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Continuous Assessment: A Preliminary Study of Student Engagement in the Assessment Process

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CONTINUOUS ASSESSMENT: A PRELIMINARY STUDY OF STUDENT ENGAGEMENT IN THE ASSESSMENT PROCESS

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Abstract

This paper provides an objective analysis of student engagement with continuous assessment over a three year period. The results of two groups of students from different stages of a modularised level seven engineering programme were examined. As both groups had taken modules where they studied numerical differentiation, this topic was selected and the corresponding assessment results and attendance of both groups were analysed.

Two assessment methods were used to evaluate student engagement. The first method of assessment required the student to complete a laboratory assignment and submit it within a specified period of time. The second method of assessment involved an invigilated practical exam which was held in the laboratory on completion of the module. For both groups, students were required to attend a one hour lecture each week and a two hour computer laboratory on alternate weeks. Specific module content was introduced through the lecture and the computer laboratory enabled students to apply the material presented in the lectures and work on laboratory assignments relating to a specific topic.

An online course management system was used which allowed students to download lecture materials, obtain model answers and view marks awarded for previously submitted assignments.

The preliminary results and findings of this study are presented in this paper and may be used in part to answer the following questions:

- Is the student's level of attendance, an indicator of how they will perform in their continuous assessment?
- Does the scheduling of weekly lectures and bi-weekly laboratory classes have an effect on the student's performance?
- How does a student's performance in a laboratory assignment compare with their performance in an invigilated laboratory exam?

Keywords: continuous assessment.

1 INTRODUCTION

The role of assessment as a means of gauging students' level of engagement with course content is well documented [1] [2]. The quantitative data representing student attendance and assessment used in this paper comes from two Level 7 Bachelor of Engineering Technology programmes offered in the College of Engineering and Built Environment at Dublin Institute of Technology (DIT). The data analysed covers three academic years (2009-10, 2010-11 and 2011-12). Both groups being studied undertook modules where a significant portion of the module content dealt with numerical methods and their implementation in a spreadsheet environment.

Engineering Computing (MECH 2006) is a second year module from the Level 7 Bachelor of Engineering Technology degree in Mechanical Engineering. The module is divided into two thirteen-week semesters and delivered over the full academic year. This paper uses data from the first semester of the module. Engineering Maths and Computing V (OMAT 3010) is a third year module from the Level 7 Bachelor of Engineering Technology degree in Civil Engineering. The module is delivered over a thirteen-week period in semester one of the academic year. This paper uses data from the computing component of this module. Both modules tap into the self-learning capacity of the student being assessed where an understanding of the material covered is encouraged rather than the ability to rote memorise and regurgitate information.

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The virtual learning environment WebCT (Blackboard Learning System) was used to manage course documents and allow students to download lecture and laboratory handouts as well as the uploading of assignments. A sample practical examination was also available for reference. Feedback, in the form of model answers, was made available through WebCT once the submission date for an assignment had passed. Marks for assignments were also posted so students could keep track of their progress.

For Irish students the standard route for entry to both programmes is through the Central Applications Office (CAO) with successful candidates gaining entry once they reach the minimum points level for the programme in a particular year. A student is awarded points based on their performance in a senior state examination known as the Leaving Certificate (LC) which takes place in the final year of secondary school in Ireland. Points are awarded for the six examinations where the student performs best. TABLE 1 summarises the educational attainment of students at entry to both modules based on their LC points and the number who gained entry to both courses.

TABLE 1: SUMMARY OF EDUCATIONAL ATTAINMENT[1] AND NUMBER OF STUDENTS REGISTERED.

	MECH 2006		OMAT 3010	
Year	**Final Points at Entry**	**Number of Students**	**Final Points at Entry**	**Number of Students**
2011-2012	305 (395)	67	260 (385)	48
2010-2011	315 (405)	76	360 (435)	45
2009-2010	330 (400)	79	390 (455)	48

Note: Values given in brackets are median points (out of 600) at entry to first year of the given programme.

Correlation analysis (Pearson's correlation, r) was used to examine the relationship between attendance (lectures and laboratories) and performance (laboratory assignment and practical exam). Scheduling of lectures and laboratories, specifically where lectures were held weekly and laboratory session's bi-weekly was investigated to determine if it was a factor which could affect a student's performance. This may be particularly prevalent where attendance is optional as students may opt not to attend the lecture if they are not scheduled for a laboratory on the same day. Comparison of the students' performance in laboratory assignments with performance in an unseen time-constrained practical exam as well as the effect of lecture/laboratory scheduling was carried out by analysing a single topic common to both modules, numerical differentiation (ND). The rationale for choosing ND was that both cohorts of students would already have covered differentiation in other modules and therefore would have prior knowledge of the mathematical principles involved.

2 LITERATURE REVIEW

Attendance: Attendance may be viewed as one marker of student engagement with a programme of study [3]. The role of attendance and its effect on student performance in engineering courses is documented by a number of authors. Purcell [4] used lecture attendance among second and third year students in the Civil Engineering programme at University College Dublin (UCD) to investigate if there was a relationship between lecture attendance and examination performance. The results of this study indicate that there was direct relationship with each 10% increase in lecture attendance corresponding to a 3% improvement in examination performance. Attendance among second, third and fourth year students across four modules at the School of Mechanical and Manufacturing Engineering in Dublin City University (DCU) was recorded by Naher et al. [5]. Student performance in continuous assessment and their final overall performance were compared with their attendance to see if it influenced their overall result. The results of this study indicates a direct link between attendance and the marks awarded with higher attendance being associated with higher grades. O'Dwyer [3] examined lecture attendance and examination performance over a four year period among first year Level 7 Electrical Engineering students at the School of Electrical Engineering Systems in DIT and established that there was a statistically significant weakly positive correlation between lecture

[1] Source: http://www.cao.ie/index.php?page=points

attendance and examination performance. Results from this study indicate that with each 10% increase in student attendance at lectures a corresponding increase of approximately 3% in exam performance may be achieved. These findings are similar to those made by Purcell [4].

Scheduling: In order for an assessment to be effective and efficient it must be designed in such a way that student learning is supported. With engineering courses the traditional methods of instruction are through lectures, tutorials and laboratories. Scheduling of lectures and laboratories can have an effect on student performance especially where attendance is optional. Mandatory or optional attendance is a topic discussed by a number of authors who have found that regular attendance results in better performance [6], [7]. In a study by Shimoff et al. [8] it is observed that the recording of attendance was a factor in improving student performance in examinations even though no course credit was awarded for attendance. However, Lockwood et al. [9] proposes that the mandatory recording of attendance may not be the only factor in improving performance but other factors such as student motivation, interest and aptitude may also have an effect.

Performance: The role of coursework assignments and the effectiveness of feedback are key elements which determine the conditions under which assessment supports student learning [10]. Student engagement with course content and their overall result can be affected by a number of factors. For example, assessment can be used as a factor in motivating students by encouraging them to learn. Assessing the performance of students can be considered one of the most important things a teacher or lecturer can do for their students and it can have a profound effect on their learning [9]. Assessment of students is carried out for many reasons; “to motivate students, to encourage activity, to provide guidance and feedback for remediation, grading and selection” [12]. According to Brown et al. [13], assessment consists, essentially, of taking a sample of what students do, making inferences and estimating the worth of their actions. Trotter [11] identified three main purposes of assessment; feedback, motivation and student learning. Feedback can take different forms from model answers to verbal comments. There is little empirical information to identify the best form of feedback [14] but it is generally accepted that the more feedback a student receives, irrespective of its form, the greater the opportunity exists to learn from such feedback. One way to ensure regular feedback is to set assignments at timely intervals and mark them promptly. Provision of model answers, while not suitable for all assessment types, has many advantages and may meet the criteria for effective feedback for a number of reasons [14]:

- Model answers can be given much more quickly than individual comments, hence speeding up feedback.
- Model answers do not involve personal comments from the tutor, hence avoiding the dangers of negative feedback.
- Model answers require some active engagement of the student with the feedback; the student needs to read his/her own work and compare it with the answers given.
- Model answers can (and should) be explicitly linked to marking criteria, hence making a clear demonstration of standards required.

The provision of model answers should encourage the student to partake in a self-reflective cycle of observation, reflection, planning and action in a similar way to that described by Kolb [15].

3 METHODOLOGY

Both semester one of MECH 2006 and the computing component of OMAT 3010 contain broadly similar topics differentiated primarily by discipline specific examples. Students from MECH 2006 and OMAT 3010 are required to attend a one-hour lecture each week where module content is introduced and discussed. A two-hour computer laboratory follows where students can reflect on the material presented and work on laboratory assignments. For the laboratory portion of the module, students are divided into two randomly selected groups (referred to as A and B in TABLE 2) with each group attending the laboratory portion on alternate weeks. The split in marks between laboratory assignments and the practical examination is 50:50 with each element being examined as follows:

- *Laboratory assignments:* Students are required to complete laboratory assignments and submit them within a specified period of time, typically two weeks. Assignment tasks are typically of the same style and standard as practical exam questions.
- *Practical laboratory examination:* Students are required to take an unseen time-constrained examination at the end of the semester where two out of three questions relating to module content are to be attempted.

TABLE 2 summarises the typical scheduling for ND as it is delivered to both MECH 2006 and OMAT 3010. A '*Yes*' indicates the time at which a particular group is scheduled to attend while a check mark ✓ indicates that an assignment was submitted and graded. A description of the three scenarios follows.

TABLE 2: TYPICAL SCHEDULING OF LECTURES AND LABORATORIES FOR THE TOPIC BEING INVESTIGATED.

	Lecture	**Laboratory**				**Laboratory Exam**			
	Week 3	**Week 3**	**Week 4**	**Mark**		**Week 12**	**Week 13**	**Mark**	
	A + B	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Scenario 1	*Yes*	*Yes*		✓		*Yes*		✓	
Scenario 2	*Yes*		*Yes*		✓		*Yes*		✓
Scenario 3				✓	✓			✓	✓

Note: A refers to group A and B refers to group B

- Scenario 1: Group A
  - Student attends the lecture where ND is introduced i.e. week 3.
  - Student attends the laboratory on the same day as the lecture on ND i.e. week 3.
  - Student sits the laboratory exam on their allocated week, i.e. week 12 for group A, and attempts the question on ND.
- Scenario 2: Group B
  - Student attends the lecture where ND is introduced i.e. week 3.
  - Student attends the laboratory on the week following the lecture on ND i.e. Week 4.
  - Student sits the laboratory exam on their allocated week, i.e. week 13, and attempts the question on ND.
- *Scenario 3:* All Students
  - Includes all students who submitted the ND laboratory assignment and attempted the ND question on the exam.
  - Student attendance at either the lecture or laboratory is not considered for this scenario.

Attendance, while not compulsory, was recorded at lectures and laboratories using an attendance sheet which was signed by the student. Students were made aware from the start that the purpose of taking attendance was for attendance tracking purposes only and no course credit was associated.

FIG. 1 illustrates the typical steps involved in module content delivery; Step 1: Introduction to basic concepts, Step 2: Numerical formulation and Step 3: Implementation and solution in a spreadsheet. All numerical formulations such as those listed in FIG. 1 (i.e. equations eq. 1 to eq. 6) are provided to the student in the form of a handout of additional information as an understanding of the numerical techniques and their implementation is encouraged rather than rote memorisation of formulas.

Step 1: Introduction to Basic Concepts

Differentiation is the rate of change of a dependent variable with respect to an independent variable. A simple approximation of the first derivative may be described as follows:

$$\frac{dy}{dx} = \lim_{\Delta x \to 0} \frac{f(x_i + \Delta x) - f(x_i)}{\Delta x}$$

Almost all physical processes/phenomena may be described using differential calculus, for example

- Newton's 2nd Law: $F = \left(\frac{dv}{dt}\right) m$
- Heat Conduction: $Heat\ Flux = -kA\left(\frac{dT}{dx}\right)$

Algebraic approximations of derivatives are used to calculate approximate values from data sets. Three methods are commonly used; *backward*, *central* and *forward* difference methods.

Step 2: Numerical Formulation e.g. Derivative Approximations using Difference Methods

	First Derivative	
Forward	**Central**	**Backward**
$\left.\frac{dy}{dx}\right\|_i \approx \frac{y_{i+1} - y_i}{x_{i+1} - x_i}$ eq. 1	$\left.\frac{dy}{dx}\right\|_i \approx \frac{y_{i+1} - y_{i-1}}{x_{i+1} - x_{i-1}}$ eq. 2	$\left.\frac{dy}{dx}\right\|_i \approx \frac{y_i - y_{i-1}}{x_i - x_{i-1}}$ eq. 3

	Second Derivative	
Forward	**Central**	**Backward**
$\left.\frac{d^2y}{dx^2}\right\|_i \approx \frac{y_{i+2} - 2y_{i+1} + y_i}{(\Delta x)^2}$ eq. 4	$\left.\frac{d^2y}{dx^2}\right\|_i \approx \frac{y_{i+1} - 2y_i + y_{i-1}}{(\Delta x)^2}$ eq. 5	$\left.\frac{d^2y}{dx^2}\right\|_i \approx \frac{y_i - 2y_{i-1} + y_{i-2}}{(\Delta x)^2}$ eq. 6

Step 3: Implementation and Solution in a Spreadsheet

Given the values of time and distance determine the velocity ($\bar{v}$) and acceleration ($\bar{a}$) at point 6 using numerical techniques may be obtained. The screenshot below illustrates how this may be implemented in a worksheet using the numerical formulations listed in step 2.

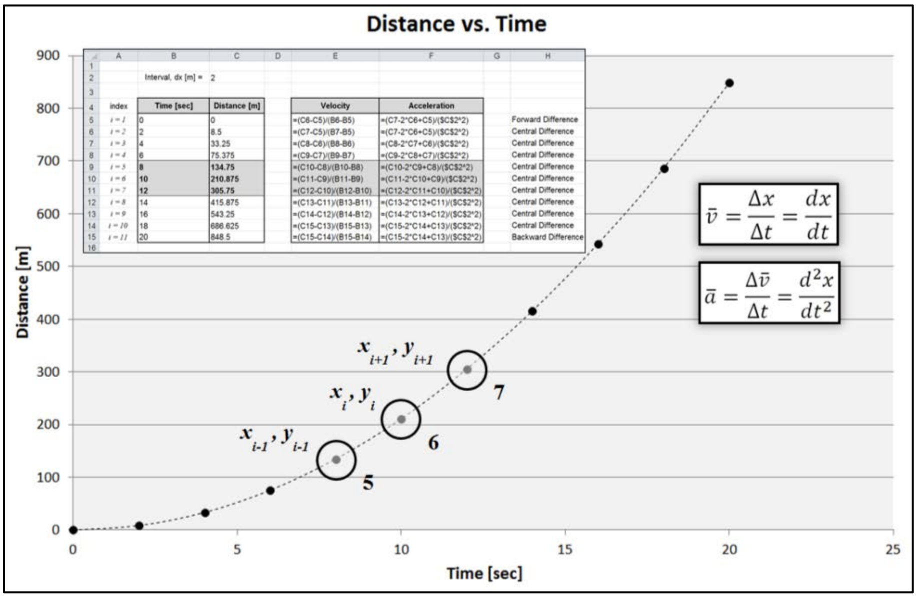


FIGURE 1: TYPICAL STEPS INVOLVED FROM THE INTRODUCTION OF A TOPIC TO EXAMINATION.

Numerous examples of the application of numerical methods in a spreadsheet environment may be found in numerous texts aimed at undergraduate engineering students [16] [17] [18].

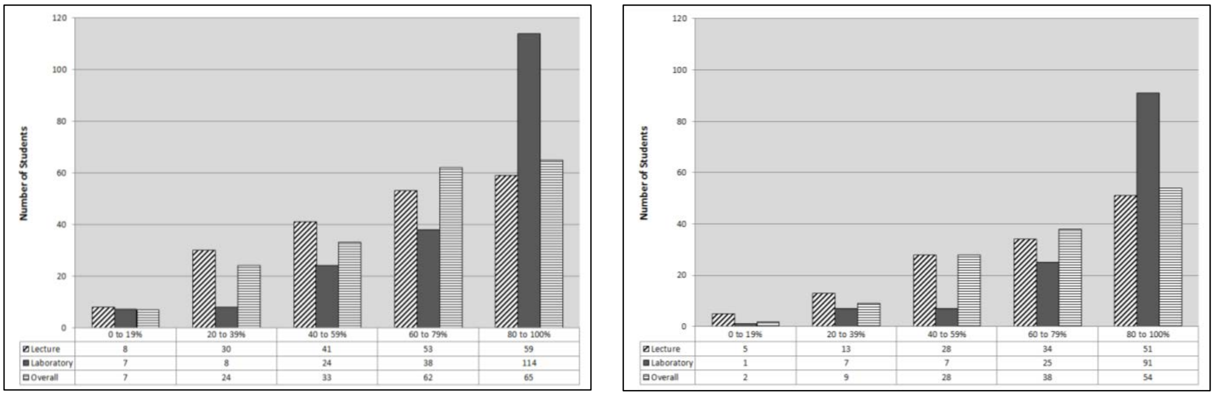
4 RESULTS

Attendance: For MECH 2006 students (n = 191) the overall attendance, on average, was 67.0 ± 1.7% for the study period (2009-2012). Attendance at laboratories (74.1 ± 1.8%) was greater than that at lectures (60.1 ± 1.8%). For OMAT 3010 students (n = 131) the overall attendance, on average, was 72.5 ± 1.9% for the same study period. Attendance at laboratories (80.1 ± 2.0%) was greater than that at lectures (67.7 ± 2.2%). A summary of the overall mean attendance for the three years of the study are summarised in TABLE 3.

TABLE 3: SUMMARY OF MEAN ATTENDANCE.

	MECH 2006		OMAT 3010	
Year	**Lecture**	**Laboratory**	**Lecture**	**Laboratory**
2011-2012	73.6 ± 2.8%, n = 59	78.6 ± 2.7%, n = 59	66.7 ± 4.3%, n = 45	84.4 ± 3.5%, n = 45
2010-2011	61.1 ± 2.6%, n = 66	74.5 ± 2.7%, n = 66	68.3 ± 4.0%, n = 45	69.3 ± 3.8%, n = 45
2009-2010	48.2 ± 3.2%, n = 66	69.7 ± 3.5%, n = 66	68.3 ± 3.2%, n = 41	88.8 ± 2.4%, n = 41

FIG. 2 quantifies the number of students, in intervals of 20%, who attended and is presented in terms of overall, lecture and laboratory attendances for both groups over the study period (2009-2012).



(a) MECH 2006 - Breakdown of attendance. (b) OMAT 3010 - Breakdown of attendance.

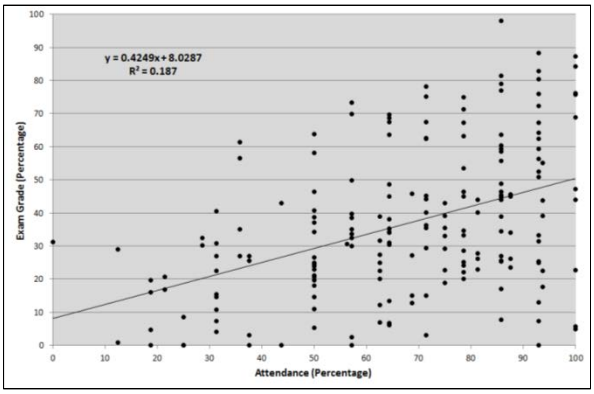
FIGURE 2: BREAKDOWN OF STUDENT ATTENDANCE FOR THE STUDY PERIOD 2009-12.

Performance (Overall): The overall grade for MECH 2006 students (n = 191) was, on average, 39.0 ± 1.4% for the study period (2009-2012). The overall laboratory grade (42.0 ± 1.7%) was greater than that for the end of semester practical exam (37.0 ± 1.6%). For OMAT 3010 students (n = 131) the overall grade, on average, was 63.2 ± 1.5% for the study period (2009-2012). The overall laboratory grade (69.1 ± 1.5%) was greater than that for the end of semester practical exam (59.6 ± 2.0%). A summary of student grades for the study period are given in TABLE 4.

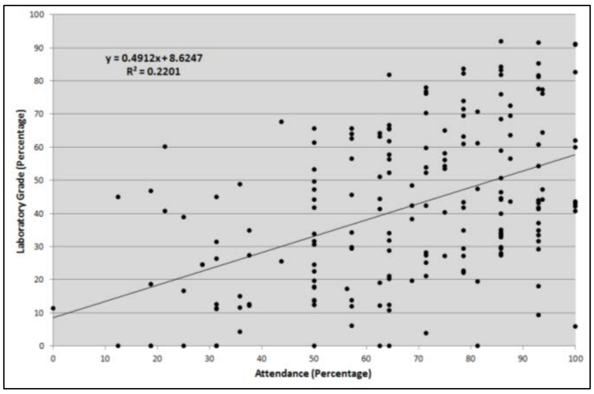
TABLE 4: SUMMARY OF MEAN MARKS AWARDED TO STUDENTS.

	MECH 2006		OMAT 3010	
Year	**Exam**	**Laboratory**	**Exam**	**Laboratory**
2011-2012	35.8 ± 3.1%, n = 59	28.7 ± 1.8%, n = 59	53.4 ± 3.7%, n = 45	67.7 ± 2.9%, n = 45
2010-2011	50.4 ± 2.5%, n = 66	59.8 ± 2.6%, n = 66	54.4 ± 3.1%, n = 45	77.9 ± 1.4%, n = 45
2009-2010	23.2 ± 1.7%, n = 66	34.8 ± 2.8%, n = 66	72.0 ± 2.7%, n = 41	61.1 ± 2.6%, n = 41

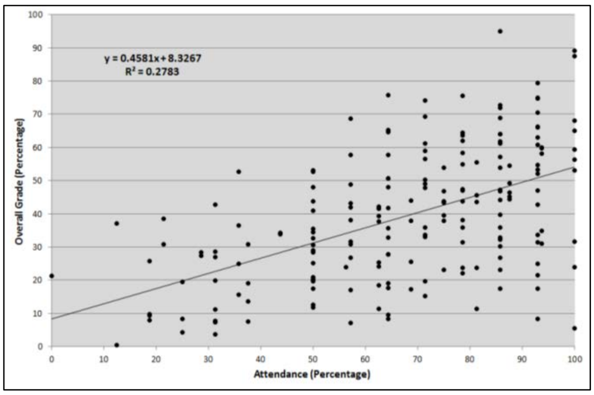
The relationships between overall attendance and marks for the laboratory assignments, practical exam and the overall mark for MECH 2006 (n = 191) and OMAT 3010 (n = 131) are shown in FIG. 3 and FIG. 4. Exam grades correlated positively with attendance for MECH 2006 (r = 0.4324, P < 0.0001) and OMAT 3010 (r = 0.4890, P < 0.0001). Similarly, laboratory grades correlated positively with attendance for MECH 2006 (r = 0.4691, P < 0.0001) and OMAT 3010 (r = 0.4368, P < 0.0001). Overall grades correlated positively with attendance for both MECH 2006 (r = 0.5275, P < 0.0001) and OMAT 3010 (r = 0.5043, P < 0.0001).



(a) RELATIONSHIP BETWEEN EXAM GRADE AND ATTENDANCE.

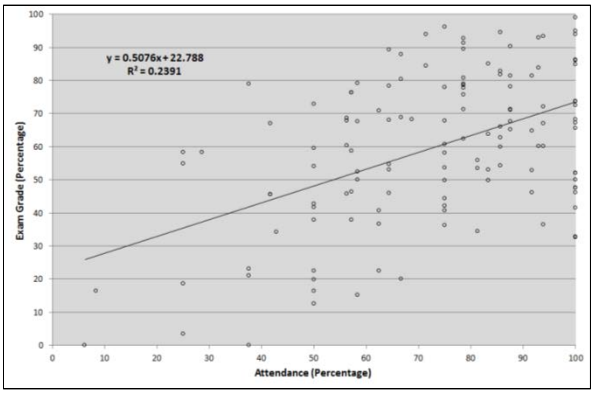


(b) RELATIONSHIP BETWEEN LABORATORY GRADE AND ATTENDANCE.

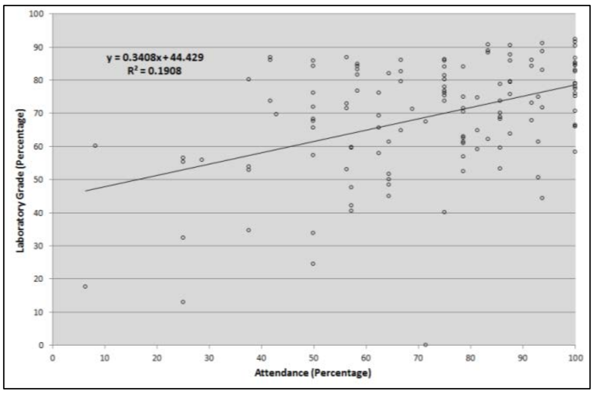


(c) RELATIONSHIP BETWEEN OVERALL GRADE AND ATTENDANCE.

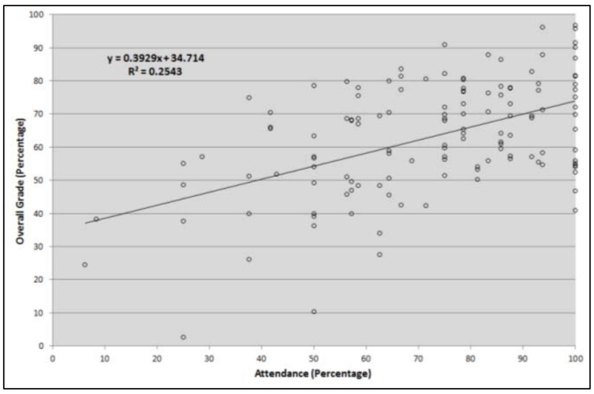
FIGURE 3: RELATIONSHIP BETWEEN GRADES AND ATTENDANCE (n = 191) FOR MECH 2006 (2009-2012).



(a) RELATIONSHIP BETWEEN EXAM GRADE AND ATTENDANCE.



(b) RELATIONSHIP BETWEEN LABORATORY GRADE AND ATTENDANCE.



(c) RELATIONSHIP BETWEEN OVERALL GRADE AND ATTENDANCE.

FIGURE 4: RELATIONSHIP BETWEEN GRADES AND ATTENDANCE (n = 131) FOR OMAT 3010 (2009-2012).

Performance (laboratory vs. examination): The figures used for student numbers (listed in TABLE 5 and TABLE 6) are based on the number of students who submitted at least one piece of coursework during the semester. This figure was used as it was considered a better indicator of actively engaged students. Consequently, the figures quoted may differ slightly from the actual number of registered students. The number of students officially registered (based on Electronic Gradebook) is given in brackets. The '% Attempt' value is the number of students who attempted the ND laboratory assignment ('Lab.' column) and those who attempted the ND question on the practical exam ('Exam' column).

TABLE 5: SUMMARY DETAILS FOR MECH 2006 (2009-2011).

		% Attempt		Mean Mark		St. Dev.		Max (Min) Mark	
Year	**Number of Students**	**Lab**	**Exam**	**Lab /10**	**Exam /10**	**Lab**	**Exam**	**Lab /10**	**Exam /10**
2011-2012	60 (67)	83.8%	60.0%	6.8	3.4	1.8	3.3	9.4 (1.8)	9.8 (0.3)
2010-2011	66 (76)	92.4%	98.5%	7.6	4.1	1.5	2.7	10.0 (2.8)	10.0 (2.8)
2009-2010	70 (79)	54.3%	61.4%	4.9	4.9	1.9	2.7	8.7 (0.8)	8.7 (0.8)

TABLE 6: SUMMARY DETAILS FOR OMAT 3010 (2009-2011).

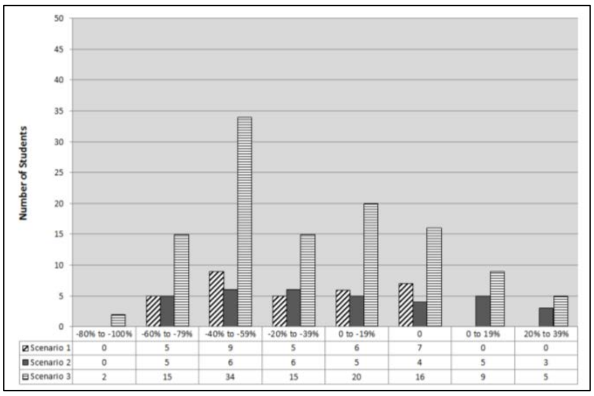
		% Attempt		Mean Mark		St. Dev.		Max (Min) Mark	
Year	**Number of Students**	**Lab**	**Exam**	**Lab /10**	**Exam /10**	**Lab**	**Exam**	**Lab /10**	**Exam /10**
2011-2012	46 (48)	84.8%	82.6%	8.2	6.2	1.4	3.0	9.9 (3.6)	9.6 (0.0)
2010-2011	45 (45)	97.8%	95.6%	8.5	6.9	1.0	2.4	9.9 (4.4)	9.6 (1.3)
2009-2010	44 (48)	90.9%	86.4%	8.4	7.4	1.4	2.0	9.9 (1.6)	9.9 (1.4)

For comparison of performance in ND, the difference between the laboratory mark and the examination mark was calculated. The values presented in TABLE 7 give the reduction in mark expressed as a percentage of the total mark, between the laboratory and examination. A negative value indicates that the student mark in the exam was less than that scored in the laboratory assignment by the given percentage i.e. student performance deteriorated, in most cases, from the laboratory assignment to the practical examination.

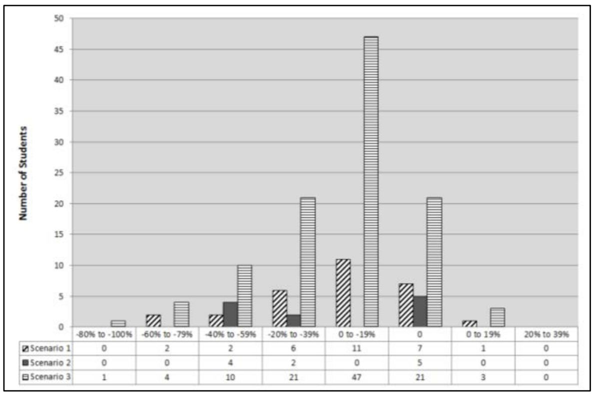
TABLE 7: PERCENTAGE DIFFERENCE IN STUDENT PERFORMANCE BETWEEN LABORATORY AND EXAM.

	Scenario 1		Scenario 2		Scenario 3	
Year	**MECH 2006**	**OMAT 3010**	**MECH 2006**	**OMAT 3010**	**MECH 2006**	**OMAT 3010**
2011-2012	-33.2 ± 9.1% n = 10	-15.1 ± 6.8% n = 9	-35.2 ± 9.6% n = 11	-28.5 ± 11.8% n = 5	-31.8 ± 5.8% n = 30	-24.0 ± 3.5% n = 34
2010-2011	-31.6 ± 6.8% n = 17	-6.8 ± 4.3% n = 9	-31.9 ± 6.1% n = 12	-11.1 ± 16.6% n = 3	-36.3 ± 3.5% n = 58	-12.0 ± 2.8% n = 39
2009-2010	-8.9 ± 4.6% n = 5	-19.2 ± 8.7% n = 11	+16.2 ± 9.2% n = 11	-11.1 ± 16.6% n = 3	+2.6 ± 6.1% n = 28	-10.2 ± 3.7% n = 34

FIG. 5 quantifies the number of students, in 20% intervals, based on the three scenarios investigated.



(a) MECH 2006



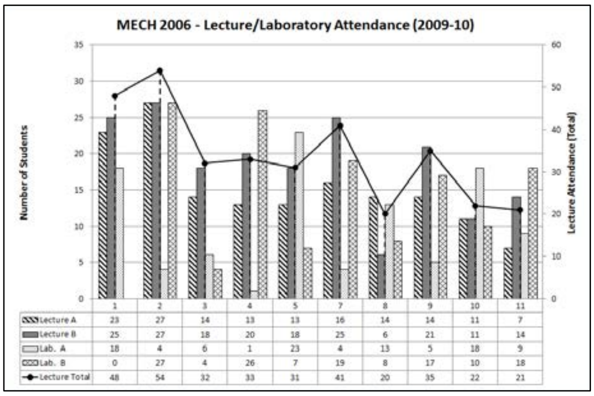
(b) OMAT 3010

FIGURE 5: PERCENTAGE DIFFERENCE BETWEEN LABORATORY AND EXAM MARKS (2009-12).

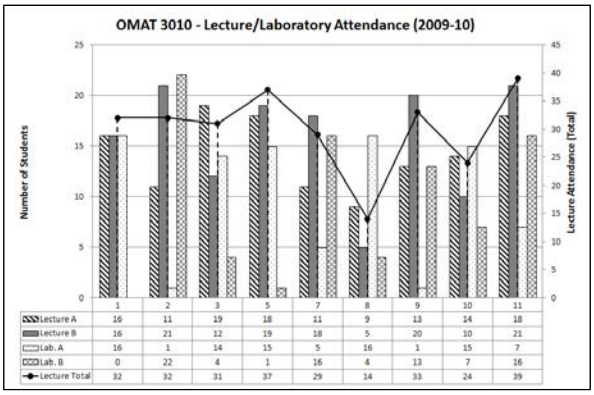
The following observations are made when comparing the laboratory and examination mark for ND.

- *Scenario 1:* MECH 2006 students recorded a higher reduction (-28.6 ± 4.8%, n = 32) in mark than OMAT 3010 students (-14.1 ± 4.1%, n = 29).
- *Scenario 2:* MECH 2006 students recorded a lower reduction (-17.4 ± 6.2%, n = 34) in mark than OMAT 3010 students (-19.0 ± 7.9%, n = 11).
- *Scenario 3:* MECH 2006 students recorded a higher reduction (-25.7 ± 3.1%, n = 116) in mark than OMAT 3010 students (-15.2 ± 2.0%, n = 107).

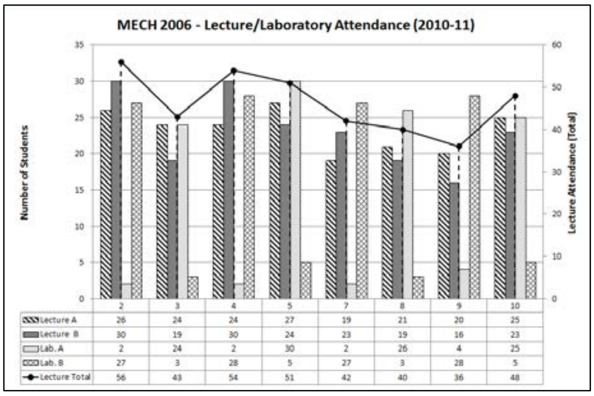
Scheduling: For both cohorts of students, lectures were held weekly and laboratories bi-weekly with each group attending a laboratory on alternate weeks. FIG. 6 (MECH 2006) and FIG. 7 (OMAT 3010) summarise how students attended week-to-week, where attendance was recorded, and is broken down according to their group allocation. It can be observed that a small number of students appear to chosen to attend only on the weeks where they had a laboratory. A more in-depth investigation of this pattern may form the basis of a future study.



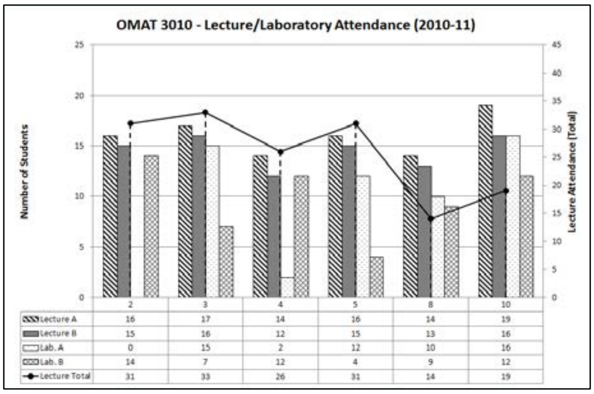
(a) LECTURE/LABORATORY ATTENDANCE 2009-10.



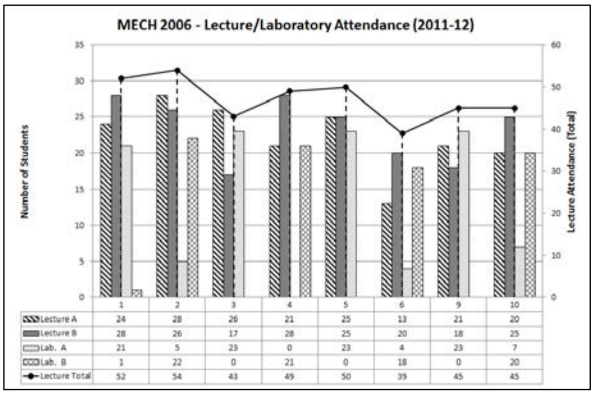
(a) LECTURE/LABORATORY ATTENDANCE 2009-10.



(b) LECTURE/LABORATORY ATTENDANCE 2010-11.

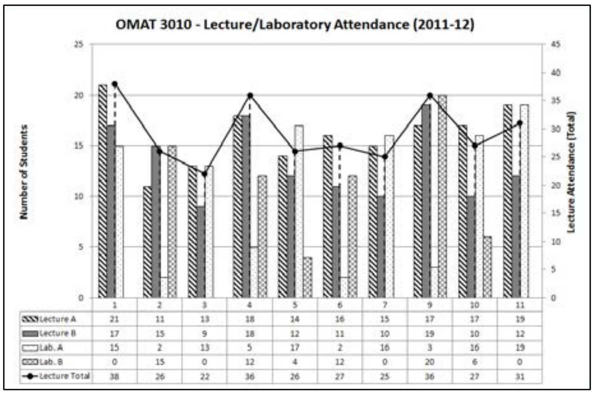


(b) LECTURE/LABORATORY ATTENDANCE 2010-11.



(c) LECTURE/LABORATORY ATTENDANCE 2011-12.

FIGURE 6: LECTURE/LABORATORY ATTENDANCE.



(c) LECTURE/LABORATORY ATTENDANCE 2011-12.

FIGURE 7: LECTURE/LABORATORY ATTENDANCE.

TABLE 8 summarises the attendance at the end-of-semester practical exam for both MECH 2006 and OMAT 3010. The figure given in brackets represents the number of students from the other group who sat the practical exam out of sequence.

TABLE 8: Summary of attendance at practical exam.

	MECH 2006		OMAT 3010	
	A	B	A	B
2011-2012	28 (0)	34 (4)	43 (0)	---
2010-2011	22 (2)	36 (7)	20 (2)	25 (4)
2009-2010	26 (2)	33 (4)	20 (0)	24 (0)

Note: In 2011-2012 OMAT 3010 groups A and B were combined for the laboratory assessment.

5 DISCUSSION AND CONCLUSION

Attendance: Overall attendance for OMAT 3010 students was 5.5% higher than MECH 2006 students for the three years 2009-2012. For each year of the study (TABLE 3) it was observed that attendance at laboratories was higher. The higher level of attendance by OMAT 3010 may be attributed to its delivery in year three (award year) of the programme and the contribution of the final module mark to the overall grade of the student and consequently their award classification for both groups. The issuing of laboratory assignments on a regular basis may also account for the higher attendance rates at laboratories when compared to lectures. It is possible that the availability of lecture notes on-line following the lecture results in a number of students not attending lectures on the weeks that they are not scheduled for laboratories (FIG. 6 and FIG. 7).

Scheduling: When comparing the marks for the ND laboratory with the marks of those who attempted the ND question on the exam, it can be observed that, for those who satisfied the conditions for scenario 1, OMAT 3010 students performed better than their MECH 2006 cohorts by an average of 14.5%. For scenario 2, MECH 2006 students performed slightly better than their OMAT 3010 cohorts. When all students are taken into account in scenario 3, OMAT 3010 students performed, on average, 10.5% better than their MECH 2006 cohorts. The only increase in performance from the laboratory to the examination was by MECH 2006 (2009-2010) for both scenario 1 and scenario 2 where +16.2% was recorded for scenario 2 and +2.6% for scenario 3.

Performance: The overall performance of both cohorts differed considerably. While the difference in previous academic attainment was, on average 25 points (400 for MECH 2006 and 425 for OMAT 3010) from the median points listed in TABLE 1, OMAT 3010 with a mean mark of 63% performed considerably better that MECH 2006 whose mean mark was 39%. From attendance figures, it is clear that students who attended more regularly and engaged more with the assessment process performed better than those who did not. A statistically significant weak to moderate positive correlation between attendance (lecture and laboratory) and performance (laboratory assignments and practical exam) was established with correlation coefficients varying between 0.43-0.53 for MECH 2006 and 0.44-0.50 for OMAT 3010. For the study period, 2009-2012, the best fit equation for MECH 2006 ($y = 0.4581x + 8.3267$) indicates that for each 10% increase in attendance, on average, an improvement of approximately 4.6% in performance would be achieved. The best fit equation for OMAT 3010 ($y = 0.3929x + 34.714$) indicates that each 10% increase in attendance would result, on average, in approximately 3.9% improvement in performance. These figures are slightly higher than those from broadly similar studies [3] [4].

Conclusion: From the results obtained, it is observed that a relationship exists between attendance and performance and, in general, those who attended more performed better. From a scheduling perspective, an unexpected finding was observed in the case of MECH 2006 (2009-2012) where those taking the laboratory and lecture on the same day performed worse (-28.6%) than those who did the laboratory on the following week (-17.4%). For OMAT 3010 the difference was 4.9% in favour of those who did the lecture and laboratory on the same day (-14.1% to -19.0%). A further study, with all module topics analysed, may provide a greater insight into the effect of scheduling. Performance in the laboratory examination was poorer than that in the laboratory assignments (MECH 2006, -5%; OMAT 3010, -9%). Overall, students in the award year (OMAT 3010), based on attendance and performance, were more engaged in the assessment process than their cohorts in year two (MECH 2006).

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