MAURITIUS RESEARCH COUNCIL

FACTORS AFFECTING PERFORMANCES OF FIRST-YEAR STUDENTS IN ONLINE COURSES

Final Report

June 2016

MAURITIUS RESEARCH COUNCIL

Address:

Level 6, Ebène Heights,
34, Cybercity,
Ebène 72201,
Mauritius.

Telephone: (230) 465 1235
Fax: (230) 465 1239
Email: mrc@intnet.mu
Website: www.mrc.org.mu

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FACTORS AFFECTING PERFORMANCES OF FIRST-YEAR STUDENTS IN ONLINE COURSES

MRC - funded Project

FINAL REPORT

Principal Investigator

Assoc Prof (Dr) Mohammad Issack Santally

Officer in Charge, Centre for Innovative & Lifelong Learning

Team Members

Assoc Prof (Dr) Ravindra Boojhawon, Mrs Dorothy Cooshna-Naik, Mr Kevin Sungkur, Ms Yousra Rajabalee

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BACKGROUND AND RESEARCH QUESTIONS

At the University of Mauritius, the Diploma in Web and Multimedia development is offered to secondary school leavers using the online mode of delivery through the e-learning platform @ http://ilearn.uom.ac.mu/. Two modules in the first year are however offered on a face-to-face basis given that they form the core of the subject area. The course is offered on a full-time basis over a period of 2 years. The modules follow a yearly structure and are of 6 credits each. This means that exams for one module are normally held at the end of an academic year. However, throughout the year, there are a number of assignments, and practicals that students have to hand over as part of the continuous assessment of the course.

In 2012, about 120 students were enrolled on the first year of the programme. In August 2013, a new cohort of 160 students joined in the first year of the programme. After the first year exams (for the 2012 cohort) about 30 % of the overall student population either had at least one re-sits, have to repeat the year or have been terminated from the course. There have been sporadic claims especially from a few students who fall in the 30% that the online mode of delivery was to their disadvantage (despite knowing that the course was offered on DEOL mode prior to registration). Given that the number of students is steadily increasing due to the policy of opening access to tertiary education, there are a number of factors that can be contributing to the problem mentioned.

These can be linked to the quality of HSC results, hence the students' academic ability, the mode of delivery, the assessment modalities, the courseware design and other factors such as students' commitment to the course and participation in mandatory learning activities like assignments, and presentations. It is therefore important to find the major causes of failures and whether the new modality of online learning is the main cause of student's lack of success. There is also a need to probe into the current pedagogical practices and student support framework to identify any shortcomings that need to be addressed for future improvements.

The main research questions based on the specific objectives of the project are as follows:

- Is there a correlation between HSC grades of first year students and their performances in online modules?
- Is there a significant difference between the performances of students in the online modules when compared to modules offered on a face-to-face mode?
- Is there a correlation between student engagement in an online module and the performances of the student?

LITERATURE REVIEW

ICTs have revolutionized both the traditional classroom teaching and the distance education concept. The advances in educational technology have helped to enhance learners' learning process, through self-paced learning environments where they can exert a better control over their learning (Jung, 2001). There are certain perceived advantages behind the reason to why it is better to opt for online learning. These include, but not limited to factors such as an increase in potential learners, learner accessibility, learner effectiveness, platform independence, learning flexibility and administrative support respectively (Olson & Wisher, 2002). However, there are debatable issues relating to the effectiveness of online instruction. Previous research has reported that learners found that online instructions sometimes fail to meet their learning needs. These might be in terms of instructional effectiveness, ease of locating information on the platform, learner support or even the design layout of the online learning environment (HRC, 2009). These factors can lead to frustration and ultimately results in high dropout rates (Rodriguez, 2012).

Learning analytics is an emerging research method in education technology. It is based on the principle of educational data mining from all traces of student activity and data collected throughout their online activities to identify patterns and trends that can highlight potential issues and areas for improvement in terms of educational design, delivery and administration of student

learning. Learning analytics refers to the collection and compilation of data produced, which will then be used to assess the progress of learners, as well as, judge their performances. Assessing these learners might be in terms of different variables, such as their way of participating, their responses and their academic performances (Siemens, 2013). In an online learning environment, learning analytics can be applied by assessing and judging learners' performances in assignment submissions, in online test or quizzes, through their participation in discussion forums as well as their through reflective comments and feedbacks posted.

Numerous studies have compared both online and face-to-face courses. In a study (Gulacar, Damkaci, & Bowman, 2013), comparison was made for a chemistry course for non-majors which showed that there are significant differences at the lowest order of thinking, "remember", "thinking" and "understanding", with face-to-face students performing lower than online students. However, no significant differences were obtained at "analyze" level or while comparing topics covered in exams. This lead to the observation that online instruction promotes better memorization of facts and appears to be as effective as face-to-face instruction while teaching introductory topics.

Enrollment in online courses has considerably increased in the higher education sector. During a survey (Allen & Seaman, 2011) the rate of increase in online enrollment has slowed about 10%, but has still outpaced the overall growth in higher education enrollment of approximately 1%. Despite this trend, the study showed that fully one third of professors surveyed still believe that face-to-face education (F2F) is superior to online education in providing students quality instruction. This proportion has remained nearly constant since 2003 (Allen & Seaman, 2011).

In an early study on how effective is online education, (Piccoli *et al.*, 2001) found no significant differences in performance of students between face-to-face and online instruction. In fact, during the study, a virtual learning environment (VLE) was used for daily instruction, but held all course exams in person. However, students in the online sections of the course pointed out

that they have higher self-efficacy than did their face-to-face peers but online students reported lower satisfaction in the course in computers for business majors.

The effectiveness of online education has largely been investigated where different results have been obtained when comparing online and face-to-face courses. In a teacher education course, traditional, online, and classroom-in-a-box were compared and no significant difference in student performance was found between the three different delivery methods (Skylar, 2005). Student satisfaction was likewise shown to be roughly equal. However, in a Thai business statistics course, students in the online course were observed to perform significantly better than students in an equivalent F2F course (Suanpang, 2006).

Since 2009, the University of Mauritius has been running the Diploma in Web and Multimedia Development programme online. Two modules in the first year are however offered on a face-to-face basis. In 2013, the enrolment on the programme has climbed to 150. However, in 2012, it was noticed that many students were terminated in the first year, or had to repeat the year or had at least one re-sit module. The research will investigate into this problem to try to establish the main reasons through the learning analytics approach using educational data mining. Learning analytics refers to the collection and compilation of data produced, which will then be used to assess the progress of learners, as well as, judge their performances. Assessing these learners might be in terms of different variables, such as their way of participating, their responses and their academic background and performances.

Learning analytics will be the main research method to be adopted in the research. The pool of data is already available on the e-learning platform and on the student information system at the University. Students' personal data will be kept strictly confidential and the identities of the students will be kept anonymous throughout the study.

The findings will mainly be used to improve the current pedagogical model in use for the online programmes and to identify how the academic team can modify their current interaction model

with students to help them through the learning process. The results will also be helpful to all tertiary education providers in the country with respect to online education.

METHODOLOGY

An online learning platform tracks and stores a lot of data about students learning patterns and behaviors. The first activity therefore consisted of using data mining techniques to retrieve, order and put the available data in a structured format. Such data related to the students HSC grades, Performances in the Modules, their Cumulative Point Average and their learning interaction patterns on the eLearning platform.

The data to be used in this research would have implications regarding existing provisions under the data protection legislation. All data on the students were kept anonymous and their use was restricted only for the purpose of this specific research. With respect to data from interviews and focus group discussions, participants were invited to sign a consent form allowing the use of their feedback and views to contribute to the research. At no point, identities of the participants were revealed.

The second activity took the form of a survey with academics to get a feedback from the academic standpoint on the issues raised by students and on issues that academics report with respect to the students' engagement and participation in course activities.

The third activity related to the analysis of the data retrieved from the online learning platform and the student online system to identify any patterns and/or correlations as per the research questions. The data from the face-to-face modules were used as a control in the experiment. It was also be compared with the data available from the online modules to further test the hypotheses if needed.

The findings of the research was presented to the academic community of CILL including students in a mini-workshop to get feedback and to work on a set of best practice recommendations for online learning. These can be taken on board to be included in the student

charter of the university. The final activity would be to draft the final report that would be submitted to the MRC for wider dissemination of the research findings.

IBM's SPSS 20 was used to run the statistical tests (Field, 2009) which consists of mainly correlation analysis using Pearson's correlation coefficient, regression analysis and ANOVA (analysis of variance).

DATA ANALYSIS AND DISCUSSIONS

PARTICIPANTS

Our study focuses on five modules under two cohorts for two Academic Years 2013-14 (AY1) and 2014-15 (AY2): programming fundamentals (LLC1010Y), database design and development (LLC1030Y), visual communication and graphic design (LLC2010Y), dynamic scripting (LLC1090Y) and software development methodologies (LLC1020Y). The total number of students 111 and 123 for the AY1 and AY2 respectively. The cross-tables 1 & 2 present the details of the number of students registered. The modules LLC1010Y and LLC1030Y are face-to-face modules while the other three modules are online modules.

Courses * Modules * Academic Year Crosstabulation

Count

Academic Year			Modules					Total
			Programming Fundamentals (LLC1010Y)	Database Design and Development (LLC1030Y)	Visual_Communication & Graphic Design (LLC2010Y)	Dynamic Scripting (LLC1090Y)	Software Development Methodologies (LLC1020Y)	
Academic Year 2013-2014	Courses	Diploma in Web and Multimedia Development (LC201)	30		30	30	30	120
		Diploma/BSc in Web and Multimedia Development (LC302)	81		81	81	81	324
	Total		111		111	111	111	444
Academic Year 2014-2015	Courses	Diploma in Web and Multimedia Development (LC201)	23	23	23	23	23	115
		Diploma/BSc in Web and Multimedia Development (LC302)	100	100	100	100	100	500
	Total		123	123	123	123	123	615
Total	Courses	Diploma in Web and Multimedia Development (LC201)	53	23	53	53	53	235
		Diploma/BSc in Web and Multimedia Development (LC302)	181	100	181	181	181	824
	Total		234	123	234	234	234	1059

Table 1: Number of students as per courses versus modules.

Mode of delivery * Modules * Academic Year Crosstabulation

Count

Academic Year			Modules					Total
			Programming Fundamentals (LLC1010Y)	Database Design and Development (LLC1030Y)	Visual_Communication & Graphic Design (LLC2010Y)	Dynamic Scripting (LLC1090Y)	Software Development Methodologies (LLC1020Y)	
Academic Year 2013-2014	Mode of delivery	ONLINE	0		111	111	111	333
		FACE TO FACE	111		0	0	0	111
	Total		111		111	111	111	444
Academic Year 2014-2015	Mode of delivery	ONLINE	0	0	123	123	123	369
		FACE TO FACE	123	123	0	0	0	246
	Total		123	123	123	123	123	615
Total	Mode of delivery	ONLINE	0	0	234	234	234	702
		FACE TO FACE	234	123	0	0	0	357
	Total		234	123	234	234	234	1059

Table 2: Number of students as per mode of delivery and modules.

PERFORMANCES

USE OF MEDIAN AS CENTRAL MEASURE OF LOCATION

The marks obtained by students are compared module-wise, course-wise, academic year-wise and gender-wise as presented by the boxplots as shown in Figures 1-5. We initially use median as a method for comparison since it is neutral to outliers.

Figure 1 shows that performances are better in terms of median for LC302 compared to LC201 for all the modules except of LCM1030Y. Figure 2 shows the distribution of the performances cohort-wise. In terms of median values, Diploma/BSc in Web and Multimedia Development (LC302) cohorts perform slightly better than Diploma in Web and Multimedia Development (LC201) cohorts and also AY2 outperforms those of AY1.

Figures 3 and 5 show the distribution of the overall performances gender-wise. It is observed that we have a lot of outlier cases particularly for girls meaning that there is a small cluster for poor performing girls who perform around below 10 marks in total. Despite this, girls' performances are more consistent due to lesser variability and on average are slightly better than those of the boys.

From Figure 4 we note that boys perform better when using median for only the module visual communication and graphic design (LLC2010Y).

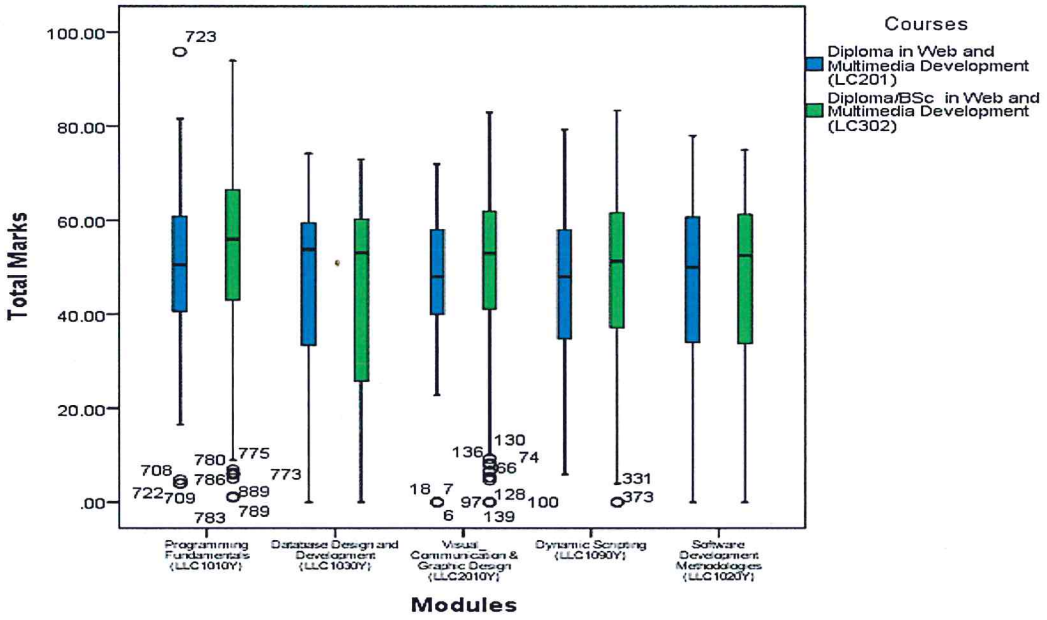

Figure 1: Boxplots for total marks per module and per courses.

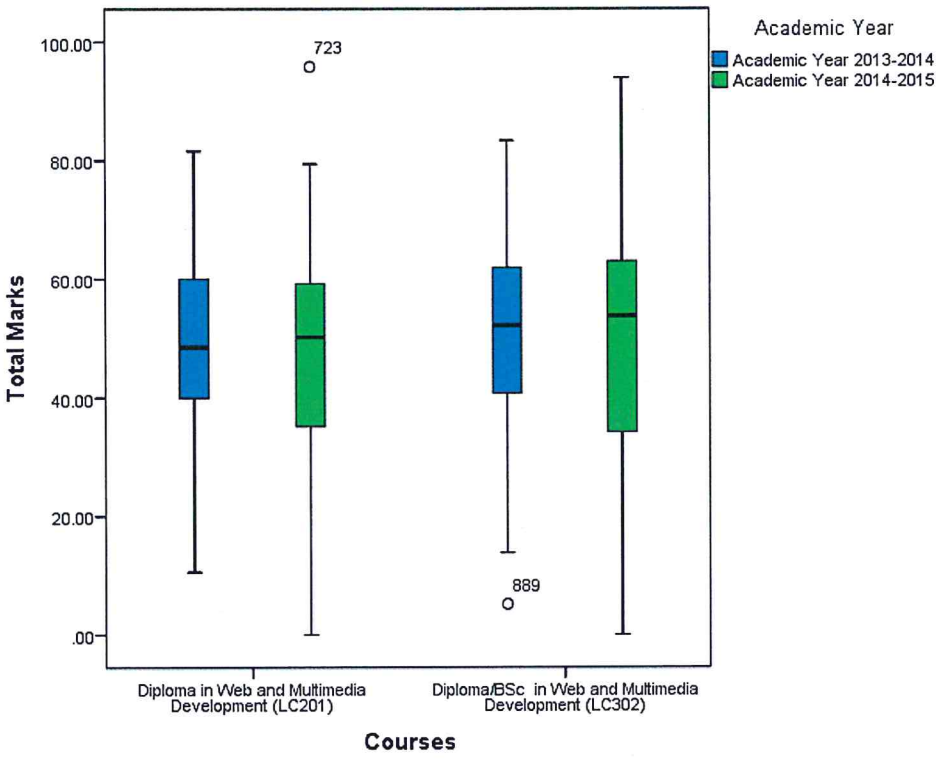

Figure 2: Boxplots for total marks per course and per Academic Year.

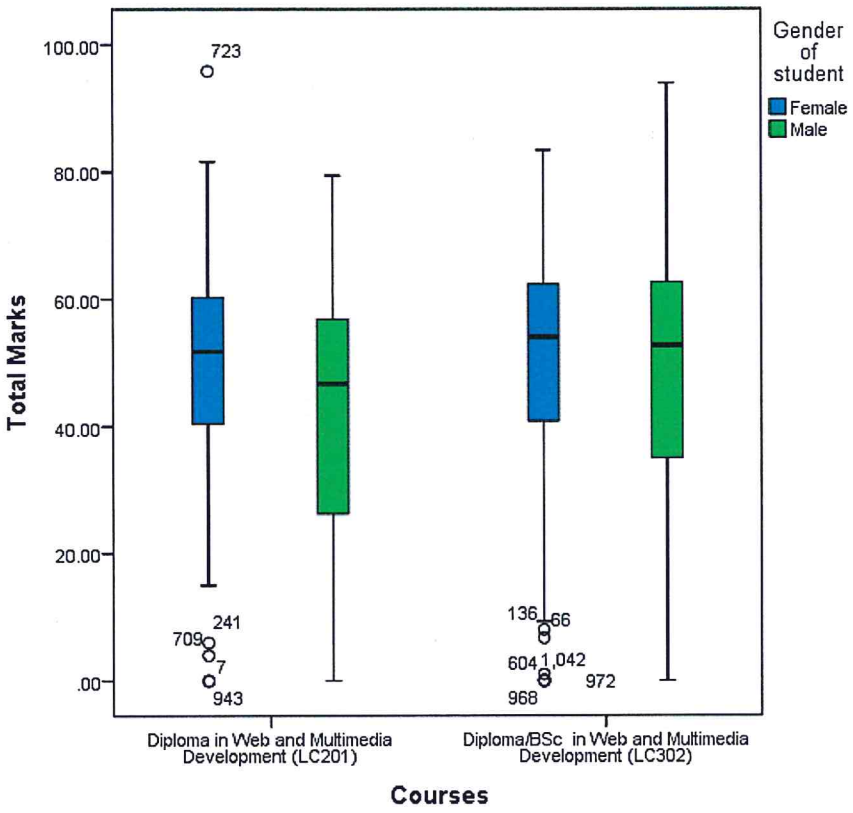

Figure 3: Boxplots for total marks per course and per Gender.

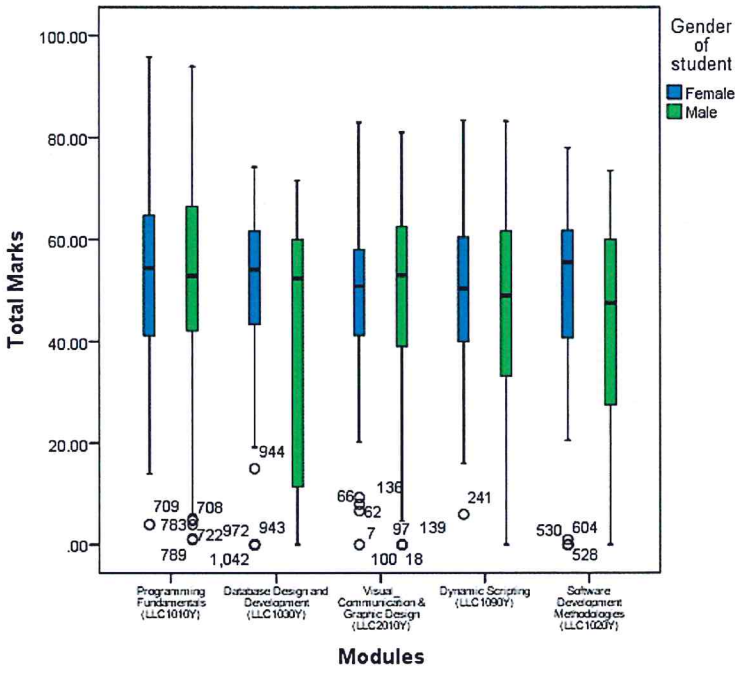

Figure 4: Boxplots for total marks per module and per Gender.

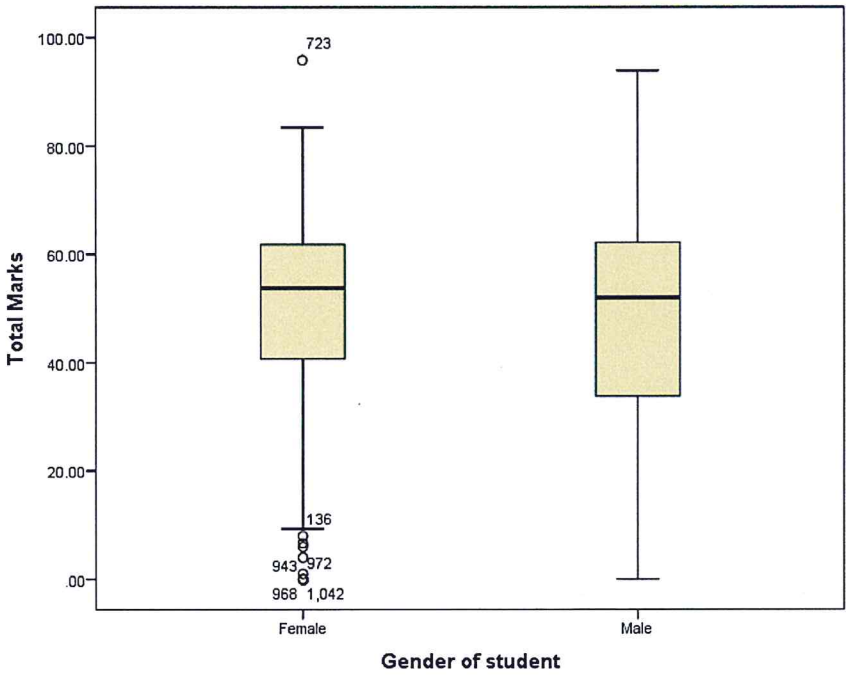

Figure 5: Boxplots for total marks per Gender.

1. CORRELATION BETWEEN VARIABLES

CORRELATIONS

Ten different variables such as total marks, HSC score, exam marks, course work marks, the mode of delivery, courses, academic years, results, gender and attendance of students were investigated using the correlational analysis.

Correlations

			Total Marks	HSC Score	Examination Marks	Course Work Mark	Mode of delivery	Courses	Academic Year	Results	Gender of student	Attendance of Student
Spearman's rho	Total Marks	Correlation Coefficient	1.000	.188**	.759**	.711**	.061*	.063*	-.016	.730**	-.066*	.355**
		Sig. (2-tailed)	.	.000	.000	.000	.048	.042	.611	.000	.031	.000
		N	1059	1059	1057	1057	1059	1059	1059	1059	1059	234
	HSC Score	Correlation Coefficient	.188**	1.000	.158**	.127**	-.027	.238**	-.173**	.157**	-.042	.098
		Sig. (2-tailed)	.000	.	.000	.000	.380	.000	.000	.000	.176	.137
		N	1059	1059	1057	1057	1059	1059	1059	1059	1059	234
	Examination Marks	Correlation Coefficient	.759**	.158**	1.000	.170**	-.244**	.046	.003	.616**	-.074*	.296**
		Sig. (2-tailed)	.000	.000	.	.000	.000	.135	.916	.000	.016	.000
		N	1057	1057	1057	1056	1057	1057	1057	1057	1057	234
	Course Work Mark	Correlation Coefficient	.711**	.127**	.170**	1.000	.282**	.033	-.114**	.625**	-.068*	.301**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.288	.000	.000	.026	.000
		N	1057	1057	1056	1057	1057	1057	1057	1057	1057	234
	Mode of delivery	Correlation Coefficient	.061*	-.027	-.244**	.282**	1.000	.015	.157**	.085**	.009	.
		Sig. (2-tailed)	.048	.380	.000	.000	.	.615	.000	.006	.763	.
		N	1059	1059	1057	1057	1059	1059	1059	1059	1059	234
	Courses	Correlation Coefficient	.063*	.238**	.046	.033	.015	1.000	.099**	.024	.101**	.132*
		Sig. (2-tailed)	.042	.000	.135	.288	.615	.	.001	.440	.001	.044
		N	1059	1059	1057	1057	1059	1059	1059	1059	1059	234
	Academic Year	Correlation Coefficient	-.016	-.173**	.003	-.114**	.157**	.099**	1.000	-.091**	.059	.068
		Sig. (2-tailed)	.611	.000	.916	.000	.000	.001	.	.003	.054	.300
		N	1059	1059	1057	1057	1059	1059	1059	1059	1059	234
	Results	Correlation Coefficient	.730**	.157**	.616**	.625**	.085**	.024	-.091**	1.000	-.122**	.206**
		Sig. (2-tailed)	.000	.000	.000	.000	.006	.440	.003	.	.000	.002
		N	1059	1059	1057	1057	1059	1059	1059	1059	1059	234
	Gender of student	Correlation Coefficient	-.066*	-.042	-.074*	-.068*	.009	.101**	.059	-.122**	1.000	-.221**
		Sig. (2-tailed)	.031	.176	.016	.026	.763	.001	.054	.000	.	.001
		N	1059	1059	1057	1057	1059	1059	1059	1059	1059	234
	Attendance of Student	Correlation Coefficient	.355**	.098	.296**	.301**	.	.132*	.068	.206**	-.221**	1.000
		Sig. (2-tailed)	.000	.137	.000	.000	.	.044	.300	.002	.001	.
		N	234	234	234	234	234	234	234	234	234	234

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3: Correlation matrix for ten variables.

Summary Remarks:

Variables	Correlation	p-value
Total marks, Exam marks, CW marks and Results (Fail or Pass) v/s HSC Score	0.188, 0.158, 0.127, 0.157	0.000 -> Significantly positively correlated despite a very low correlation
Total marks, Exam marks, CW marks and Results (Fail or Pass) v/s attendance for	0.355, 0.296, 0.301, 0.206	0.000 -> Significantly positively correlated despite a very low correlation

Programming Fundamentals (LLC1010Y)		
Total marks, Exam marks, CW marks and Results (Fail or Pass) v/s Gender	-0.066, -0.074, -0.068, -0.122	0.00 -> Sig negatively correlated despite a very low correlation showing that girls perform significantly better than boys.
Total marks, Exam marks, CW marks and Results (Fail or Pass) v/s mode of delivery	0.061, -0.244, 0.282, 0.085	0.00 -> Sig. positive correlation for Total marks, CW and results when we shift to Face-to-face mode while sig. negative correlation for Exam marks while shifting to F-F.

Correlations

		Total Marks	Normalised Exam marks on 100%	Normalised Coursework marks on 100%	HSC Score	Attendance of Student	Gender of student
Total Marks	Pearson Correlation	1	.888**	.870**	.214**	.563**	-.122**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	1059	1057	1057	1059	936	1059
Normalised Exam marks on 100%	Pearson Correlation	.888**	1	.580**	.206**	.462**	-.084**
	Sig. (2-tailed)	.000		.000	.000	.000	.006
	N	1057	1057	1056	1057	935	1057
Normalised Coursework marks on 100%	Pearson Correlation	.870**	.580**	1	.169**	.521**	-.129**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	1057	1056	1057	1057	935	1057
HSC Score	Pearson Correlation	.214**	.206**	.169**	1	.119**	-.022
	Sig. (2-tailed)	.000	.000	.000		.000	.465
	N	1059	1057	1057	1059	936	1059
Attendance of Student	Pearson Correlation	.563**	.462**	.521**	.119**	1	-.157**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	936	935	935	936	936	936
Gender of student	Pearson Correlation	-.122**	-.084**	-.129**	-.022	-.157**	1
	Sig. (2-tailed)	.000	.006	.000	.465	.000	
	N	1059	1057	1057	1059	936	1059

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4: Correlation matrix for six variables using normalised marks.

Remarks from Table 4:

i. As expected the total marks and both normalized exam and CW are highly related. The normalized exam marks and normalized CW are moderately positively linearly correlated (0.580)

ii. HSC marks are significantly poorly positively linearly correlated with respect to total marks (0.214), normalized exam marks (0.206) and normalized (0.169).

iii. Attendance of students (not regular, regular and very regular) are significantly moderately positively linearly correlated with respect to total marks (0.563), normalized exam marks (0.462) and normalized (0.521).

iv. Though poorly correlated, performances of the total marks, normalized exam and normalized CW are significantly negatively linearly correlated with gender meaning that higher scores are obtained by girls (0) compared to boys (1).

2. IS THERE A SIGNIFICANT DIFFERENCE BETWEEN THE PERFORMANCES OF STUDENTS IN THE ONLINE MODULES WHEN COMPARED TO MODULES OFFERED ON A FACE-TO-FACE MODE?

CONFIDENCE INTERVALS AND ANALYSIS OF VARIANCE

We will stick to 95% Confidence Interval and 5% significant level for all our inferential test unless specified.

a. 95% Confidence Interval for Total marks, Normalised Exam marks and Normalised Courseworks.

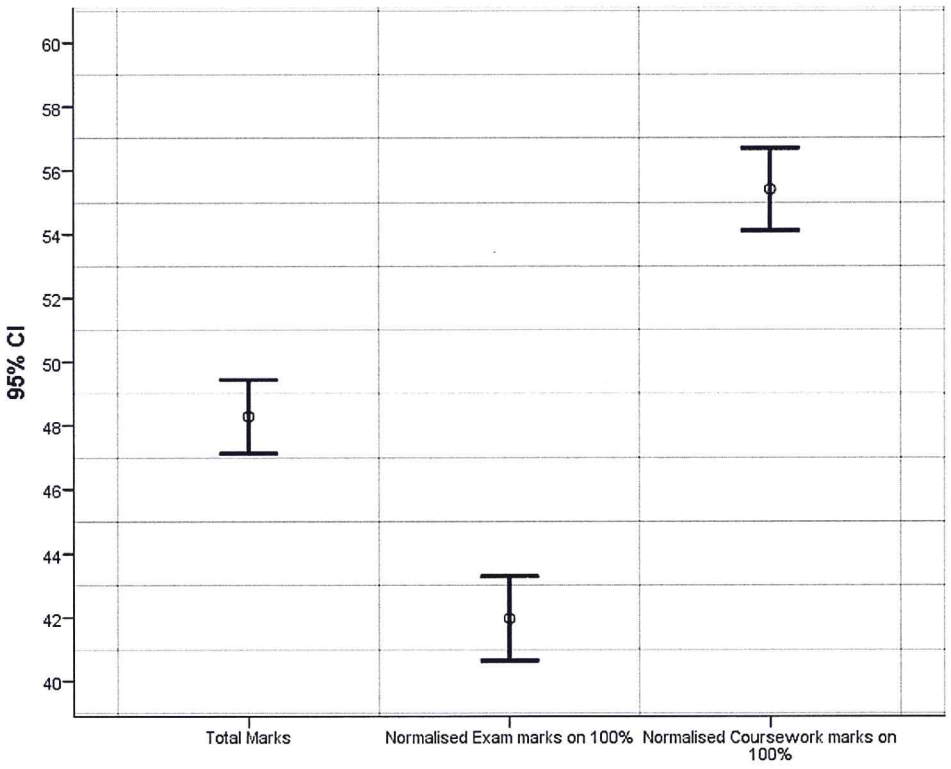

Figure 6: Error plots (Confidence Interval) for the marks.

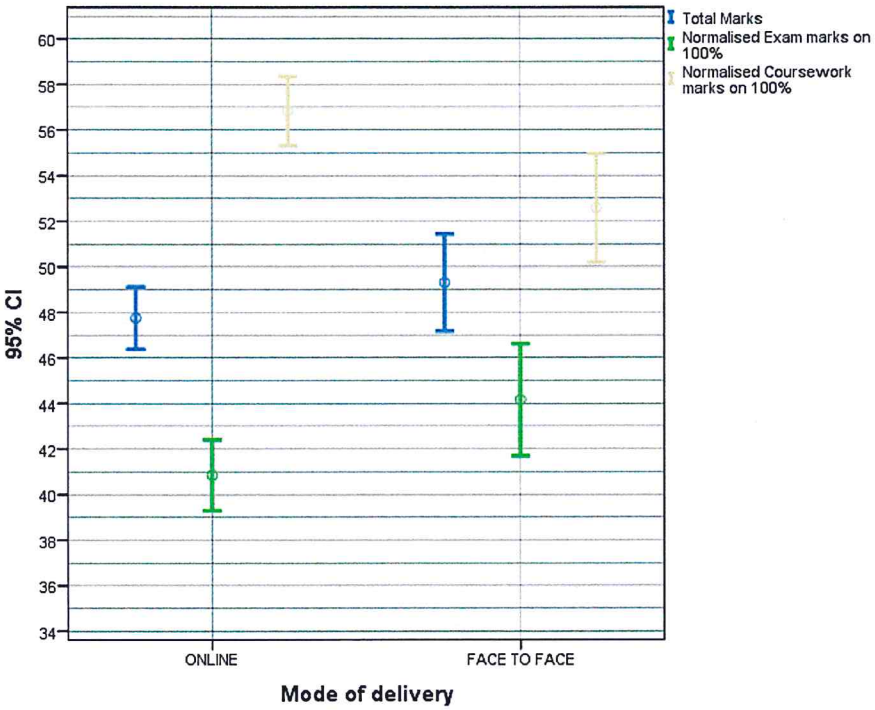

Figure 7: Error plots (Confidence Interval) for the marks by mode of delivery.

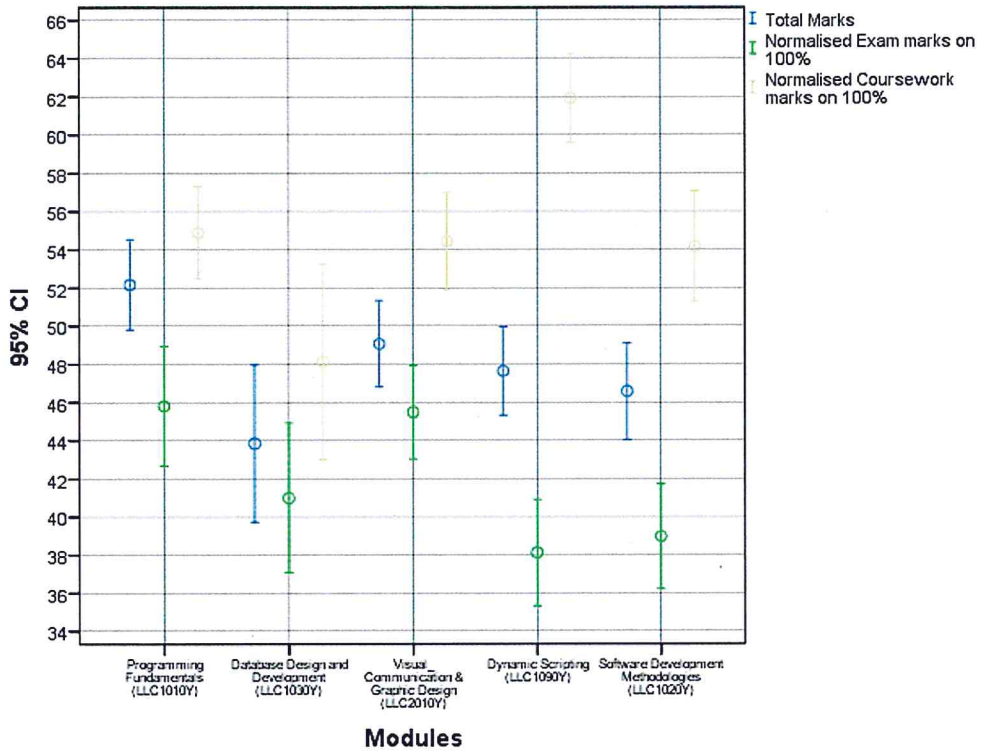

Figure 8: Error plots (Confidence Interval) for the marks module-wise.

Remarks:

i. Significance disparity between the three markings where normalized courseworks (highest), normalised exam marks (lowest) and logically the total marks in between the two.

ii. Normalised coursework for online mode is significantly highest on average in terms of perfomances when compared to the other modes of teaching and as well as assessments (Exam and also overall total marks). In fact, the former is around 4 marks higher than of face-to-face on average.

iii. For both face to face and online methods, normalized exam marks are significantly lower on average than normalized coursework and total exam marks.

iv. Face-to-face normalized exam scores are not significantly different on average from the online method despite the former is around 3 marks higher.

v. Face-to-face normalized total scores are not significantly different on average from the online method despite the former is around 1 mark higher.

vi. Module-wise normalized courseworks are highest on average for all the modules while normalized exam marks are the lowest.

The remarks are further supported by the one-way ANOVA performed.

b. One-Way ANOVA: Mode of delivery v/s the Total marks/Normalised Exam/ Normalised CW

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Marks	Between Groups	531.366	1	531.366	1.441	.230
	Within Groups	389899.606	1057	368.874		
	Total	390430.972	1058			
Normalised Exam marks on 100%	Between Groups	2575.158	1	2575.158	5.386	.020
	Within Groups	504378.267	1055	478.084		
	Total	506953.425	1056			
Normalised Coursework marks on 100%	Between Groups	4213.858	1	4213.858	9.272	.002
	Within Groups	479467.738	1055	454.472		
	Total	483681.596	1056			

Table 5: One-way ANOVA Table for marks by mode of delivery.

Remarks:

i. No significant difference for mean total marks between f-f and online mode of delivery.

ii. Significant difference for mean normalized exam marks between f-f and online mode of delivery.

iii. Significant difference for mean normalized coursework marks between f-f and online mode of delivery.

c. One-way ANOVA: Marks differ gender-wise only/module-wise only

Gender-wise

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Marks	Between Groups	5857.732	1	5857.732	16.100	.000
	Within Groups	384573.241	1057	363.835		
	Total	390430.972	1058			
Normalised Exam marks on 100%	Between Groups	3558.099	1	3558.099	7.457	.006
	Within Groups	503395.326	1055	477.152		
	Total	506953.425	1056			
Normalised Coursework marks on 100%	Between Groups	8090.653	1	8090.653	17.947	.000
	Within Groups	475590.943	1055	450.797		
	Total	483681.596	1056			

Table 6: One-way ANOVA Table for marks by gender.

Module-wise

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Marks	Between Groups	7247.958	4	1811.990	4.984	.001
	Within Groups	383183.014	1054	363.551		
	Total	390430.972	1058			
Normalised Exam marks on 100%	Between Groups	11988.646	4	2997.161	6.370	.000
	Within Groups	494964.779	1052	470.499		
	Total	506953.425	1056			
Normalised Coursework marks on 100%	Between Groups	16989.075	4	4247.269	9.574	.000
	Within Groups	466692.520	1052	443.624		
	Total	483681.596	1056			

Table 7: One-way ANOVA Table for marks by module.

Remark:

i. Confirmation that girls perform better.

ii. Confirmation performance disparity with respect to modules.

iii. One-way ANOVA: Average total marks differ significantly module-wise. From previous graphs, we note that Programming fundamentals differ significantly to Database Design and Development, Dynamic scripting and software development modules respectively while Visual Communication and graphic design is not significantly different to the others on the average.

d. One-way ANOVA: Results in terms of pass (score of 1) and fail (score of 0) is significantly different on average by mode of delivery. Face-to-face has significantly higher success rates in terms of passes than online mode of delivery.

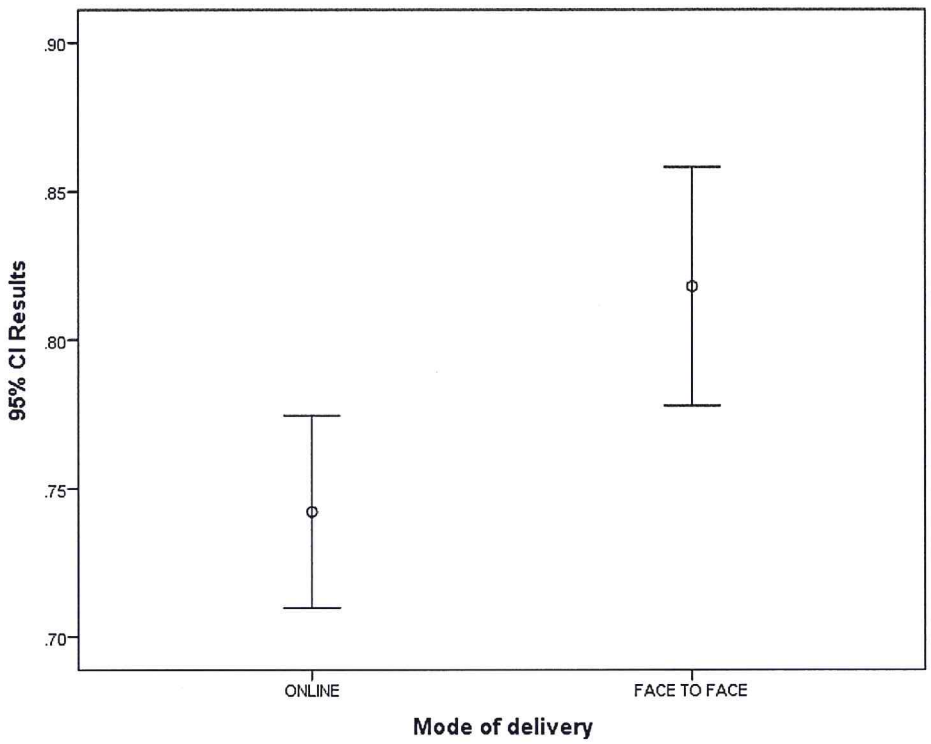

Figure 9: Error plots (Confidence Interval) for the results by mode of delivery.

Descriptives

Results

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
ONLINE	702	.74	.438	.017	.71	.77	0	1
FACE TO FACE	357	.82	.386	.020	.78	.86	0	1
Total	1059	.77	.422	.013	.74	.79	0	1

ANOVA

Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.358	1	1.358	7.658	.006
Within Groups	187.497	1057	.177		
Total	188.856	1058			

Table 8: One-way ANOVA Table for results by mode of delivery.

e. Contrast between the online modules.
From Figures 10 and 11, we observe that the final total marks obtained for the three online modules are not significantly different where there exists a significant difference between the two face-to-face modules.

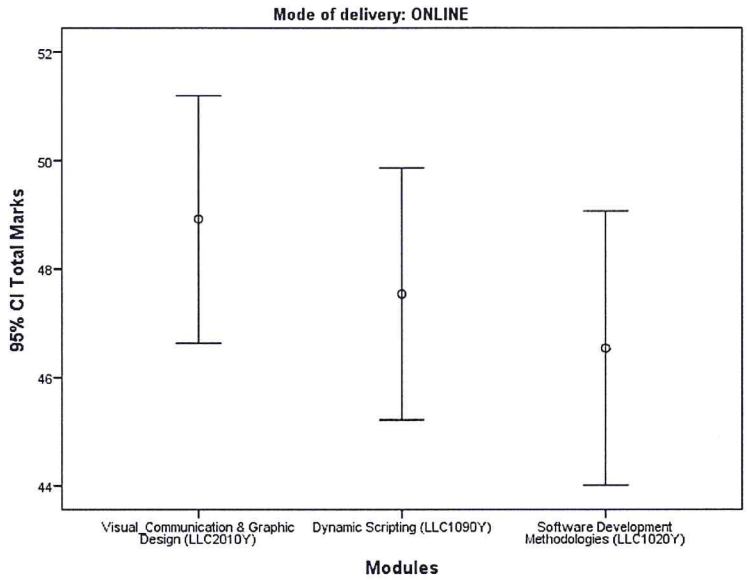

Figure 10: Error plots (Confidence Interval) for the total marks by online modules.

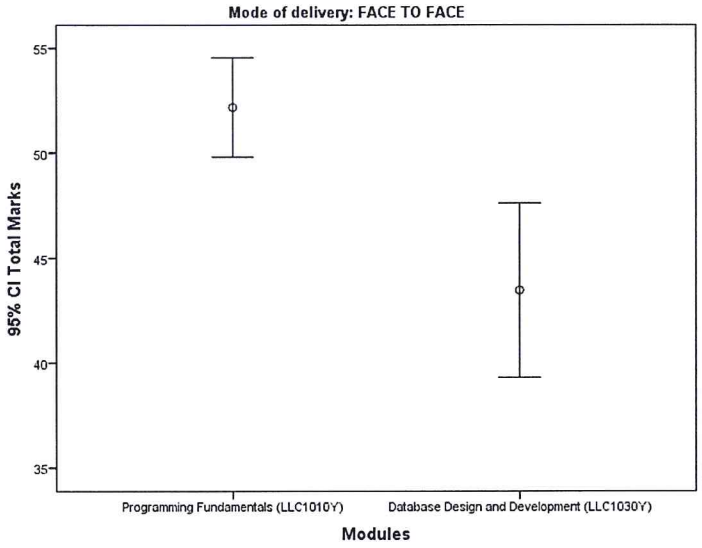

Figure 11: Error plots (Confidence Interval) for the total marks by face-to-face modules.

INFLUENCE OF ATTENDANCE OR ONLINE ACTIVITIES ON PERFORMANCE

In this part of the analysis, the impact of **student activities (attendance),** indexed as not regular, regular and very regular, and overall involvement in the online courses with respect to their final results at the end of the academic year is investigated.

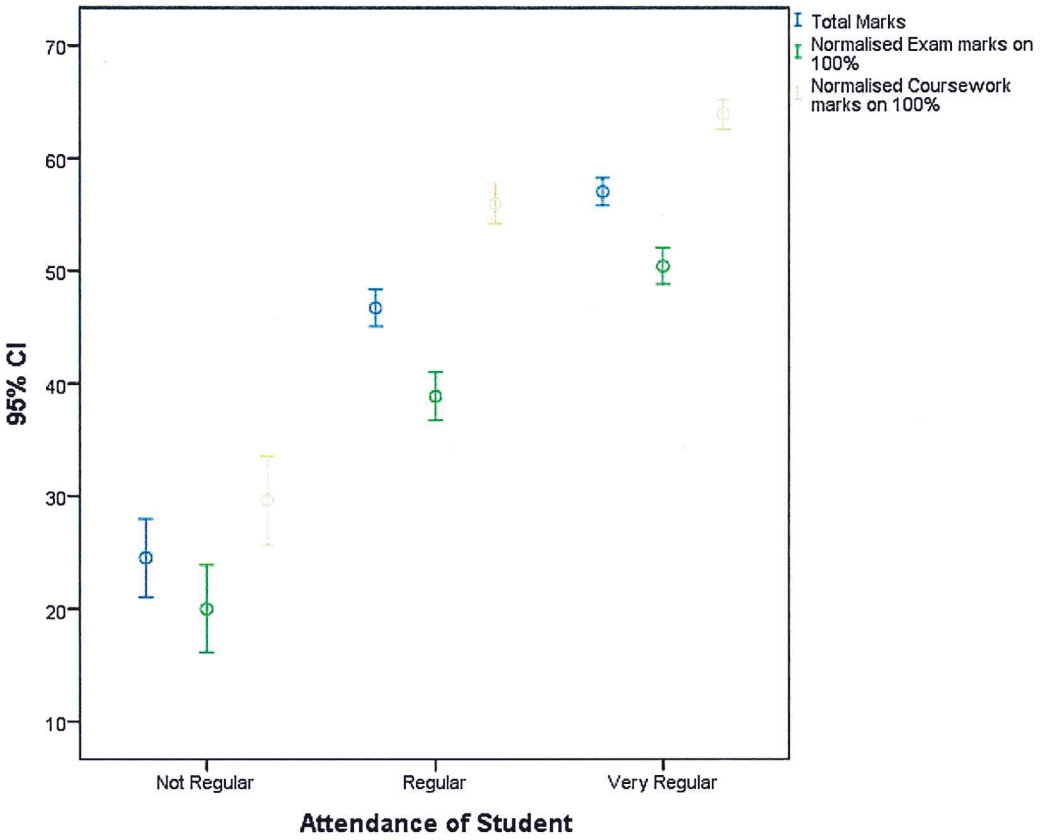

Figure 12: Error plots (Confidence Interval) for marks by students' activities.

From Figure 12, we note that the total marks, normalized exam marks and the normalized coursework marks are best if students are very regular, are average if students are regular and lowest if students are not regular. It also indicates a positive linear trend in the performance of the three categories of assessment which motivates us to apply a simple linear regression (SLR) for further investigation.

Figure 13 shows the bar chart for the results (pass or fail) with respect to the attendance of students which clearly demonstrates that the pass rate increases and as a consequence failure rate decreases as the regularity of students increases.

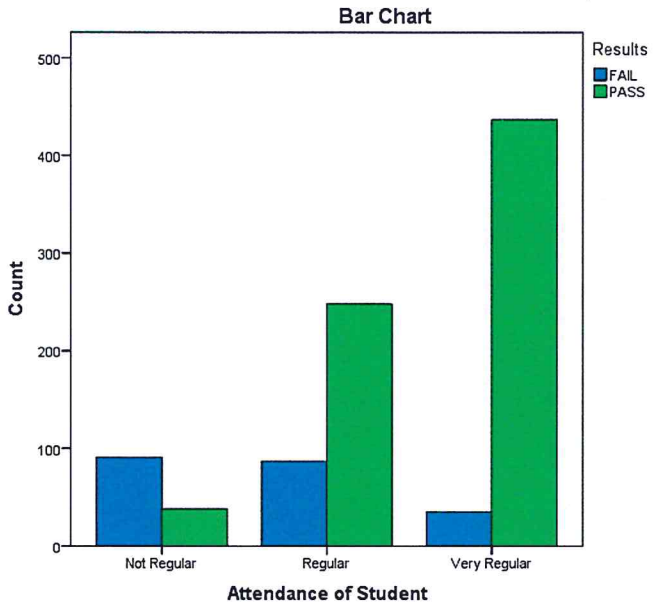

Figure 13: Bar chart for results (Pass and Fail) by attendance.

REGRESSION ANALYSIS FOR TOTAL MARKS VERSUS ATTENDANCE.

Mode of Delivery	**Attendance (1= Not regular, 2 = Regular, 3 = Very regular)**	**Correlation Coefficient ( )**	**Trend coefficient**
Overall (Both Online and Face-to-face)	Total marks	0.563	14.6
	Normalised Exam marks	0.462	14.2
	Normalised Coursework marks	0.521	14.7
Online	Total marks	0.618	15.9
	Normalised Exam marks	0.508	14.9
	Normalised Coursework marks	0.595	17.1
Face-to-face	Total marks	0.361	9.9
	Normalised Exam marks	0.315	11.4

	Normalised Coursework marks	0.329	9.2

Table 9: Regression Summary.

The SRL is a significant model for all cases. We note from Table 9 the following:

- Interestingly, the overall marks (both online and face-to-face) of the students in general increases at an average rate of 14.5 marks per shift from one attendance level to the next level (0, 1, 2). The linear correlation coefficient between the different mode of assessment and the attendance level is positive and moderate.
- The correlation coefficient for online modules are higher than those of face-to-face (almost double) for the three assessment modes with higher trend coefficients. This shows that performances of students are more sensitive to the regularity of students for online modules than those of face-to-face modules.

GENERAL CONCLUSIONS:

i. There exists a significance disparity between the three markings where normalized courseworks (highest), normalised exam marks (lowest) and logically the total marks in between the two.

ii. Normalised coursework for online mode is significantly highest on average in terms of perfomances when compared to the other modes of teaching and as well as assessments (Exam and also overall total marks).

iii. Module-wise normalized courseworks are highest on average for all the modules while normalized exam marks are the lowest.

iv. Face-to-face normalized total scores are not significantly different on average from the online method despite the former is around 1 mark higher.

v. Significant difference for mean normalized exam marks as well as mean normalized coursework marks between face-to-face and online mode of delivery.

vi. Confirmation that girls perform better.

vii. The final total marks obtained for the three online modules are not significantly different where there exists a significant difference between the two face-to-face modules.

viii. This shows that performances of students are more sensitive to the regularity of students for online modules than those of face-to-face modules.

ix. From the brainstorming session, it was highlighted further studies should take into account the role of the module weightage distribution as this could have an impact over the results and could explain further the findings. For example one face to face module was assessed with 70% coursework and 30% exams while the online module was 50-50 and 60-40 weightage distributions.

x. The nature of the modules have to also taken into account, as programming module is different from a theory module which is offered online, for example.

xi. The possibility that the assignments are more or less the same in a DEOL (online) module might also explain the fact that students work better in the coursework, as they might also get access to previous coursework, which then results in overall better coursework marks than in exams.

xii. There is finally a need to probe more in the nature of assignments in terms of the cognitive level distribution to be able to understand in more depth the discrepancies. For example in programming modules, students are given lab sheets which they follow to achieve a predefined result, while in a theory module, they need demonstrate ability to understand and for critical analysis.

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