

Development and Delivery of the Appropriate Assessments Items for Power Systems Related PBL Subjects

Amanullah MTO^a*, Alex Stojcevski^a

^aDeakin University, Geelong Waurn Ponds Campus, Geelong, 3220, Australia

Abstract

Problem Based Learning (PBL) as a teaching method has been around for many years. It is one of the most effective ways of learning and teaching. It uses real world problems as a learning method and encourages learners to learn independently while a mentoring support is provided by the academic. However, various academic institutions develop the assessments items in many ways; the implementation and delivery become a challenge in ensuring the right assessment and implementation. This paper discusses some of the practical experiences of the development and delivery of the appropriate assessment items for power systems related PBL subjects.

Keywords: PBL, Assessments, Delivery, Power Systems

1. Introduction

PBL method has proven to be one of the most effective ways of learning particularly in engineering and medicine. However, many institutions in many countries still face challenges in developing the right assessment items for the right cohort of students. The core reason behind this is due to the lack of academics with the right skills and commitments. PBL delivery requires extra effort from the academics in ensuring students learn the desired knowledge within the specified time.

Many academics are not fully committed to PBL though the institution is committed to promote it. In most cases, academics do not receive the training when they join a new institute which promote PBL mode of delivery. It is important to understand various proven assessment strategies and adopt those in PBL subjects. Tai et al (2007) reported various categorizes on assessment strategies. According to them, content deals with the knowledge students acquire, while process focuses on the students' ability to apply knowledge and skill in problem-solving. Outcome assessments whereas involve the products students design that shows their combination of content and new applications of knowledge.

Tai et al (2007) also shared that PBL tends to require more of a focus on assessing process than on assessing content, yet obviously content knowledge is still important. Ultimately, we need to seek evidence that students possess the means to embrace situations faced by practitioners of their profession and are competent to know how to go about dealing with such situations. White (2001) talks in terms of rather than assessing the achievement of content oriented objectives, we need to assess achievement of process oriented objectives - those that relate to how practitioners of a discipline or profession think about and solve problems within a certain field.

The success of delivering an effective PBL subjects starts with the development of the right assessment items for the relevant subjects. This paper presents some of practical experiences of the authors in developing and delivering the various PBL based subjects in the area of power systems.

2. Developing the appropriate assessments items

As the industry evolves, it is critical that academic courses and programs are revised to suit the industry needs. Accordingly, many universities in Australia have started curriculum review. Being involved in the curriculum review process for a number of subjects, it was found that developing the right assessment items is extremely vital in ensuring the students acquire the right skills and knowledge. In developing Capstone Power and Control Design subject to be delivered in PBL structure, an industry survey was conducted inviting practicing engineers from various industries. It was proven to be very fruitful approach as practicing engineers provided very useful feedback for the contents and delivery approach. The subject was developed to ensure students can learn independently.

As per the G. Xiao-Lian Tai and M. Chan Yuen (2007), "Assessment is a complex field, and almost everybody has an opinion as to what should be done. In recent years, ideas such as authentic assessment, performance-based assessment, and portfolio assessment have received a lot of attention. The authors further stated "two of the defining characteristics of a PBL study unit

* Dr Aman Than Oo. Tel.: +613 52479216
E-mail address: aman.m@deakin.edu.au

are that both the content and the assessment be authentic. Authentic assessment is substantially different than traditional assessment that is based on objective and short answer questions. As students are responsible for their own learning in PBL setting, students learn self-reflection where they become proficient in assessing their own progression in learning and also peer-assessment on how to effectively provide constructive feedback to their peers.” D. G. Moursund (2002) has shared to a more general assessment practices: “Authentic assessments are generally categorized into Performance Assessment, Portfolio Assessment, Reflection and Self-Assessment. Performance Assessments test students’ ability to apply acquired knowledge and skills in a variety of authentic contexts and work collaboratively to solve complex problems. Portfolio Assessment involves developing a portfolio that documents learning over time. Reflection and Self-Assessment requires students reflect and evaluate their own participation, learning progress, and products which are essential components of autonomous learning.”

N. Hosseinzadeh (2009) systematically looked at the development strategy in power system analysis based on PBL learning methodology. For a subject in power system areas, projects were defined in the following areas;

- Modeling of power system components
- Load flow studies
- Fault studies
- Economic dispatch
- Load forecasting
- Power system planning
- Power system stability

This has given a solid foundation for the students who are required to analysis power system using industry based software/tools such as SINCAL. N. Hosseinzadeh (2009) also reported the following assessments components which were proven to be very effective.

- Project reports
- Reflective journal
- Workbook
- Mid-semester test
- Reflective paper
- Self-grade nomination
- Peer assessment

It is very interesting to note that there is a mid-semester test in this subject though it is a PBL based subjects. There were concern and discussion whether to include a test in a PBL subject. Nonetheless, assessment in PBL is very complex and it is continuous topic to be further discussed in various forums. From N. Hosseinzadeh (2009), it can be learnt that though PBL courses are offered in projects, a written test has proven to be very effective to assessment students individually.

As for the Capstone Power and Design subject, the assessment was based on the Portfolio submission. It includes reflective journal for each week, project report, workbook and Peer’s evaluation report. Reflective Journal requires to reflect on the way the assigned project was conducted. Project report for each project was expected to be a technical report similar to a project report done by engineers in industries. Work Book, which included all the related work that students had done during the project time. Overall, the portfolio should demonstrate how the learning outcomes have been met and to what level, and be presented in the form of a technical report. The portfolio must include all pieces of work produced which the individual claims can demonstrate how they have met the learning objectives of the subject.

Students were asked to design a microgrid system for each typical university campuses. They were asked to investigate distributed generation including from the renewable energy sources. As the assessment item was developed in a very practical way, the student enjoyed it and was able to use all the skills they learnt in the earlier subjects.

3. Delivery of appropriate assessment items

There were a number of challenges in delivering this subject in PBL mode as half of the students were in off campus or distance mode. More and more universities in Australia are offering their courses and programs in distance modes to attract working and mature aged students. Delivering subjects in PBL modes has proven to be extremely difficult. Nonetheless, the teams were carefully chosen to ensure each group has at least one distance or off campus students.

In addition to their prior knowledge, additional lectures were also delivered relevant to the topic. In some cases, practicing engineers were invited to deliver the lectures and the students found it very useful. This has also provided an opportunity for the staff and the students to develop more engagement with the industry. It was a single large project in which students have to look at various aspect of modern microgrid. The project was divided to look into the following subcategories with specific task:

Week 1: Introduction to Microgrid

Activity: Understanding Microgrid: find relevant literature on Microgrid

Week 2: Electricity Uses and Demand Assessment

Activity: Make demand assessment by identifying your assigned campus energy requirements

Week 3: Electricity Uses and Demand Assessment

Activity: Develop a Single line diagram model of your campus

Week 4: Energy Sources for a Microgrid System

Activity: Identifying various energy sources for your campus

Week 5: Mapping and System Layout

Activity: Develop conceptual model

Week 6: Mapping and System Layout

Activity: Develop Model

Week 7: Control Elements of a Microgrid

Activity: Identify control system requirements for an efficient Microgrid

Week 8: Control Elements of a Microgrid

Activity: Design control system for Microgrid

Week 9: Safety and protection

Activity: Identify relevant safety standard and procedures

Week 10: Demand Side Management

Activity: Develop methodology for demand management

Week 11: Portfolio Preparation

Activity: Prepare your portfolio

Week 12: Student Presentations

Activity: Submit and present your portfolio

With this clear guideline, students were able to execute the task successfully. Modern technologies such as skype were used to communicate with the distance students. Assessments were carried out based on a final portfolio report. Each individual student was asked to present about their finding. One to one interview was also carried to ensure each student within the team contributed as per their claim. This has proven to be very effective. In some cases, students could not even answer some of the basic questions though they claim to do their respective sections in the report.

4. Conclusion

The assessment in this particular subject was designed to ensure the subject learning outcomes are met. Engaging industry engineers in the development of the assessment was proven to be very useful as they could contribute in the development of the projects along with its respective assessment items. Though there were some challenges with the distant students, the overall delivery of the subject was very satisfactory. Being capstone subject, students were able to demonstrate all the knowledge and skills acquired in their earlier studies.

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