

A Quantitative Analysis of an Online Survey Completed by Students Engaging with Numbas as
Part of a Multi-Disciplinary First Year Maths Course.

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Introduction

An online survey on students attitudes to using the Numbas tool was delivered to students from CIT and UCC undertaking a compulsory first year maths module. The Numbas tool comprised a series of online exams which students completed and represented a portion of their mark for the module. A total of 244 students completed the survey - 82 students from CIT and 162 students from UCC.

Survey design.

The survey consisted of ten questions. Four questions were open-ended. Three of these (questions 7, 8 & 9) elicited yes/no/maybe answers and were retained for descriptive purposes. The tenth question, a qualitative question was included for consideration in the qualitative report.

The six remaining questions that were scored on a five-point Likert scale (strongly disagree, disagree, neutral, agree, strongly agree) were considered for quantitative analysis:

1. The use of Numbas has increased my attendance at tutorials.
2. Feedback given by the Numbas program is useful for me.
3. The Numbas assessments are easier for me to complete than the written assessments.
4. The Numbas system is straightforward for me, as a student, to use.
5. The Numbas system has enhanced my understanding of course content.
6. Numbas has changed the way in which I engage with maths in college

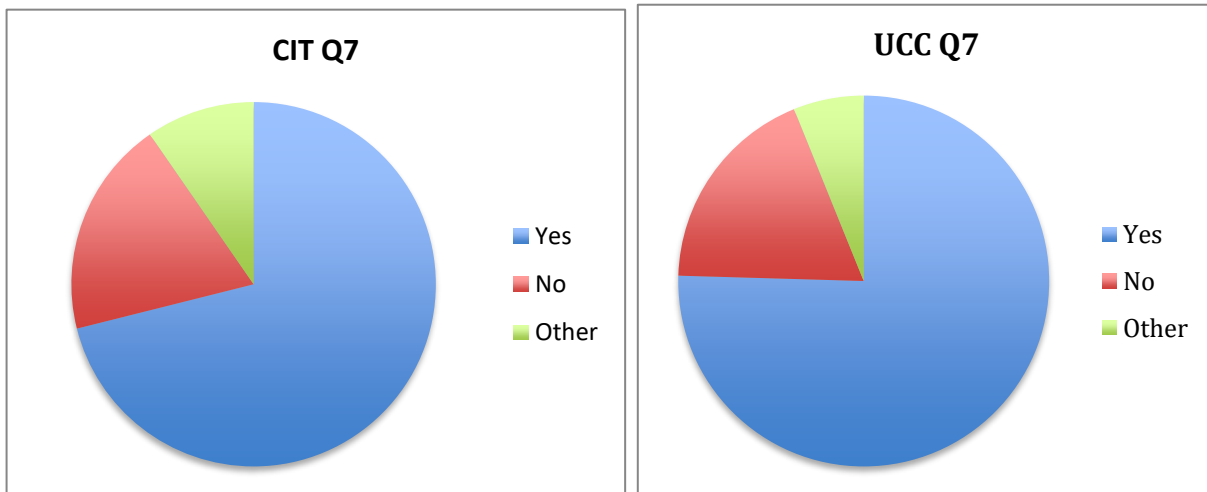
Analysis

The dataset was cleaned. Questions 1-6 were coded for entry into SPSS. Data was then analysed in Excel and SPSS v.20.

Firstly data for questions 7,8 and 9 was considered. Results to questions 1-6 were then analysed to asses to what degree students endorsed the statements overall. Groups were then compared in order to establish if students from UCC had a different experience of using the Numbas tool.

A breakdown of responses to questions 7,8 and 9 are presented below.

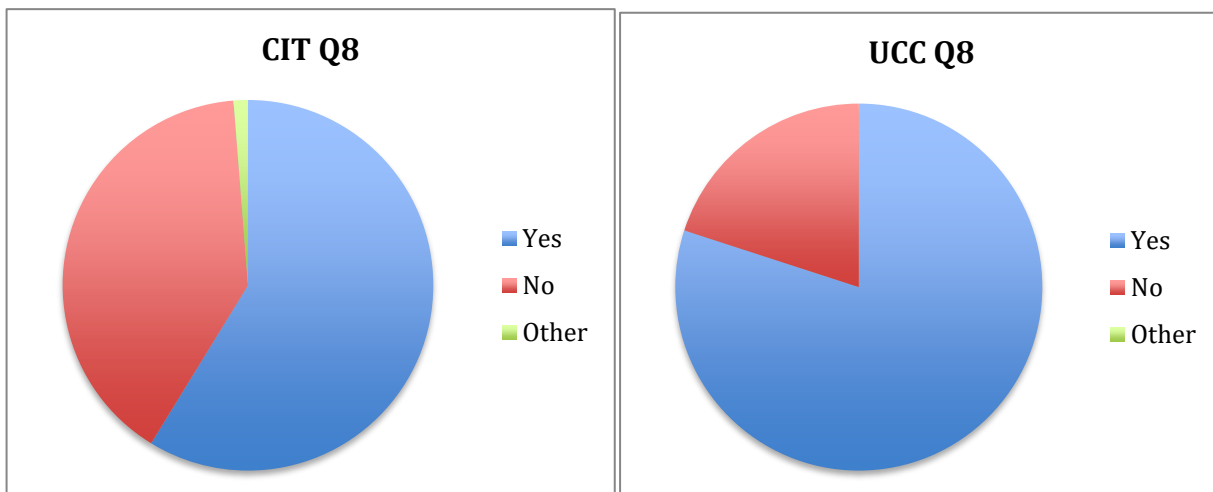
Question 7. Do you feel that tutorial classes on the use of Numbas would help you with completing the assessments?



Responses in percentages:

	Yes	No	Other
CIT	71	19	10
UCC	75.5	18.5	6

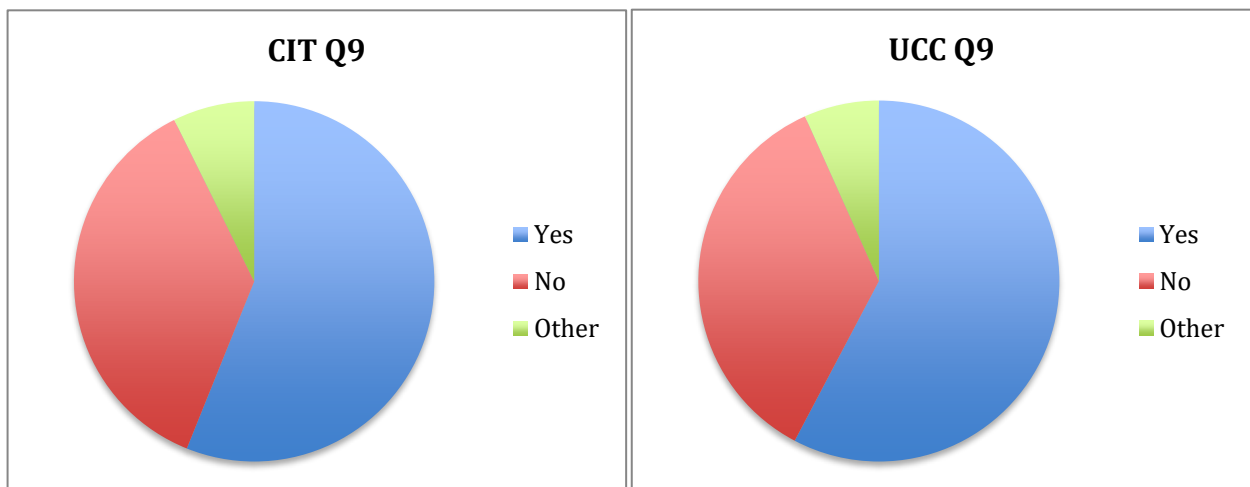
Question 8. Do you feel that Numbas has helped you to retain the course material?



Responses in percentages:

	Yes	No	Other
CIT	58.75	40	1.25
UCC	80	20	1.25

Question 9. Do you feel that the Numbas assessments have allowed you to enjoy maths more in college?



Responses in percentages:

	Yes	No	Other
CIT	56	36.6	7.4
UCC	58	35.5	6.5

Students from both groups strongly agreed that tutorials would enhance their expertise in using Numbas. UCC students agreed that Numbas helped them retain course material (80%) while this figure is considerably lower for CIT students (58.75). A majority of students from each group felt that Numbas had allowed them to enjoy maths more at third level.

Analysis of questions 1-6.

Questions 1-6 were then analysed.

Descriptive statistics.

Question	N	Mean	Std. Deviation
Q1	244	3.20	1.056
Q2	244	3.11	1.087
Q3	243	3.57	1.127
Q4	243	3.72	1.129
Q5	243	3.60	1.125
Q6	244	3.61	0.965

Table 1. Overall means and standard deviations for questions 1-6

The table shows that, on average, questions received a positive endorsement with mean scores ranging from 3.11 (Q2 Feedback given by the Numbas program is useful for me.) to 3.72 (Q5 The Numbas system has enhanced my understanding of course content). This is reflected in the qualitative analysis, students feel that the tool was useful but criticised the quality of feedback from the tool. While the strongest endorsement was for question 5, students also endorsed questions 3, 4 and 6; while questions 1 and 2 were close to a neutral response on average. This indicates that overall students had a positive response to using the Numbas tool. The standard deviations for each question indicate that responses clustered around the mean – with few students either strongly endorsing or strongly disagreeing with the statement questions.

Comparison of CIT and UCC data.

It was evident from the qualitative analysis that the delivery of the Numbas tool to each group differed considerably. Therefore the data from the groups will be treated as samples from separate populations. This analysis considers how the groups differ in their endorsements of the six quantitative question contained in the online survey.

Overall means and standard deviations for each question by college are given in the table below:

Group		N	Mean	Std. Deviation
UCC	Q1	162	3.02	1.02
	Q2	162	3.02	1.02
	Q3	161	3.52	0.96
	Q4	161	3.73	1.11
	Q5	161	3.71	1.12
	Q6	162	3.59	0.94
CIT	Q1	82	3.56	1.04
	Q2	82	3.28	1.2
	Q3	82	3.68	1.4
	Q4	82	3.72	1.17
	Q5	82	3.39	1.12
	Q6	82	3.65	1.02

Table 2. Means and standard deviations by group.

It can be seen from the table that CIT students have endorsed questions more strongly bar question 5 (has improved understanding of course content). In order to examine if these differences were significant the data was subject to a statistical test of difference.

Firstly data was tested for assumptions necessary for parametric analysis of the data. All six questions for each group gave significant results ($P < .05$) for Kolmogorow-Smirnov and Shapiro Wilkes tests of normality indicating that the data was not normally distributed. Tests of skewness and kurtosis conformed these findings. While skewness and kurtosis do not, in themselves, exclude a parametric test, data from CIT showed a binomial distribution for questions 2,3 & 4. This coupled with the differences in number of respondents between groups indicate that a non-parametric test of differences between groups should be used. Therefore a Mann-Whitney U test was used to test for differences in response between groups.

Results.

Independent-Samples Mann-Whitney U Test

Question	N	Statistic	Sig.	Effect size
Q1	244	4,801	$P < .001^{**}$.23
Q2	244	5,786	$P = .087$.11
Q3	243	5,490	$P = .024^*$.14
Q4	243	6.501	$P = .838$.01
Q5	243	7.784	$P = .016^*$.15
Q6	244	6,395	$P = .614$.03

Table 3 H1 - That the distribution of scores differ across groups.

** - Sig $p < .05$, **-sig $< .001$*

A Mann-Whitney U Test of difference showed a significant difference between groups for questions 1, 3 & 5 while results for questions 2, 4 and 6 showed that the groups did not express significantly different scores on these questions. Effect sizes for all differences were very small.

Discussion.

The results indicate that overall students endorsed the use of Numbas. While the differing methods of delivery of the Numbas tool to CIT and UCC students means that the data from these groups could not be considered as one sample (coming, as it did, from essentially different populations) some interesting comparisons emerged, resulting in data which is more useful when considering refining of the tool. Overall the results indicate that students had a positive attitude to Numbas. While overall students positively endorsed the statement questions CIT students consistently endorsed statement question more positively, suggesting they had a more positive attitude to and experience of the Numbas tool. In particular there was a significant difference in endorsement of questions 1, 3 and 5; 1. The use of Numbas has increased my attendance at tutorials. 3. The Numbas assessments are easier for me to complete than the written assessments. 5. The Numbas system has enhanced my understanding of course content. However the effect sizes for these differences were very small. Relevant here are the question upon which groups did not significantly differ namely questions 2, 4 and 6. 2. Feedback given by the Numbas program is useful for me. 4. The Numbas system is straightforward for me, as a student, to use. 6. Numbas has changed the way in which I engage with maths in college. Question 2 shows the lowest level of endorsement for both groups, suggesting that feedback for students regarding questions on Numbas need refining. Both groups positively endorsed questions 4 and 6 suggesting students found the tool itself usable and Numbas improved their perception of maths.

Future research.

The survey captured attitudes to Numbas and maths after students had used the Numbas tool for assessment. It would be useful to measure student's attitude to maths prior to using the tool and after, therefore measuring any change in attitude to and feeling of expertise in maths. This would provide a more robust measure of efficacy of the tool. Given that the qualitative

analysis suggests a difference in the user experience of Numbas depending on whether the students took honours or pass leaving cert maths (equivalent to A levels), a demographic question relating to the level of maths exam taken at leaving cert level should be included. The binomial distribution of data on some questions was specific to CIT. In effect CIT students did not endorse the 'neutral' option for these questions, while a larger number of UCC students did. While this is a curiosity in itself this can be avoided in future scales by forcing students to endorse a four-point Likert scale (strongly disagree, disagree, agree and strongly agree) and omitting a neutral option.

Appendix 1. Distribution of responses for groups by question.

