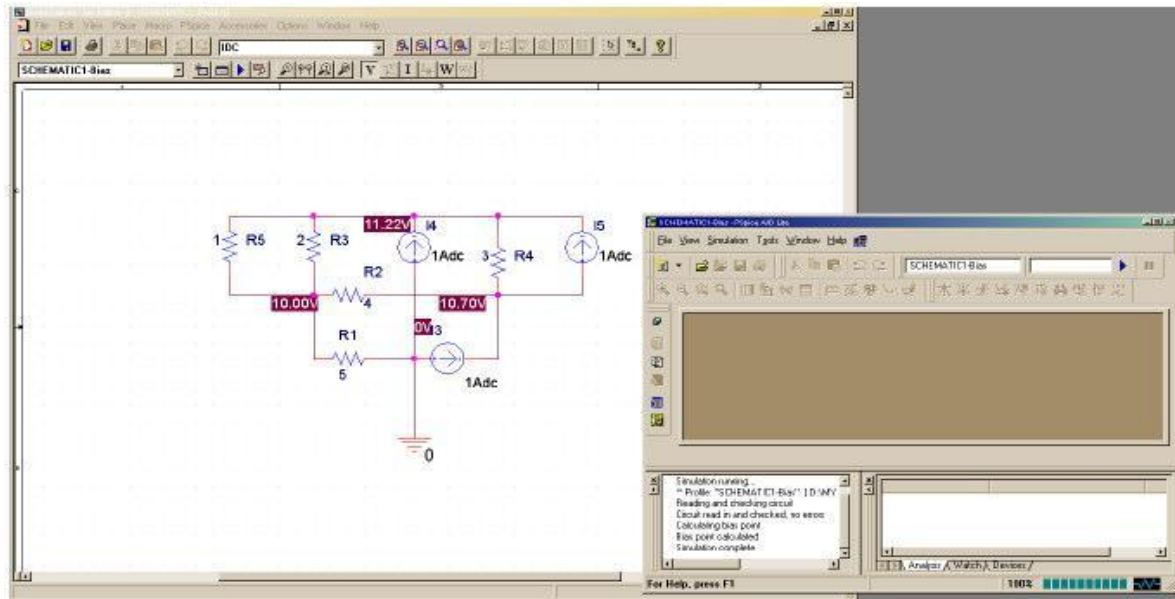


Figure 2 pSpice platform

The first SPICE users designed circuits with manual circuit drawing tools. Then, inspection of the circuit design was used to generate a text-based description of the circuit design. Even today this still occurs in certain special instances. However, the arrival of graphical drawing tools allows a circuit designer to directly draw circuit schematics using circuit design tools and then special “capture” tools operate to “capture” the schematic and generate the text-based description of the circuit design, automatically. The versions of pSpice available to us operate in this way.

This is a great advantage for the engineering design process – this provides the designer with the ability to focus directly on a visual description of their system and obtain circuit operation numerical and graphical results in an automatic, convenient process [6-15].

In the electronic principles course, the 1st Lab assignment was to explain and verify Thévenin theorem & Maximum power transfer theorem using pSpice and 2nd Lab assignment was to plot the resonance curve for series and parallel RLC circuit. These topics are from two important units of the course and students were satisfied by the technique of lab demonstration. It would be better to explain that how we demonstrated these experiments so the Thévenin theorem methodology has explained here.

We know that the application of Thevenin’s theorem requires an interesting maneuver to determine the Thevenin equivalent resistance R_{TH} . It is a maneuver, however, that has application beyond Thevenin theorem whenever a resistance level is required. The network which students had analyzed with the pSpice is shown in Fig.3

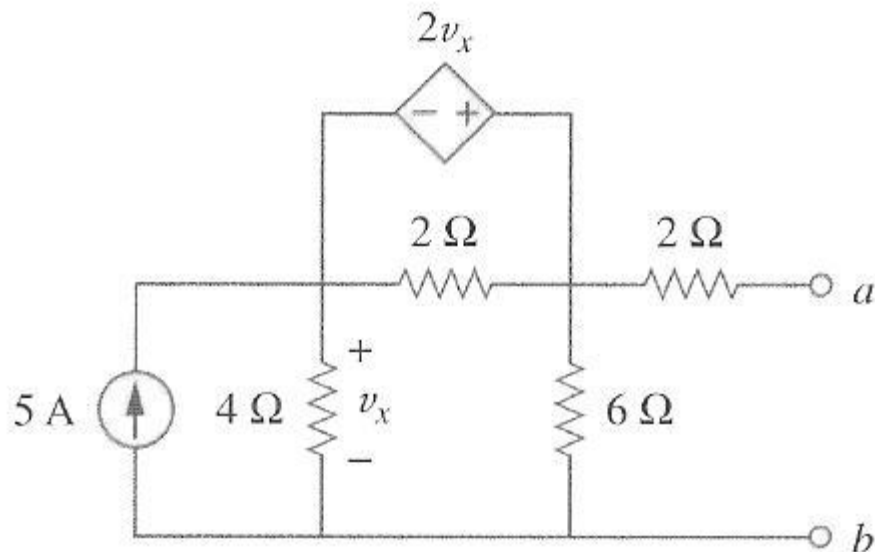


Figure 3: Network to which *pSpice* is to be applied

To find the Thevenin resistance and Thevenin voltage V_{Th} at the terminal a-b in the circuit, we first use Schematics to draw the circuit as shown in Fig. 4. Notice that probing current source I_2 is inserted at the terminals.

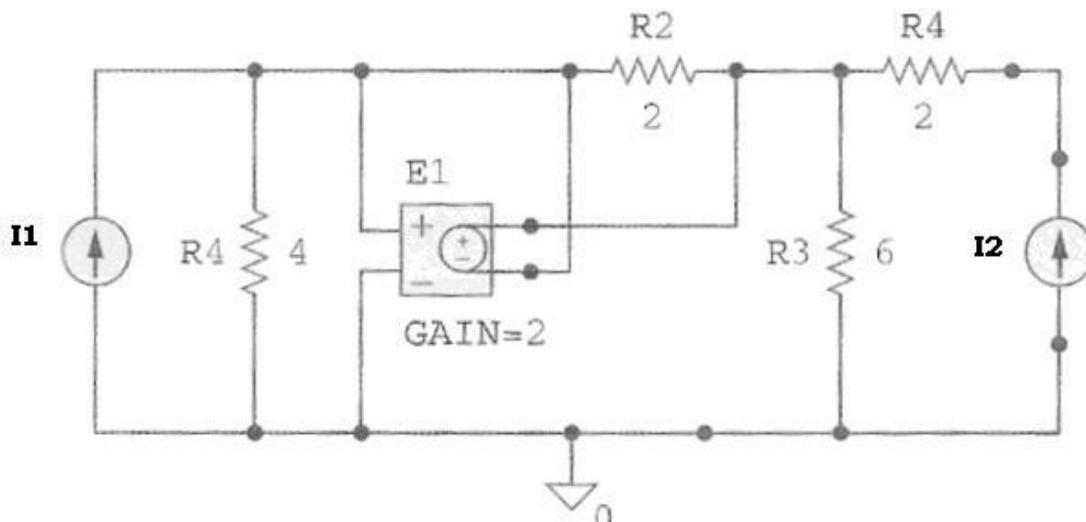


Figure 4 Schematics to draw the result

Under **analysis/Setup**, we select DC sweep. In the DC sweep dialog box, we select **Linear for the Sweep type and Current Source for the sweep Var.Type**. We enter I_2 under the Name box 0 as start value, 1 as end Value and 0.1 as Increment. After Simulation, we add trace $V(I_2:-)$ from the pSpice A/D window. After simulation, we add trace $V(I_2:-)$ from the pSpice A/D window and obtain the plot as shown in Fig. 5. From the plot, we obtain;

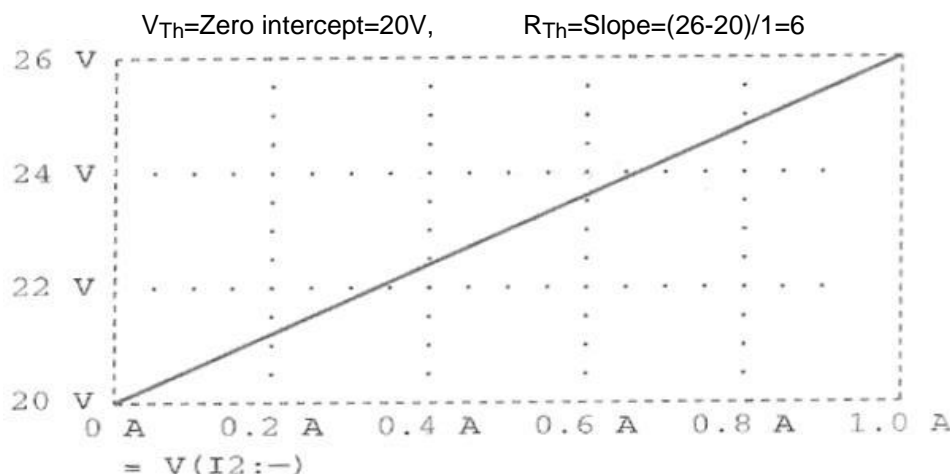


Figure 5 Thévenin Equivalent of the circuit

Now, one can compare all these simulated results with hand calculated results. It is educating students about this theorem effectively without using expensive physical components. We know that a strong laboratory component is at the heart of many science courses. It is also one of the more challenging components to deliver effectively at a distance. There is no one correct solution or technology and often an assortment of methods are used in concert to overcome these challenges. The methodology and success of varying approaches to delivering science laboratories at Wawasan Open University hasn't been discussed elsewhere using the open educational resources. In each instance, however, the intent is to offer students a laboratory experience equivalent to, but not necessarily identical to, that they would encounter in a more traditional face-to-face setting.

IV. Survey & Results

To validate the successful implementation of the course a survey between all the students of electronic principles course conducted. The student response to the questionnaires was positive, the students were especially appreciative of the flexibility offered by the online course and being able to work at a time that suited them ("you could learn the course material whenever you liked"), pace of their own choosing ("you could pause it to write your own notes") and repeat lectures and quizzes as required. The mix between different resource types and the discussion forums were all received well by the students as was the choice of recorded renowned academic's videos lecturer, than spending many hours for unknown lecturer class. They also felt that there was greater interaction with the tutor through the forums than was typical in a lecture. The questionnaire was as follows:

Student Survey on Teaching and Learning Effectiveness

A. Face to Face Tutorials

My tutor has provided sufficient guidance for me to understand the course content.

My tutor encouraged me to participate actively in the tutorials.

My tutor provided me additional examples and illustrations to help strengthen my understanding of the subject matter.

My tutor provided guidance to help me answer the TMA questions / activities by myself.

My tutor provided useful feedback on my TMA (Laboratory).

B. Course Materials and Learning Support Services:

– **Course Materials**

I find the course material easy to understand.

The course material is presented in such a way that it helped me to study by myself (i.e. become an independent learner).

The content of the course is manageable for learning in one semester.

The course material has sufficient examples that relate to real world situations.

The self-tests help me to reassure me that I have understood the course material.

The course materials is sufficiently enhanced with additional links to the web and library resources.

I find the text book provided by WOU for this course useful. The course material presented in CD format is learner friendly.

– **Learning Management System (*WawasanLearn*)**

The Course Coordinator and Tutor have posted adequate online resources in this course in *WawasanLearn*.

WawasanLearn helps me to stay *in touch* with my course-mates in this course.

I find the *Tutorial Group Forum* discussions to be relevant to what I have studied in this course.

I find the *Public Forums* in *WawasanLearn* to be useful in this course.

Tutor responded promptly to all my queries.

– **Library**

I find the library resources to be adequate for this course.

Library "help desk" responds promptly to all my queries.

The library website provides comprehensive links which assists me in this course.

– ***MyDigital Library***

MyDigital Library resources are relevant to my course.

In completing my TMAs, I could find relevant resources in *MyDigital Library*.

C. Tutor Marked Assignments (Assignment + Laboratory)

I have difficulties in understanding the TMA questions in this course. I have sufficient time to complete my TMAs.

The TMAs in this course helped me to assess my understanding and progress in the course. The feedback / remarks by the tutor on my TMAs in this course are helpful to me to improve myself.

It is easy and convenient to submit the TMAs via the online assignment submission (OAS) systems.

All participants were asked to answer the above questions and solicit their opinions of the course presentation method used for teaching electronics principle course. The data obtained then underwent content analysis using contextual analysis on pre-determined topics. To ensure the participants would be representatives of entire school of science and technology, participants from all streams were surveyed.

Table 1: Score Summary of Students' Feedback

	Item Description	Score	Overall Score
1	Face To Face Tutorials	4.03	4.03
2	Tutorial Assistance (Tel, email)	3.76	3.79
3	Library & E-Library	3.49	3.47
4	Course Materials	3.48	3.47
5	Tutor Marked Assignment + Laboratory	3.68	3.68
6	Learning Management System	3.70	3.69

Generally, the mean values of the evaluation for all the items are above 3.0 as shown in Table 1 and demonstrating overall good perception of students on our delivery. The best rating was for the face to face tutorials, followed by the tutorial assistance. This has shown that the students were satisfied with their tutor and the service provided in this course. The worst rating was on the course material. Overall students were satisfied with the tutors' performance. The students requested to increase tutorial and lab hours because this subject involve heavy practical component. The strong tutors' profile in the presentation has been proven from the students' feedbacks. Most of the time, students contacted the tutors through email or sms. All tutors had replied students' email. The comments from the tutors on the TMAs helped students to correct their mistakes so that it would not be repeated in the next assignment. Student also welcomed the submission of assignment online. LMS provided power point slides and online activities for students as reference. They shared information with each other and formed a network community. Student has utilized the library computers for his assignments and practical sessions. Student commented he prefer to do library search using Google. He may not aware that the database search was available on the e-library although he knew that e-library resources have assisted him in studies.

V. Conclusion & Recommendations

This study finds that all participants of electronic principles course are agreed with the equivalence of virtual learning environment and face-to-face classes. However, these scenarios should be further explored in more detail for higher level capstone courses of any programme and for project courses. With the virtual learning environment, both the learning and the cost effectiveness will be easier to measure. The students found learning online to be "very flexible, you can learn how you want to learn". Perhaps surprisingly, both tutor and students remarked that they had better access to the other: the tutor could monitor student progress through logs and the students had access to the discussion forum: "does seem like you get slightly more interaction with him". It was observed that the uptake for this course has increased, while the drop-out and failure rates have decreased.

Our intent was to justify the implementation of virtual learning environment in the technical course, which we find acceptable because we found that face-to-face mode of teaching also uses the virtual learning environment in higher level courses of electronics & telecommunications programme. Any education systems want participants to think about what they are doing, rather than being working as conventional way teaching so it was a good and exciting experience for participants. We also feel that it would be informative to pilot some of higher level courses with groups of students. This would effectively require students to communicate and learn on their own at a distance, rather than chasing to faculty for the help. Another feature we would like to incorporate in LMS is a trouble-shooting flowchart, or frequently asked questions, or autonomous agent, to assist student learning through ODL. With the feedback received we suggest that distance education implementation of virtual learning techniques can gain in importance and contribute in a significant way to science teaching through ODL.

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