

Design of Assessment for Project modules with Dissertation Type of session

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Abstract— Most engineering degree programs require the incumbent to carry out a thesis project. Such projects are carried out in the final year of study, and culminate with the submission and defense of the thesis. The thesis project has specific objectives, one of which is training in research methodology. However, with ever growing student numbers, it is found that some of the objectives are either not clear to the student, or are not met. The problems arise due to unclear goals and assessment methods. The paper describes a method of designing a thesis project module. It also describes the method of assessment that is criterion based and continuous.

Index Terms $\frac{3}{4}$ Final Year Project, thesis, National University of Singapore.

INTRODUCTION

The Bachelor of Engineering (Electrical) Honours program at the National University of Singapore requires students to carry out a research project. In the final year of study, students carry out a project that involves a varied mix of research, design and development components. It is carried out over two academic semesters on a topic of current interest in Electrical and Computer Engineering. Students learn how to apply knowledge and skills acquired in the classroom and also think of innovative ways of solving problems. Apart from intrinsic rewards such as the pleasure of problem solving, students are able to acquire skills for independent and lifelong learning.

Such type of project based modules are common to many undergraduate honours degree programmes. The students and supervisors are usually expected to be well aware of the goals and the learning outcomes. The projects are assessed at completion, usually based on written thesis, thesis presentation and defense. Such an outcome based assessment is suitable for mature researchers but for students who carry out their first major research project, this approach usually leads to bad practices and poor learning. This paper looks at how effective assessment can be used as a tool to provide students with a feedback on their learning.

ROLE FOR PROJECTS AND RESEARCH

There is a famous Chinese saying that goes:
Tell me and I will forget
Show me and I will remember

Involve me and I will understand
Step back and I will act

This sums up the importance of a project based learning approach. One aspect of learning is to acquire and understand new knowledge while other is ability to use the knowledge. Skills also form an important part of learning. Especially in professional education, skills define the profession. Thus projects offer an avenue for students to practice and acquire new knowledge and skills. Undergraduate education is a stepping stone to diverse career paths and hence should offer students opportunities to train and demonstrate various competencies. Research is one of these. The undergraduate research opportunities program (UROP) [2] offers 2nd year students a chance to carry out research. However, the final year project is on a much larger scale and is mandatory for all graduating students.

Project modules should offer students opportunities to acquire research skills and to demonstrate the ability to carry out research. Since assessment is a unit of measurement of success of the desired learning outcomes, it should be well planned. If the learning outcomes are not clear and the assessment does not match the outcomes, ineffective learning happens [3]. This has been the problem with the projects. Since final year projects were assessed and graded at the end of the academic year based on achievement, thesis and presentation, students were much focussed on the “product” of the project. This increases the likelihood of students doing most of their work in the latter part of the year, which led to high level of stress, quick-fix solutions and poor research training for many students. Students were often found to have poor understanding of the purpose of the final year project. All this led to rethinking on the final year project.

OBJECTIVES AND OUTCOMES OF PROJECT MODULE

Clear goals and learning outcomes are necessary for an effective management of learning. Hence, the purpose and justification of the project module had to be carefully thought through and documented. The main objectives were identified as

- teach skills, such as questioning, forming hypotheses and gathering evidence,
- students to learn how to work in a research environment,

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- students are able to acquire skills for independent and lifelong learning and pleasure of problem solving,
- Students learn how to apply skills acquired in the classroom and think of innovative ways of solving problems.

Projects can be proposed by academic staff, students or researchers and engineers from industries in consultation with the academic staff. The projects have a varied mix of research, design and development components. Students work on the project throughout the academic year. Academic staff advise students and continuously monitor their progress. The students will keep a logbook of activities during their project. The students are required to submit a short report for continuous assessment at end of semester 1. At the final assessment a dissertation is to be submitted and defended by the student

The learning outcomes that meet the objectives of the final year project were defined. They are:

At the completion of the module, the students should be able to:

- carry out preparatory work such as literature search/review of past work/software/hardware etc.
- evaluate material of direct relevance to the investigation.
- formulate the problem/focus on main issues/identify areas of major contribution in the project.
- validate the problem statement and solution through analytical studies/software design and simulation/ design & building instrumentation/ experimentation.

Assessment will be made on the following criteria:

- Planning:* time-schedule, milestones, usage of existing resources, and consumable requirement.
- Execution:* Execution in parts as directed by the milestones, integration of all the parts to provide the solution to the formulated problem.
- Outcomes:*
 - write a dissertation and a technical paper
 - present and defend the thesis

ASSESSMENT OF PROJECTS

Criterion based assessment is very suitable for project based learning [4, 5]. These assessment criteria are listed as (i) to (v) in the previous section. They assume an appropriate meaning depending on the nature of the project. A criterion-based, continuous assessment is proposed for the final year project. The goals of the assessments are:

- To inculcate disciplined work habits.
- To avoid accumulation of work at end of year.
- To notice symptoms of potential problems at an early stage and take corrective action.
- To assess students on execution, good practices and on achievements.

There will be four assessments spread over the two semesters. The first assessment, CA1, will be carried out by the first semester break. It will constitute 10% of the total assessment. The criteria for assessment will be (i) and (ii). The second assessment, CA2, will be held at the end of the first semester and will constitute 30% for the total assessment. The criteria will be all of (iii) and some of (iv). The third assessment will be carried out before the second semester break. It will include the criteria (iv), and will contribute 30% of the total assessment. The final assessment will constitute 30% of the total and will be based criteria (iv) and (v). Table I shows the assessment break up.

TABLE I
FINAL YEAR PROJECT ASSESSMENT DETAILS

Time of assessment	Criteria of assessment	Total
CA1 mid-semester I	i, ii, iii,	10%
CA2 end- semester I	iii, iv	30%
CA3 mid- semester II	Iv	30%
CA4 end-semester II	iv, v, vi	30%
Total		100%

At CA1, the student will be given a qualitative feedback by the supervisor alone. For CA2, carried out at the end of the first semester, students will submit a short report for review by both the supervisor and examiner. The assessment could be in form of an interview and demonstration of the work done. CA3 will be done solely by the supervisor and can be completed by the middle of the second semester. CA4 will be carried out solely by the examiner at the end of the second semester.

The proposed break up of the final marks for the final year project is roughly 10% for the thesis, 10% for the presentation and technical paper and 10% Achievements. Examiner may request the presence of the supervisor during CA4; however, the assessment will be done solely by the examiner. The proposed scheme retains a similar break up, 60% Supervisor and 40% examiner. The scheme presented in this paper provides the benefit of continuous and independent assessment. The students and the supervisors will have regular meetings; the assessments are not to replace the meetings. The students will be given objective feedback at the end of CA1 and CA2. At the end of CA3 the supervisor can give advice on the thesis and technical presentation. Examiner for each of the projects will have to be decided by the end of first assessment (first assessment is done solely by the supervisor)

Formative feedback to students

- Body of knowledge/reading/research done is

poor				adequate
1	2	3	4	5

2. Understanding of major concepts is

poor				adequate
1	2	3	4	5
3. Plan of execution, time schedules/milestones
4. Goals and objectives of the project are

achievement of the student and it is an independent assessment by the examiner.

Break up percentages

Criteria	CA1	CA2	CA3	CA4	Total
Student effort criteria i, ii, iii, iv	5%	4%	3%	0	12%
Student initiative criteria iii, iv	0%	6%	6%	0	12%
Outcomes criteria iv	5%	20%	21%	9%	55%
Thesis, Presentation, paper	0%	0%	0%	21%	21%
Total	10%	30%	30%	30%	100%

CONTINUOUS ASSESSMENT

CA1

This assessment is carried out by the mid-semester of the first semester of the project. The actual form of assessment is decided by the supervisor, depending on the nature of the project. 10 % of total taken towards final assessment. The student effort with respect to the criteria i, ii, and iii are being assessed. This looks at the process and skill of research that the student has acquired. Student achievement with respect to these criteria is also assessed with equal weightage. What has the student achieved? Both in terms of skills and knowledge.

It is clear from the break up percentages that all aspects of a typical project have been given an adequate weightage. It also ensures that the weightages for different criteria are satisfied, so that there is a match between the criteria and the assessment.

CA2

The second assessment is to be completed by the end of the first semester. By this time the student is expected to have completed a fair portion of the research project. Hence the criteria for assessment will be iii and iv. Student effort in the process of carrying out the research project will be assessed with 20% weightage; whereas student initiative is weighted 30% and the achievement are weighted 50%. The exact criteria will vary according to the specific topic of the project; hence no attempt is made to define them. Supervisor and examiner are involved in the assessment. The assessment may have different form suitable to the nature of the project. The choice is left to the supervisor and the examiner.

CONCLUSION

A scheme to assess and implement projects so that the students learn actively throughout the duration of the project has been presented. The assessments are spread over the full project duration and students are given formative feedback to improve on the execution of projects. A criterion based method of assessment that evaluates not only the project achievements but also the learning objectives is proposed.

CA3

The third assessment is carried out by the March, which is roughly 3/4ths of the second semester. By now the student is expected to have completed the major portions of the project. Important results or conclusion are expected at this stage. This stage is assessed solely by the supervisor and will be based on the criteria iii and iv. Criteria iv deals with the main process of the research project. This relates to the execution of the research project. Since the supervisor will be working closely with the student, it is expected that the supervisor will have a better appreciation of the difficulties and the achievements of the student. The last assessment is carried out by the examiner independently of the supervisor. It will mainly consist of dissertation, presentation and defense and technical paper. 30% weightage is give to overall

REFERENCES

- [1] Cowan, J, "On Becoming an Innovative University Teacher", *Open University Press, Buckingham, MK181 XW*, 1998, ISBN 0335 19993 3
- [2] <http://www.eng.nus.edu.sg/urop/>
- [3] Khambadkone, A, "Assessment towards in-depth and student centered learning", *Proceedings of International Conference on Engineering Education, ICEE 2001, Norway, Session 8B5*.
- [4] Brown, G, Bull, J and Pendlebury, M, "Assessing students in higher education", Routledge, London, 1997.
- [5] Gibbs, G, "Assessing student centered courses", Oxford Brookes University, Oxford, OX3 0BP, 1995.
- [6] Astin, A W, et. al. "9 Principles of Good Practice for Assessing Student" ,[Learninghttp://www.aahe.org/assessment/principl.htm](http://www.aahe.org/assessment/principl.htm)

