

Does Attending Lectures Matter When Lecture Recordings are Available? Results for a Preliminary Study Comparing Attending and Non-Attending Nursing Students in Bioscience and Pharmacology

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Abstract

Historically, positive relationships between lecture attendance and academic outcomes have been reported. Lecture recordings have been increasingly introduced into the teaching environment, and it is not clear whether these affect this relationship. The aim of the present study was to determine the effect of lecture attendance on academic outcomes in bioscience and pharmacology for nursing students provided with access to lecture recordings in 2013 and 2014. To do this, lecture attendance was monitored at a lecture late in semester, and attendance and non-attendance was related to academic outcomes (grade, overall mark, examinations, and ongoing assessment). We show that nursing students attending lectures in bioscience and pharmacology have better academic outcomes than the non-attending students, despite the availability of lecture recordings. This preliminary study suggests that for nursing students studying science, despite the availability of lecture recordings, it may be important to continue to provide face-to-face lectures, as students that attend lectures outperform those that do not. Further studies are required to clarify whether this applies to other students, and why this positive relationship is maintained despite the availability of lecture recordings.

Introduction

Lecture-based learning was the standard way of delivering material to university students for many years. It has been assumed by many lecturers that grades were related to lecture attendance with students who attended classes more frequently, obtaining better grades. This is supported by a major meta-analysis conducted by Credé, Roch and Kieszczynka (2010), considering all disciplines and different cohorts of students in 68 studies, and showing a strong relationship between class attendance and class grades. Furthermore, class attendance was a better predictor of grades than any other known predictors including high school scores, Scholastic Aptitude/Assessment Test (SAT) scores, study habits, and study skills (Credé et al., 2010).

In their meta-analysis, Credé et al. (2010) also separated science units from non-science units, and showed that the positive relationship between lecture attendance and class grades was slightly higher for the science students (8524 students in 11 studies; samples weighted correlation, r_{obs} of 0.49) than for non-science students (12640 students in 57 studies; r_{obs} of

0.41) (Credé et al., 2010). Credé et al. (2010) suggested that this may be related to the provision of laboratories for science students, despite not providing data on the use of laboratories.

For nursing students studying bioscience or pharmacology or related subjects, there have only been three studies of the association of lecture attendance and academic outcomes, and none of these report the use of lecture recordings. The first study was a 1994 US study showing a positive relationship between lecture attendance and academic scores for the students in human physiology (Hamen & Kelland, 1994) and the second was a 1999 Canadian study showing a negative correlation between nursing student absenteeism from two units on pathotherapeutics and grades (Brown, Graham, Money, & Rakoczy, 1999). The third study was an Australian study showing a positive relationship between lecture attendance for nursing students and the end of semester examination mark in pathophysiology (Salamonson, Andrew, & Everett, 2009).

Lecture recordings have been increasingly introduced into the teaching environment, giving the students more flexibility in their learning. These lecture recordings are commonly of PowerPoint presentations with the lecturer's voice overlaying the presentation. There have been no studies of whether the availability of lecture recordings has any effect on the positive relationship between lecture attendance and academic outcomes for nursing students. Studies with other cohorts of students studying the biological sciences reporting the use of lecture recordings, have given mixed results. Three studies, showed a positive relationship between lecture attendance and academic outcomes: pharmacology students in a science degree (Fernandes, Maley, & Cruikshank, 2008); cell biology students (Soto & Anand, 2009); and physiology students (Horton, Wiederman, & Saint, 2012). However, Fernandes et al. also showed that using lecture recordings in Lectopia, instead of lecture attendance, was associated with lower outcomes in the summatives, exam and final mark (Fernandes, Maley, & Cruikshank, 2008). In contrast, two other studies reporting the use of lecture recording have shown that there may be no relationship between lecture attendance and academic outcomes in some units. The first was of pharmacy students and showed an association between lecture attendance and grade point average in the therapeutics unit, but not the biomedical science unit (Hidayat, Vansal, Kim, Sullivan, & Salbu, 2012). The second of these was a 2012 Australian study, and this study showed no statistically significant relationship between lecture attendance and academic outcomes in two biochemistry units and one of two pharmacology units (Davis, Hodgson, & Macauley, 2012). A more recent study showed no relationship between lecture attendance and outcomes for dental students studying the basic sciences with access to lecture recordings (Azab, Saksena, Alghanem, Bidle, Molgaard, Albright, & Karimbux, 2016). The reason for this discrepancy between studies of students studying science is not clear-cut, and this indicates that further studies are required to determine whether the availability of lecture recordings impacts the relationship between lecture attendance and academic outcomes.

The aim of the present study was to determine the effect of lecture attendance on academic outcomes in bioscience and pharmacology for nursing students provided with access to lecture recordings.

Methods

At the Queensland University of Technology (QUT), nursing is taught at both a city and regional campus. The entrance requirements for nursing are lower at the regional than city campus. Both the bioscience and pharmacology units are 2nd year level, core, 12 credit point units (96 credits/year is full-time study). The bioscience unit is the 3rd of three units in

bioscience, which progress follows units in anatomy and physiology, and has emphasis on pathophysiology, and the pharmacology unit is the only pharmacology unit in the nursing course. Both units had 3 hours of lecturing/week, over 12/13 weeks, which were made available via Blackboard as recordings (Echo). The bioscience lectures were supported by two hours of practicals/tutorials per week for 10 weeks, and the pharmacology lectures by a one hour of tutorial on a weekly basis. These tutorials were designed to reinforce the material presented in lectures for both bioscience and pharmacology.

In both units, the marks are 60% for examinations, which is a combination of multiple choice questions and short answer questions, and 40% for ongoing assessment. The ongoing assessment for the bioscience unit was quizzes at the end of laboratory/tutorials, and for the pharmacology unit was 20% for preparation and participation in tutorials, and 20% for a written assignment. Half of the tutorial marks in pharmacology were given for preparation, which was unsupervised and could be undertaken alone or in groups. The other half of the tutorial marks was a group mark for performance at the tutorial, which included questioning by the tutor of individuals and the group about the content of the student preparation.

In 2013 and 2014, we undertook a study of the recall of bioscience and pharmacology by these nursing students (Doggrell & Schaffer, 2016). At this time, discussions with the QUT Human Ethics Committee indicated that ethical review by the committee was not required for this project, provided students were not identifiable in any report/publication, and the study was conducted in accordance with the National Statement, which it was. As part of this study, a short quiz was undertaken by the students attending a lecture in week 10 for bioscience or week 11 for pharmacology, and participating students provided their ID numbers. This paper quiz consisted of five MCQs, which tested the recall of the student's knowledge in gastrointestinal physiology (for bioscience) or introductory microbiology (for pharmacology) from a unit undertaken 16 months previously, and the results of the quiz was not discussed with the students. All students at the lecture in pharmacology undertook the quiz, and $\geq 80\%$ of students at the lecture in bioscience undertook the quiz. Students who undertook the quiz are 'attending students', and those that did not are considered as 'non-attending students', in the data analysis.

The marks for both examinations and ongoing assessment, and for pharmacology, the tutorial and assignment marks were calculated as a percentage of 100%. The results for all of these components were averaged. Passing grades at QUT are 4 (overall mark, 50-64%), 5 (65-74%), 6 (75-84%) and 7 ($\geq 85\%$). Individual values were compared by student's unpaired t-test with P values of less than 0.05 being considered significantly different.

Results

We observed that lecture attendance was higher at the start than at the end of semester. The gastrointestinal lecture in the bioscience unit and anti-infectives lecture in the pharmacology unit were given in the final weeks of semester, and the numbers of nursing students attending, was low. The numbers of attending and non-attending students are given in the Tables, as (n).

Bioscience

In 2013, only 13% of the nursing students attended the gastrointestinal lecture at the city campus, and this percentage decreased to 8% in 2014. The attendance was higher at the regional than city campus in both years, but also decreased in 2014, compared to 2013 (34% in 2013; 24% in 2014).

The attending nursing students undertaking the bioscience unit at both the city and regional campuses had higher final outcomes in grades, overall mark, examination mark and ongoing assessment mark than the non-attending students. The results were very similar for 2013 and 2014 at the city campus (Figure 1).

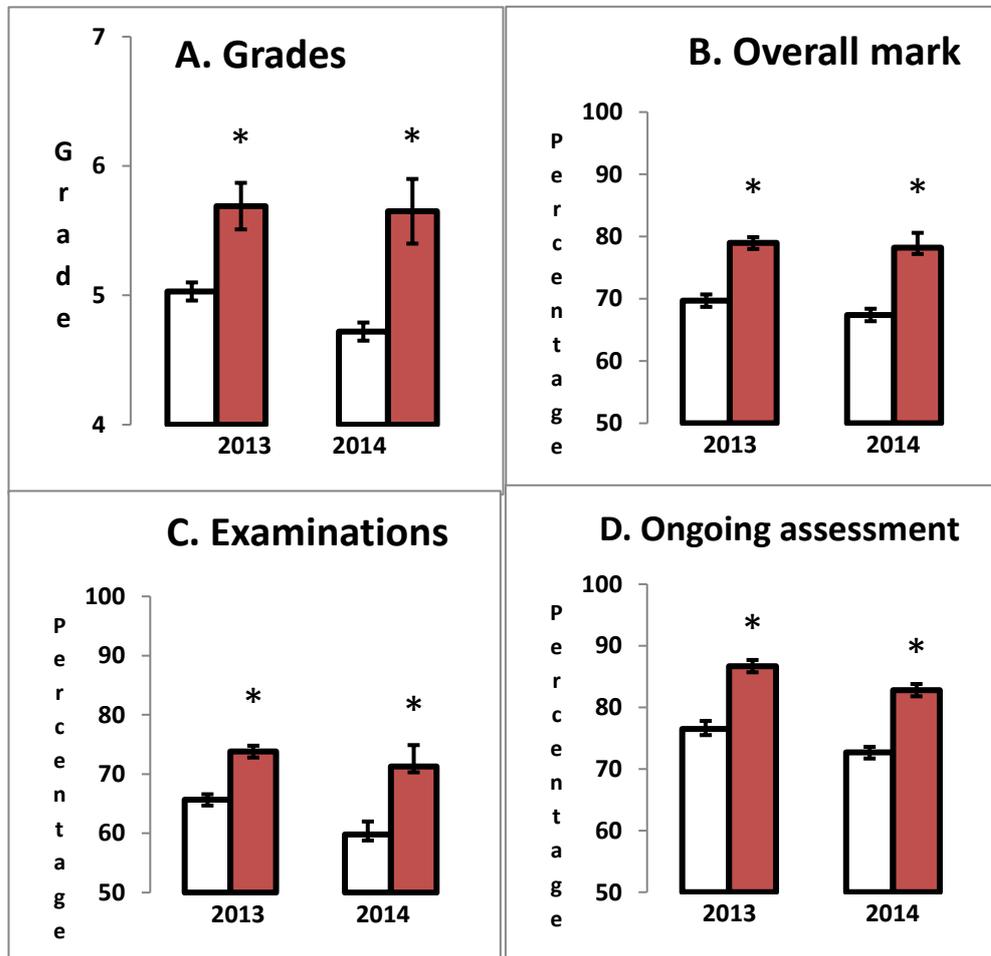


Figure 1: Nursing students attending lectures at the city campus do significantly better than non-attending students at all aspects of a bioscience unit: Top; grades (A), overall mark (B), Bottom examinations (C) and ongoing assessment (D). Empty columns are non-attending students (2013, n = 312; 2014, 273) and filled column are attending students: 2013, 48; 2014, 23. Each value is the mean ± SEM. * P ≤ 0.05

The data from the city and regional campuses were very similar; consistently showing that the attending students achieve better outcomes in all aspects for the bioscience unit (Table 1). Thus, grades are about 0.50 higher, overall marks are 7-10 percentage points higher, examination marks are 8-11 percentage points higher, and ongoing assessment marks are 9-11 percentage points higher for attending students than non-attending students at both campuses.

Table 1: Bioscience outcome data for lecture attending and non-attending nursing students at the city and regional campuses

	City campus				Regional campus		
	Year	Non-attending	Attending	P-values	Non-attending	Attending	P-values
Grade	2013	5.03 ± 0.07 (312)	5.69 ± 0.18 (48)*	P = 0.0009	4.96 ± 0.15 (52)	5.78 ± 0.22 (27)*	P = 0.0021
	2014	4.72 ± 0.07 (273)	5.65 ± 0.25(23)*	P = 0.0003	4.65 ± 0.15 (47)	5.27 ± 0.25(15)*	P = 0.0476
Overall mark	2013	69.7 ± 0.09 (312)	79.0 ± 1.88 (48)*	P = 0.0002	69.1 ± 1.71(52)	76.6 ± 2.33 (27)*	P = 0.0133
	2014	67.5 ± 0.09 (273)	78.2 ± 2.40 (23)*	P = 0.0006	63.9 ± 1.76 (47)	72.4 ± 2.50 (15)*	P = 0.0172
Exams	2013	65.7 ± 0.9 (312)	73.8 ± 2.2 (48)*	P = 0.0013	67.1 ± 1.9 (52)	74.9 ± 2.7 (27)*	P = 0.0213
	2014	59.8 ± 1.0 (273)	71.3 ± 3.6 (23)*	P = 0.0011	56.8 ± 2.0 (47)	65.6 ± 3.7 (15)*	P = 0.0417
Ongoing assessment	2013	76.5 ± 1.3 (312)	86.7 ± 2.6 (48)*	P = 0.0033	75.1 ± 2.9 (52)	85.0 ± 2.7 (27)*	P = 0.0339
	2014	72.6 ± 0.9 (273)	82.8 ± 2.1 (23)*	P = 0.0145	74.5 ± 2.1 (47)	82.6 ± 1.3 (15)*	P = 0.0415

Each value is the mean ± SEM

Number in brackets is the number of students

* Indicates that the result for the attending students is significantly higher than for non-attending students, and the P values are from the Student's unpaired t-test.

Pharmacology

In 2013, only 11% of the nursing students attended the anti-infectives lecture at the city campus, and this percentage decreased to 7% in 2014. The attendance was higher at the regional than city campus in both years, but also decreased in 2014, compared to 2013 (34% in 2013; 16% in 2014).

The attending nursing students undertaking the pharmacology unit at both the city and regional campuses had higher final outcomes for grades by 0.4 – 0.6 points and overall mark by 5-7 percentage points (Table 2). At the city campus, the examination outcomes were about 5 percentage points higher for the attending students than the non-attending students, and this difference reached significance (Table 2). In comparison, at the regional campus, the examination outcomes were only about 3 percentage points higher for the attending versus non-attending students and this difference was not significantly different. At both campuses, although the marks for ongoing assessment were consistently higher for attending versus non-attending students in both years, this was only significant for the ongoing assessment in 2014 at the regional campus (Table 2).

Separating the marks for ongoing assessment into those for tutorials and the assignment showed a similar pattern, thus the marks for the attending students were usually higher than those of the non-attending students, but this only reached significance at the city campus for the assignment in 2013, and, at the regional campus, for the tutorials and assignment in 2014 (Table 2).

Table 2: Pharmacology outcome data for lecture attending and non-attending nursing students at the city and regional campuses

	City campus				Regional campus		
	Year	Non-attending	Attending	P-values	Non-attending	Attending	P-values
Grade	2013	4.90 ± 0.05 (382)	5.34 ± 0.14 (50)*	P = 0.0028	4.75 ± 0.14 (48)	5.40 ± 0.22 (25)*	P = 0.0152
	2014	4.72 ± 0.06 (308)	5.21 ± 0.21 (23)*	P = 0.0131	4.40 ± 0.09 (67)	5.00 ± 0.25 (13)*	P = 0.0128
Overall mark	2013	67.2 ± 0.58 (382)	72.5 ± 1.38 (50)*	P = 0.0040	67.9 ± 1.37 (48)	74.2 ± 2.22 (25)*	P = 0.0239
	2014	65.3 ± 0.74 (308)	70.8 ± 2.36 (23)*	P = 0.0318	61.2 ± 1.38 (67)	68.5 ± 2.67 (13)*	P = 0.0330
Exams	2013	59.1 ± 0.7 (382)	66.0 ± 1.8 (50)*	P = 0.0015	56.9 ± 1.8 (48)	62.3 ± 2.9 (25)	P = 0.1005
	2014	57.4 ± 0.8 (308)	64.4 ± 2.9 (23)*	P = 0.0108	52.4 ± 1.1 (67)	56.5 ± 3.3 (13)	P = 0.1688
Ongoing assessment	2013	77.2 ± 0.7 (382)	80.6 ± 1.5 (50)	P = 0.0800	83.0 ± 1.8 (48)	88.2 ± 2.1 (25)	P = 0.1151
	2014	75.9 ± 0.7 (308)	80.2 ± 1.9 (23)	P = 0.0791	76.5 ± 1.4 (67)	86.4 ± 2.2 (13)*	P = 0.0040
Tutorials	2013	83.8 ± 0.7 (382)	84.9 ± 2.4 (50)	P = 0.7874	85.2 ± 2.2 (48)	90.4 ± 2.1 (25)	P = 0.1621
	2014	82.9 ± 0.8 (308)	87.3 ± 2.0 (23)	P = 0.1044	90.9 ± 1.1 (67)	97.7 ± 0.3 (13)*	P = 0.0045
Assignment	2013	74.2 ± 0.5 (382)	78.0 ± 1.2 (50)*	P = 0.0195	83.8 ± 1.6 (48)	86.0 ± 2.3 (25)	P = 0.5092
	2014	74.4 ± 0.6 (308)	73.2 ± 2.8 (23)	P = 0.5775	64.5 ± 1.6 (67)	75.0 ± 4.1 (13)*	P = 0.0045

Each value is the mean ± SEM. Number in brackets is the number of students.

* Indicates that the result for the attending students is significantly higher than for non-attending students, and the P values are from the Student's unpaired t-test.

As there were low numbers of attending versus non-attending students in the pharmacology unit, and only small differences between groups, this may have been the reason the differences did not reach significance. To increase the numbers of students, we combined the pharmacology data for attending and non-attending nursing students in 2013 and 2014 (Table 3).

Table 3: Combined pharmacology outcome data for lecture attending and non-attending nursing students at the city and regional campuses for 2013 and 2014

	City campus			Regional campus		
	Non-attending	Attending	P-values	Non-attending	Attending	P-values
Grade	4.76 ± 0.04 (700)	5.30 ± 0.04 (73)*	P < 0.0001	4.54 ± 0.08 (115)	5.26 ± 0.16 (38)*	P < 0.0001
Overall mark	66.2 ± 0.46 (700)	71.7 ± 0.41 (73)*	P = 0.0002	64.0 ± 1.11 (115)	72.1 ± 1.74 (38)*	P = 0.0002
Exams	58.0 ± 0.5 (700)	65.4 ± 1.8 (73)*	P < 0.0001	56.9 ± 1.4 (115)	62.5 ± 1.7 (38)*	P = 0.0126
Ongoing assessment	76.5 ± 0.5 (700)	80.5 ± 1.5 (73)*	P = 0.0135	79.2 ± 1.2 (115)	87.6 ± 1.5 (38)*	P = 0.0002
Tutorials	83.4 ± 0.5 (700)	85.5 ± 1.7 (73)	P = 0.2196	87.9 ± 1.0 (115)	90.0 ± 1.7 (38)	P = 0.2690
Assignment	74.3 ± 0.4 (700)	76.2 ± 1.3 (73)	P = 0.1415	73.4 ± 1.6 (115)	85.1 ± 2.3 (38)*	P = 0.0002

Each value is the mean \pm SEM. Number in brackets is the number of students

* Indicates that the result for the attending students is significantly higher than for non-attending students, and the P values are from the Student's unpaired t-test.

After combination, the attending nursing students undertaking the pharmacology unit at both the city and regional campuses had higher final outcomes in grades, overall mark, examination mark and ongoing assessment mark than the non-attending students (Table 3). However, the results for the ongoing assessment remained ambivalent, with all being higher, but only the assignment marks at the regional campus being significantly higher for attending versus non-attending students (Table 3).

Discussion

This preliminary study, based on the attendance of students at one lecture in each unit, suggests that nursing students attending lectures in bioscience and pharmacology have better overall academic outcomes (grades) than students who do not attend lectures. A positive relationship has previously reported between lecture attendance and overall academic outcomes for nursing students (Hamen & Kelland, 1994; Brown et al., 1999; Salamonson et al., 2009). Prior to the general availability of lecture recordings, when textbooks and practicals were the main source of material, other than lectures, it was considered that it was the repeated and extensive contact with information in lectures, which led to the improved academic outcomes with lecture attendance (Credé et al., 2010).

None of the previous studies with nursing students report on the relationship between lecture attendance and the components of academic outcomes. Thus, the present study is the first to suggest that lecture attendance may be associated with better academic outcomes in both examinations and ongoing assessment. The better outcomes in the ongoing assessment was more definite for the bioscience unit and was smaller, and not always significant, in the pharmacology unit. The reason for the better outcomes in ongoing assessment has not been determined. One possibility is that students attending lectures have higher entry scores than those that do not attend, and consequently have better outcomes in both examinations and ongoing assessment. None of the studies with nursing students of the association between lecture attendance and academic outcomes have tested this, and neither have we. However, although the multi-disciplinary meta-analysis by Credé et al., showed that taking grade point average into consideration reduced the strength of the association between lecture attendance and academic outcomes for 9, 243 students in 33 studies, it did not fully explain the association, and an association remained (Credé et al., 2010). A second possibility for the better outcomes in the ongoing assessment by students who attended lectures, is that, as the tutorials in bioscience and pharmacology were designed to reinforce the lecture material, the better outcomes were also due to the repeated and extensive contact with information in lectures. These possibilities need to be tested.

The three previous studies with nursing students showing an association between lecture attendance and academic outcomes were in the absence of lecture recordings (Hamen & Kelland, 1994; Brown et al., 1999; Salamonson et al., 2009). The present study supports that this relationship remains for nursing students when lecture recordings are available.

Studies of non-nursing studies in science subjects with lecture recordings have had mixed results with three studies showing a positive relationship between lecture attendance and academic outcomes (Fernandes et al., 2008; Soto & Anand, 2009; Horton et al., 2012) and two

showing no relationship in some units (Davis et al., 2012; Azab et al., 2016). The reason for this discrepancy for non-nursing students is not clear-cut, and the present study does not clarify the reason for this discrepancy, but does suggest that for nursing students studying science, it is probably important to continue to provide face-to-face lectures, as students that attend lectures outperform those that do not. Further studies are required to clarify why this occurs.

The findings in this study are quite similar for the units in bioscience and pharmacology, despite the differences in the make-up of the ongoing assessment. Thus, the bioscience unit, but not the pharmacology unit, had a laboratory component as part of the ongoing assessment. Previously, it has been suggested that the provision of laboratories may improve the relationship between lecture attendance and academic outcomes (Credé et al., 2010), although this has not been tested. The present study does not support this suggestion as the relationship between lecture attendance and academic outcomes was similar for the unit with (bioscience) and without (pharmacology) laboratories. Thus, further studies are needed to determine whether the provision of laboratories is a determinant in the relationship between lecture attendance and academic outcomes.

Although lecture recordings were available to the nursing students in our study, we do not know whether they were used by the students. This is consistent with several previous studies of the relationships between lecture attendance and academic outcomes, where lecture recordings were available (Soto & Anand, 2009; Davis et al., 2012; Azab et al., 2016). Previous studies with non-nursing students (Fernandes et al., 2008) that did monitor the use of lecture recordings showed that the student with access or use had significantly poorer overall academic performance than those without access. Thus, further studies need to be undertaken, where the use of lecture recordings by the students is monitored, to determine whether using lecture recording is a positive or negative factor in the relationship between lecture attendance and academic outcomes.

There are major limitations to the present study. The main ones are a consequence of the study not being designed for purpose, but using data collected in the process of another study (Doggrell & Schaffer, 2016). This led to the following limitations; firstly, attendance was only collected once and this was late in the semester. Thus, there is not a record of attendance throughout the semester. It was obvious to the lecturers, that the attendance late in the semester was lower than at the start of semester. One factor that may have contributed to this, is that some of the nursing students were required to do placements late in the semester, and these students, who may have normally been attending or non-attending students, were classified as non-attending students in our study.

Secondly, there are limitations to the classification of students as non-attending in the bioscience unit. The record of attending and non-attending students for the collection of IDs in the pharmacology unit, and for the attending students in the bioscience lecture collection is correct. In contrast, not all students attending the bioscience lecture completed the quiz and gave their IDs. However, $\geq 80\%$ students attending the bioscience lecture did give their IDs, and are classified as attending students. The remaining $< 20\%$ of attending students who did not give their IDs, have been classified as non-attending. This means that up to 10 students at the city campus and up to 6 students at the regional campus who attended lectures, but did not respond to the quiz, may have been classified as non-attending, when they actually attended the lectures. Given, that there were much larger numbers of students in the non-attending groups (city; 2013, 312; 2014, 273; regional; 2013, 52; 2014, 47) than in the attending groups (city; 2013, 48; 2014, 23; regional; 2013, 27; 2014, 15), it is unlikely that the classification system would have had a major effect on the significance testing. The data for the

pharmacology unit did not have this limitation, and clearly showed that despite the provision of lecture recordings, the attending nursing students had better outcomes than the non-attending students.

Thirdly, attending students were subjected to a brief quiz which tested the recall of their knowledge in gastrointestinal physiology (bioscience) or introductory microbiology (pharmacology) from a unit undertaken 16 months previously. Although the results of the quiz were not discussed with the students, it is conceivable (but unlikely), that undertaking this quiz may have contributed to their better academic outcomes in the quiz subjects in the bioscience and pharmacology units, compared to non-attending students. Also, any contribution to better outcomes in the bioscience and pharmacology units, would have been limited to after the quiz was undertaken, which was late in the semester.

In conclusion, for nursing students studying science, despite the availability of lecture recordings, our preliminary study shows that it may be important to continue to provide face-to-face lectures, as students that attend lectures outperform those that do not. As part of this, it is important that impediments to lecture attendances such as student placements or timetable clashes be avoided. Further studies are required to clarify whether the findings of this study with nursing students apply to other students, and why the positive relationship is maintained despite the availability of lecture recordings. As previous evidence has suggested that it is the repeated and extensive contact with information in lectures that leads to improved academic performance, consideration should be given to whether this repeated and extensive contact with information can be delivered in other forms than lectures e.g. flipped classrooms, to give improved academic outcomes.

Based on this preliminary study, we have ongoing studies, where we are planning to monitor lecture attendance and the use of lecture recordings on a weekly basis, survey the students on these, and correlate with academic outcomes. These ongoing studies have both nursing and science students enrolled.

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