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Evaluating Assessment Practices in Design-Based Learning Environment

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Abstract

This investigation is focused on evaluating assessment practices in design based learning environment. The School of Engineering at Deakin University practices project/design based learning as one of its learning and teaching approach. When identifying graduate attributes particularly for undergraduate engineering programs in Australia, the program accrediting body Engineers Australia (EA) initiates a set of graduate attribute elements which was mentioned in "Stage1 competencies and elements of competency". Stage1 competencies state that one of the important engineering application ability for graduates is 'application of systematic engineering synthesis and design processes'. By practicing the design focused learning environment and evaluating students perceptions, This investigation examines students' experiences of assessment practices in their curriculum through an online survey given to the same cohort of students in third year and fourth year undergraduate engineering.

Keywords: Assessment practices, Design based learning, Students' perceptions.

Introduction

Assessment in higher education is a process of evaluating students curricular performance based on learning outcomes using limited context of standardized rubrics. In this 21st century, students need to acquire career focused knowledge and skills expected by the industry. To meet those industry requirements and societal needs as a graduate, student's level of achievements have to be assessed appropriately. Academia has to develop changing quality of assessment methods, which will fulfil the demand of new knowledge and abilities.

Recent developments and various studies shown that there are different modes of assessment methods have been practiced based on knowledge, skills, practice which is linked with unit learning outcomes. Studies also revealed that effective or meaningful learning is conceived where the learner constructs their own knowledge base assessment methods[1, 2]. This implies the learners to be self directed and focused on developing strategic learning behaviour[3].

The aim of this investigation is to examine students' experiences of assessment practices in design based curriculum through an online survey given to the same cohort of students in third year and fourth year undergraduate engineering. This paper is discussing about the difference in experience of students from the different level of study environment. It analyses the students' way of practice, preferences, students' level of satisfaction, students' preference on dividing contact hours, grouping, assessment etc.

Different Assessment Practices in Education

Assessment is not only about grading, it is based on grading which visualizes the students' own capacity of acquired theoretical and practical knowledge. Assessment plays a vital role in the learning process, thus it is a need to assists in developing appropriate assessment practices, which helps students to learn effectively and efficiently. Past literatures also mentions that assessment practices based on collaborative learning will help students to grow their own interest to engage in a study environment.

Buchanan[4] states that self-assessment practice will promote more active and collaborative engagement for students. Schunk[5] revealed that developing self-evaluation assessment practice helps students to gain more control over their learning. The students are working in a team and assess each other work through peer-to-peer assessment practices. Rather only an instructor assessing and evaluating the students learning outcomes based on their performance.

Sadler[6] states that formative assessment is a practice which specifically intended to generate feedback on student performance that improve and accelerate learning. To inspire self-regulated learning for students in academia, formative assessment practice will regulate aspects of analysing, rethinking and actively engaging in learning. Graham Gibbs[7] revealed that the quality of education is based on focus of aligning learning outcomes and their assessment. Studies show that the teaching does not attract students rather they are influenced by assessment practices.

Sally Brown[8] discusses and recommends 'fit for purpose' assessment practicing enable evaluation of the extent to which learners learnt and demonstrate their learning. The Author mentions that, academics need to consider the best time to assess the students. In many cases, assessment should be focused on students' achievement through evidences. It is worth to consider student centred assessment that reflects student centred curriculum. The students are not to be driven by assessment criteria before they start working on assignments, reports or any assessment material. The assessment criteria as a rubric will help the academic to align the learning outcomes but it doesn't make a student to be innovative or creative in their performance[9, 10]. Engineers Australia (EA) is the Engineering accreditation body of Australian Engineering institutions mentioned clearly about effective team membership and team leadership (Element of competency 3.6 – professional and personal attributes) in the Stage 1 competency for professional engineer. Engineers Australia[11] states that a professional engineering graduate should understand the team dynamics and leadership fundamentals, perform as an active team member in a multidisciplinary team, recognises the value of knowledge sharing, and collaborating in a team and should respect other team members roles and responsibilities.

Design Methodology

The online survey was conducted by a third person who is not involved in the research project. The survey was given to more than 50 students' in 3rd year and in 4th year of Civil engineering. The questions were prepared to identify the challenges and issues in different assessment practices and in particular to investigate the student's perspectives. The questions were designed more definite and clear enough to acquire students learning experiences on design based learning.

The third year students' practices partial design based learning approach and fourth year students' practices full design based learning approach. The variable level of involvement of the design components in the teachings of the two different type of units will help the academics to assess the students' experiences on assessment practices based on the adopted level of design based learning approach. It also helps students to develop their learning objectives and enhance their learning outcomes. This study was performed over two years with the cohort of students in third year and followed up in final year in a relevant unit. This survey is performed on same cohort of students enrolled in the third year unit 'Reinforced Concrete Structures (SEV353)' in Trimester T2-2014 and in fourth year unit 'Advanced

Structural Design (SEV454)' in Trimester T1-2015. Both the units have same teaching staff that coordinates the unit delivery and assessment. The comparison of partial DBL and full DBL is shown below in Table 1.

Table 1: Comparison of partial DBL and Full DBL

<table>
<tr><th></th><th>Partial DBL</th><th>Full DBL</th></tr>
<tr><td>Assessment</td><td>- One Design project (30%)
+ One laboratory project – Concrete Lab (15%)
- Final examination (55%)</td><td>- Design project 1 (50%)
- Design project 2 (50%)</td></tr>
<tr><td>Contact</td><td>- 3x1 hour Class per week
- 1x1 hour Seminar per week
- 3 x 3 hour Laboratory</td><td>- 1 x 2 hour Class per week
- 1 x 2 hour Design Studio per week</td></tr>
<tr><td>Teaching</td><td>- Content driven, focused more on
- Fundamental &Theory
- Student driven design work
- Assessment based on group work & individual work</td><td>- More on practice
- Design work
- Design Briefs
- Assessment based on group work & individual work</td></tr>
<tr><td>Project Activities</td><td>For a multi storey residential Building (students have to carry out)
<table><tr><td>Group Task – 20%</td><td>Individual Task – 80%</td></tr><tr><td>- Conceptual design report
- Structural analysis</td><td>- Work on detailed design for continuous beams</td></tr></table></td><td>For a multi storey office building (students have to carry out)
<table><tr><td colspan="2">Report 1</td></tr><tr><td>Group Task – 20%</td><td>Individual Task – 80%</td></tr><tr><td>- Conceptual design for columns
- Structural analysis for columns</td><td>Detailed design for five columns in a selected floor</td></tr><tr><td colspan="2">Report 2</td></tr><tr><td>Group Task 20%</td><td>Individual Task -80%</td></tr><tr><td>- Conceptual design for shear walls & footings.
- Structural analysis for shear walls & footings.</td><td>Detailed design for a selected shear walls & footings.</td></tr></table></td></tr>
</table>

The assessment tasks for SEV353 are design work - total of 45% (one design project (30%), one laboratory report (15%)), and a final examination (55%), hence considered as partial DBL unit. However, the assessment tasks for other fourth year unit SEV454 in civil engineering that have two design projects – a total of 100% (50% each), and hence considered as full design based learning unit. The cohort of students enrolled in Advanced Structural Design (SEV454) in T1-2015, who had completed the pre requisite unit of Reinforced Concrete Structures (SEV353), in T2-2014. By analyzing online survey, the research illustrated the perceptions of students' experiences on partial DBL and Full DBL learning practices. From the analysed quantitative results, this research will discuss about students preference on better assessment practices, which helps them to develop their team learning objectives and enhance the learning outcomes for future career. The online survey questions are listed in Appendix A. The survey questions used in this research study are shown below in various modules

Module 1: Questions 1 to 3 are quantitative questions focus on design-based learning and in particular focus around project/design-based learning approach. These questions are designed to analyse students' preference and level of satisfaction on design based learning approach.
Module 2: Questions 4 to 6 are quantitative questions, which focused on students' preference on contact hours between formal lectures and design class, assessment on partial DBL (30% project/ 70% exam) and Full DBL (100% project).

Module 3: Questions 7 to 9 are designed to acquire students' preference on project assessment, students experience on grouping, composition of group, group size and estimation of each team member participation in a group.

Students Perceptions

This investigation emphasis about students' perceptions on design based learning (DBL) approach and assessment practices in DBL. DBL is combination of project-based learning and problem-based learning. In DBL approach, students work on and learn by designing creative and innovative practical solutions, which fulfil the future career ready skills. The DBL environment assists curriculum to move into the twenty-first century with students being hands-on in their work, in addition to using problem solving skills, engaging in collaborative teamwork, creating innovative designs, learning actively, and engaging with real-world assignments[12-14].

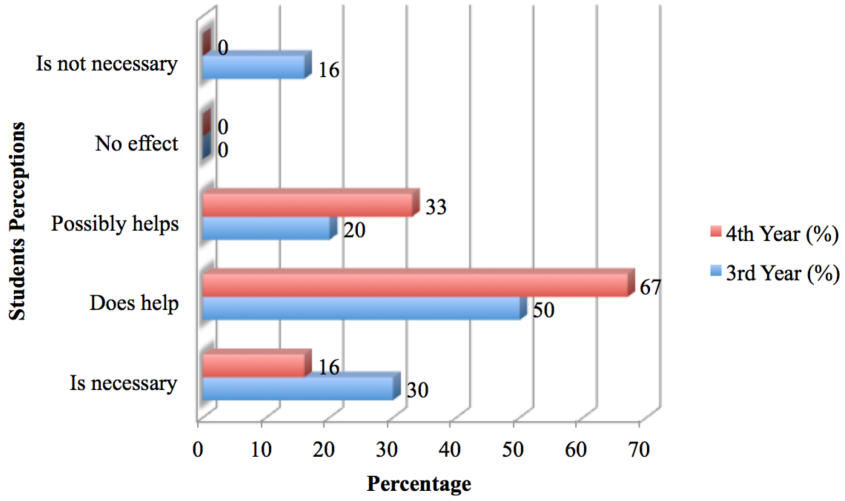

Figure 1. Students' perceptions on practising design-based learning

Module 1: Figure 1 illustrates about students perception on practising DBL, about 16% of students from 3rd year cohort mentioned that practising DBL is not necessary. When the same cohort of students in final year of their studies says that DBL is necessary (30%). By looking at this difference in number, it is clear that students have experiences in full DBL is more prominent than partial DBL. Design based learning approach enhances different cohort of students in the School of Engineering at Deakin University[15].

Table 2. Students' preference on design based learning mode

Students' perceptions	3rd Year (%)	4th Year (%)
Partial DBL (30% project / 70% Exam)	30	17
Full DBL (100% project)	70	83

The learning assessment for 3rd year students in partial DBL is 30% project / 70% exam and 4th year students in full DBL is 100% project. Table 2 shows that most of the 3rd students preferred full DBL, which resembles that students are interested in assessment through projects. About 17% of 4th year students preferred partial DBL, even though when they have experienced full DBL. Most of the student from 3rd and 4th year preferred to undertake full DBL assessment practices.

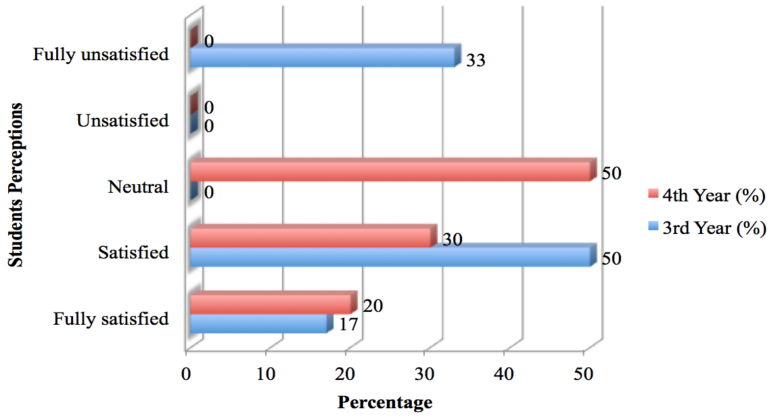

Figure 2. Students' level of satisfaction on DBL delivery

Figure 2 shows the students' level of satisfaction on DBL delivery. It is interesting to see the change of views from the same cohort of students in 3rd and 4th year. Students (3rd year) of around 33% are fully unsatisfied with partial DBL whereas 50% of 4th year students are not sure about the full DBL delivery. It is clearly shown that the students are comfortable with partial DBL than Full DBL assessment practices.

Table 3. Students' preference on dividing contact hours between formal lectures and design class

Students' perceptions	3rd Year (%)	4th Year (%)
0% lecture / 100% design class	0	20
30% lecture / 70% design class	17	20
50% lecture / 50% design class	17	60
70% lecture / 30% design class	67	0
100% lecture / 0% Design class	0	0

Module 2: When students are asked about their preference on dividing contact hours between formal lectures and design class. Table 3 illustrates that about 76% of 3rd year preferred 70% lecture/ 30% design class and on the other side 60% of 4th year students preferred 50% lecture / 50% design class. Usually in 3rd year of engineering, students have more opportunity of learning fundamentals and theory than in 4th year level. It is really inexplicable to see final year students expecting 50% lecture along with 50% design project or activities.

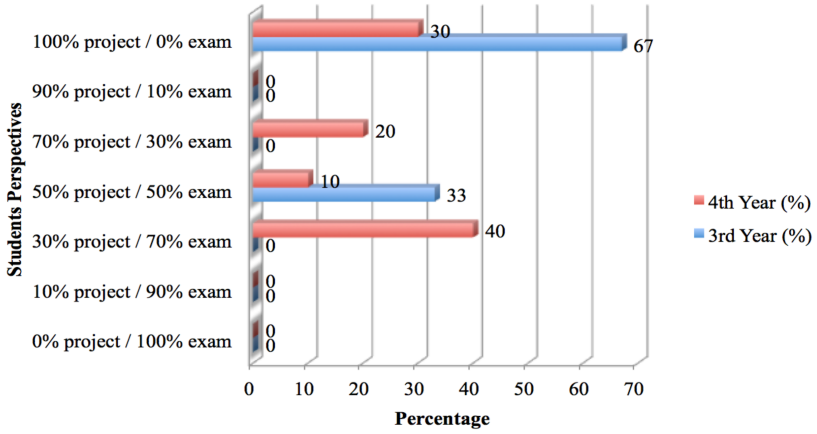

Figure 3. Students' preference on assessment for partial DBL

Figure 3 shows more than 60% of both 3rd and 4th year students preferred 100% project / 0% exam assessment in partial DBL. About 33% of students in 3rd year preferring 50% project / 50% exam which shows there is need for steady progression of assessment requirements in

the later years of courses. The assessment criteria are designed by staff for the evaluation of students' integral component of entire learning and teaching process.

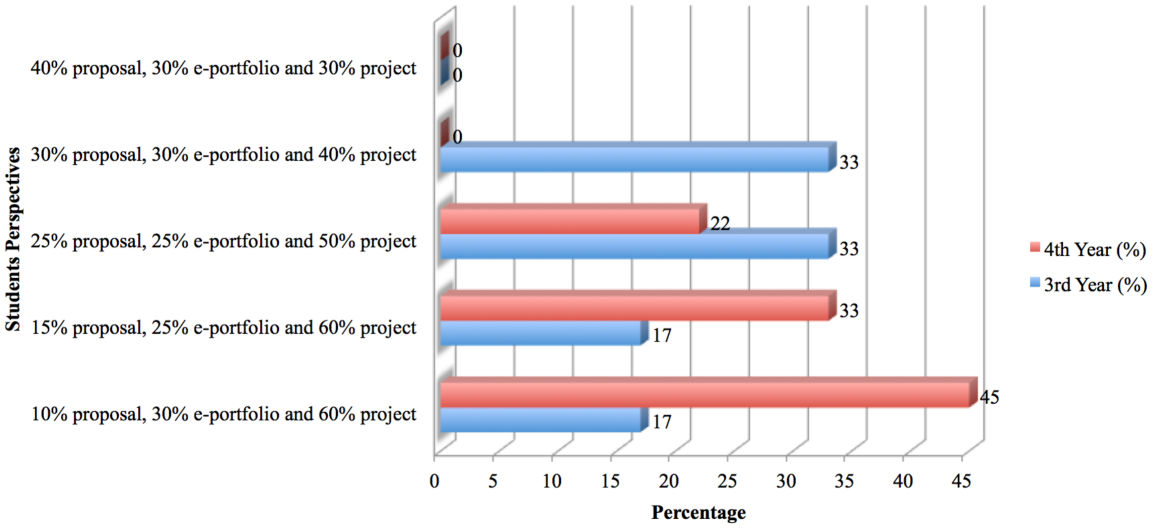

Figure 4. Students' preference on assessment for full DBL

In figure 4, around 45% of students in 4th year preferring 10% proposal, 30% e-portfolio and 60% project and about more than 60% of 3rd year students preferred 25% proposal, 30% e-portfolio and 40%project. This figure shows appropriate students selection on assessment practices in each level.

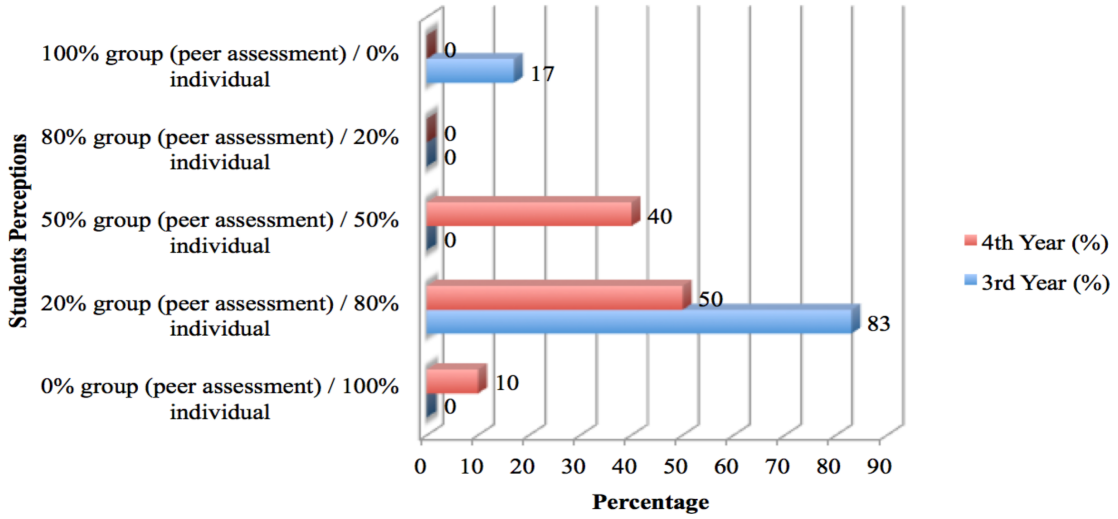

Figure 5. Students' perceptions on project assessment

Module 3: This investigation is also discussing about different assessment practices in literature review section. When students are asked about their preference on project assessment. Figure 5 shows, around 83% of 3rd year preferred 20% group / 80% individual assessment in partial DBL where there is only 30% of project takes place. About 50% of 4th year preferred 20% group / 80% individual assessment, 40% preferred 50% group / 50% individual assessment in full DBL where there is 100% project (two 50% projects).

Table 4. Students' preference on grouping

Students' perceptions	3rd Year (%)	4th Year (%)
1 (individual only)	0	11
3 students in a group	17	40
5 students in a group	17	40
7 students in a group	0	0
Group randomly	0	30
Group by alphabetical order	0	0
Group by student own preference	67	80
Focus group based on academic performance	0	10

The students are encouraged to work in teams at Deakin engineering. On/off campus students have option of choosing their own team members to work in a collaborative way. Table 4 illustrates about student preference on grouping. Cohort of students in 4th year, around 11% only preferred to work as individual and 80% of students preferring grouping by their own preference rather grouping based on academic performance. 3rd year students of 67% preferring grouping by their own preference and students also preferred 3 or 5 students in a group. This investigation will motivate staff and students to understand importance of assessment practices which foster valued study environment. There are previous studies has been conducted to evaluate students and staff experience on project/design based learning approach in the School of Engineering at Deakin University[15-18].

Table 5. Students' preference on composition of group with respect to off campus / on campus

Students' perceptions	3rd Year (%)	4th Year (%)
On campus / off campus only (only one category)	50	50
1-2 off campus students in an on campus group	50	40
1-2 on campus students in an off campus group	0	0
50% of off campus / on campus students	0	10

From the table 4 and 5 above, it is clearly shown that assessment will be accurate based on the students own grouping preferences. One of the mandatory skills for an engineering graduate is to work collaboratively with other team members in a project[19]. To encourage collaborative learning, students have opportunity to work with composition of on-campus and off-campus students in a classroom. In table 5, both 3rd year and 4th year students preferred a composition of grouping with 1-2 on/off campus students in an on/off campus group. This overall investigation is a provision for students' choice in assessment practices in different weighting learning approaches.

Discussion

Australian higher education system has quite different assessment practices than other international higher education systems around the globe. The assessment is considered to be the endpoint of the learning and teaching process. Many studies revealed that the focus of learning and teaching is not to be based only on the judgemental role of assessment rather assessment should contribute to enhance student-learning outcomes[20, 21].

Enhanced assessment practices will enhance student learning in higher education. It is possible by integrating knowledge with assessment task and also by providing spontaneous feedback during the time. Assessment practices through online, group based, and individual are having some range of reluctance in student satisfaction. However, academic staff has a

balanced vision on assessing students learning outcomes using various assessment patterns in higher education[22].

From the survey results above, same cohort of students participated the survey and given their perceptions and preference of assessment practices in design based learning approach. This study will help other academics to understand the students' expectations and experience on learning in teams, working collaboratively in following level (3rd and 4th year) of their studies. From those results, it is clearly shown that in 3rd year students slowly understanding the new design based learning approach and preparing themselves for final year full design based learning mode. Full DBL mode is a preferable choice of learning approach and for assessment practices in both levels.

When dividing the contact hours between lectures and design classes. Students while studying 3rd year, they need more theoretical knowledge along with the design activities and they expect more design activities than lectures in 4th year. It shows students capability and confidence level is growing up to level career-focused graduates. Students (3rd and 4th year) also preferred 100% project / 0% exam assessment practice along with assessment breakdown of 10-15% proposal, 25-30% e-portfolio and 60% project. Deakin University is implementing this new assessment practices in forthcoming years for all design-focused units in the School of Engineering.

Conclusions

The difference in students and staff perceptions on assessment is 'for staff – assessment is final consideration in evaluating the learning and teaching process' and 'for students – assessment is the forefront of the learning and teaching process where they work backwards through the curriculum. This study summarizes the views of same cohort of students in 3rd and final year of engineering. It shows students preference on evaluating assessment practices in design based learning approach. Even though academics set a clear alignment on expected learning outcomes, students need to be assessed based on the learnt knowledge and skills. The above results shows that students are well prepared in early level of engineering with a new learning and teaching approach. The students experienced practising partial DBL in 3rd year and full DBL in 4th year where they have different assessment criteria, project assessment, grouping and composition of grouping.

Students have positive experience in practising DBL in both years. This study experience gave an opportunity to analyse themselves with different assessment practices. Many students express a strong preference on choosing particular assessment criteria (100%project / 0% Exam), project assessment methods (10% proposal, 30% e-portfolio, 60% project), grouping (2-3 students in a team) and composition of grouping with 1-2 on/off campus students in a collaborative project. Providing higher education students with options in assessment will encourage the students to engage with curriculum. It enhances students' capability to be self –directed, outcome based, collaborative and being analytical in solving problems.

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Appendix A - Questionnaires

1. How comfortable do you feel practicing design based learning (DBL) approach in your unit?
2. Which design based learning mode do you prefer?
3. What is the level of satisfaction you have in DBL delivery in selected DBL mode (in question 2 above)?
4. How do you want to divide the contact hours between formal lectures and design class?
5. For partial DBL mode which one of these options do you prefer for assessment?
6. For full DBL mode which one of these options do you prefer for assessment?
7. Which one of these listed options do you prefer for project assessment?
8. Which one of these listed options do you prefer for grouping and how? Please click one option in each column
9. Which composition of group do you prefer with respect to off-campus and on-campus students?