

Long term study of attendance rates in a civil engineering unit of study

Tim Wilkinson

School of Civil Engineering, The University of Sydney
Corresponding Author Email: tim.wilkinson@sydney.edu.au

SESSION: C1: Integration of theory and practice in the learning and teaching process

CONTEXT: The author has been collecting attendance lecture and tutorial data in a 2nd year civil engineering core unit of study for nearly 15 years. The paper investigates any correlation between performance and attendance, and also seeks to consider the impact of international status and previous results. The timeframe of the study intersects with the introduction of lecture recording, and will seek to investigate if there is any noticeable impact on attendance caused by that technology.

PURPOSE: This paper will provide long term data on student attendance rates and examine possible correlation with technology introduction and student performance.

APPROACH: Attendance data over many years has been taken via the setting and collection of (on average) 9 non-assessable formative tasks in random lectures during a typical semester (3 lectures a week × 13 weeks) for over 15 years. It is also possible to correlate that data (in selected year) with student demographics. Individual lecture recording usage was obtained from the analytics of the Lectopia or Echo360 software. Lecture recording commenced mid way through the collection period, so it is possible to assess the impact of that technology.)

RESULTS & CONCLUSIONS: The main observations appear to be consistent with findings of similar much shorter term studies, but the added strength of spanning 16 years. There has been slow and steady decline in lecture attendance, with no evidence of changed rate of declined cause by the introduction of lecture recordings. The decline in average live attendance appears to be caused by increasing cohort who attend a minimal number of lectures, rather than the entire cohort attending slightly less. Only a small percentage of low attending students make significant use of recordings.

KEYWORDS Attendance, lecture recording, student demographics

Introduction

Anecdotally, the introduction and increased usage of lecture recordings at university causes concern in teaching staff will not get the full details of a topic, lose the opportunity to ask questions, and increase surface learning if students cram an entire course by watching an entire semester of lectures in the final week. There have been many studies on student attendance, but most are short term snapshots on 1 year only. This paper reports on attendance data spanning 16 years and including the introduction of lecture recording technology, and is able to link at individual student level relationships between live and recording lecture attendance or viewing.

Previous studies, research and data on attendance rates

Since the introduction of electronic media for educational purposes, there have been many studies on the impact on attendance, and relationship with marks. It is not the intent of this paper to provide a comprehensive literature review.

A number of papers provide analysis of multiple studies. For example:

- Gyspers et al (2011) examined other studies from 2004-2010, observing “Whilst some studies report reductions in attendance of 10-33%, the majority have found no difference in attendance pre- and post-WBLTs [web based learning technologies]. Indeed, most students who make extensive use of WBLTs also attend lectures.”
- Kinash et al (2015) studied 30 papers between 2007 – 2012, with some key observations such as “the evidence is compelling in that there is significant agreement between multiple studies that students who have access to online lectures will continue to come to class.” and “some studies have produced empirical support for the argument that students who attend lectures achieve higher grades, this is contradicted by a number of other studies.”

Most individual studies are either survey based, or make use of limited and shorter term analytic data from learning management systems, but usually do not have the specific data to link lecture attendance, on-line video usage and marks at individual student level, eg:

- Yeung et al (2015) reported on a single year in a big first year unit of study observing “Non-frequent attendees were more likely not to use lecture recordings (48.1%) to make up a missed lecture than frequent attendees (34.3%).”
- Panther et al (2012) is an example of a more qualitative, self selected survey group focusing on how students used resources rather than whether they were used at all, observing. “Students who are able to attend face-to-face lectures identify the intangible experience of the live lecture as important, including the potential for interactions in real time and space.”

However, the current author has not yet been able to find studies on attendance rates over an extended period that cover pre and post lecture recording era, and can link individual student data on live and recorded lecture attendance or viewing.

About the unit of study

General

The unit of study is CIVL2201 Structural Mechanics taught at The University of Sydney. It is a 2nd year compulsory unit for undergraduate students in civil engineering. Since 2009, a small number of postgraduate students in a professional masters degree have enrolled in this unit. They represent a small number of students (approximately 6% in 2017). Since 2013, a small number of non-engineering students doing an undergraduate degree in project

management have enrolled in this unit. They represent a small number of the total cohort (approximately 5% in 2017).

The unit of study has had the same (sole) lecturer/coordinator since 2001. There are 3 × 1 hour lectures and 1 × 2 hour tutorial per week for 13 weeks.

Syllabus

The syllabus is fairly typical of any engineering subject called “Strength of Materials”, ‘Mechanics of Solids’ or “Structural Mechanics”. Specific content includes simple bending moment diagrams of determinate beams, stress and strain under axial force, bending moment, shear and torsion, beam deflections and buckling.

The pre-requisite is a unit in fundamental statics (force and moment equilibrium of 2D and 3D bodies under forces and moments). The derivation of theory makes limited use of first year university mathematical content (eg PDEs or matrices) but use or mastery of such content is barely required for assessment tasks nor an issue that would impact a student’s ability to pass. A sound and competent knowledge of high school maths (eg trigonometry, single variable calculus, quadratics and cubics, physical units) is seen as critical pre-requisite knowledge.

Teaching style

At least initially the unit might be classified as a typical “chalk and talk” subject. The teaching mode was more traditional, using overhead projection with gaps in the notes that were filled in during class. Over the years, the mode has approached more of what is perceived as the “flipped classroom” with much more emphasis during lecture time on asking and answering “why”, and trying to convey structural engineering concepts qualitatively, rather than quantitatively. There is substantial use of live props (which are not recorded), and computer animations (which students can download). The lecture recording process does not provide a good replacement for the lecture experience (in the humble opinion of the author). The unit of study is usually in the top 2 or 3 across the faculty in student surveys for large units with enrolments over 100 students.

Demographics

Table 1 shows the year by year demographic distribution of students. Total enrolments have almost quadrupled over a 10 year period from 2002 to 2012 and remained reasonably stable since. Enrolment numbers are slightly skewed due to a fairly consistent failure rate of about 30%, and taking into account students who drop out, about 20% of enrolments are repeat students. Female enrolments remained steady from 2002-2010 at approximately 17%, but there has been a very encouraging increase in female participation from 2010 to 2017 to nearly 30%.

In the last 7 years there has been a consistent increase in international students, with about half of the 2017 class being international. For the sake of simplicity, Australian permanent residents were classed as “international” on the assumption that they had arrived in Australia only “recently” prior to enrolment. They represent a small number (3 % in 2017). Mainland Chinese nationals represent about 85% of the international student body and therefore NESB. Other internationals originate from English speaking or English schooled countries such as New Zealand, India or Singapore.

Table 1: Year by year demographic distribution

Year	Total Students	Female %	International %	Lecture Attendance %
2002	100	17%	5%	57%
2003	116	17%	20%	63%
2004	127	17%	20%	69%
2005	158	17%	26%	60%
2006	193	15%	22%	52%
2007	216	14%	21%	68%
2008	239	17%	21%	61%
2009	261	18%	18%	64%
2010	288	19%	23%	52%
2011	368	23%	31%	55%
2012	373	25%	37%	57%
2013	351	21%	33%	57%
2014	358	21%	37%	63%
2015	395	24%	41%	52%
2016	425	26%	43%	54%
2017	358	29%	55%	42%

Data

Lecture attendance

Lecture attendance was logged through the submission of (non assessable) formative tasks during lectures. While teaching a new concept, students would be asked to do a quick sample question (approximately 10-15 minutes). The question is designed to be simple, and a student is encouraged to follow the format and process of an example done just prior with only minor modification to the working provided in class. Students submitted their answer at the end of the class, and submissions were logged.

Attendance for a given year is reported as a single percentage value, namely the total number of submissions divide by {the number of students × the number of tasks}. In the first year of the study (2002), the number of tasks was 4. From 2003-2017 the number of tasks per semester varied from 8 to 13, with the average number per year being 9. The first task is usually in Week 2 of the semester. Anecdotal observation is that there a number of students who attend the very first lecture in week 1, and then are subsequently absent. Such a student is classed as having “zero attendance”. Tasks are on random days during the week, so individual student data ought not be influenced by systemic issues such as a clash or a work commitment on a single day of the week.

There is some scope for error in the attendance data. Some students submitted multiple forms in class with the names of absent colleagues (under the mistaken assumption that these submissions were worth marks or influence final grade). During post semester interviews with failing students, when asked about low attendance, some students have claimed “I was there, but I just forgot to put in the piece of paper”. It is believed any impact of such uncertainties is small and unlikely to change year by year trends.

The author of this paper believes this process of attendance is a point of difference to some previous studies, which have relied on self selection and honesty by a student in a survey response. Since the attendance data is at individual student level, it then can be directly compared to other specific data.

Lecture Recording Usage

The University of Sydney first trialled lecture recording in Semester 2 2008 with the Lectopia system. This unit of study volunteered as an “early adopter” of the system in Semester 1 2009, and has used it ever since. The Lectopia system was superseded by Echo360 in 2014. Until 2014, use of video recording was voluntary, but university policy changed in 2015 for all lectures to be recorded.

Lecture recording records the lecturer’s voice, and whatever is being displayed through the projector system (usually in built PC, the lecturer’s laptop, or the electronic visualizer). The system does not record the live lecture experience (that is the lecturer themselves nor their actions), not any writing on a non-electronic medium (whiteboard or chalk). The lecturer for this unit does make use of non-electronic teaching resources in class that are not captured. There are also substantial lecture notes and tutorial questions and solutions, and it is likely many students rely solely on those resources rather than some combination of live or recorded lectures.

Both Lectopia and Echo360 provided student usage data in the form of the total number of separate videos “watched” by each student. There is uncertainty in this data:

- Echo360 reports usage data on mobile devices may not be logged correctly.
- There is no information on how long a student watched one particular lecture.

Results and discussion

Attendance Rates

Table 1 gives the attendance rate of 4327 students by year over a 16 year period from 2002 to 2017. The data is broken down on a year by year basis by gender (Figure 1) or international status (Figure 2). Figure 3 gives attendance rate distributions (in 10 % blocks) over 3 spread out years.

Key observations from this data are:

- There has been a gradual, and reasonably consistent decline in lecture attendance. The regression trend slope is almost identical for the entire cohort, or subgroups (male, female, international or local).
- Individual year attendance rates can be influenced by external factors. For example, 2010 had one of the largest year to year drops in attendance. This was the one and only year in 16 years that lecture times were at 9 am instead of 10 am.
- Female attendance rates are about 6% higher than for males.
- Local student attendance rates are about 4% higher than for international students.
- While not shown, attendance rates for repeating students were about half that of “first timers”.
- Lecture recording was introduced in 2009 for this unit, and became compulsory for all units in the university in 2015. There is no evidence of a sudden drop in attendance on a year by year basis, nor a sharper linear regression associated with the introduction of lecture recording.
- Since attendance rates have dropped, clearly the histogram data (Figure 3) will show drops in higher attendance rate bands and increases in lower attendance rates bands. Looking more closely, the shift is caused more by a notable increase a subset of students significantly reducing their attendance, rather than most students slightly dropping their attendance. There is quite a substantial cohort (19% of first timers) attending zero lectures in 2017, whereas that cohort was non-existent in 2012.

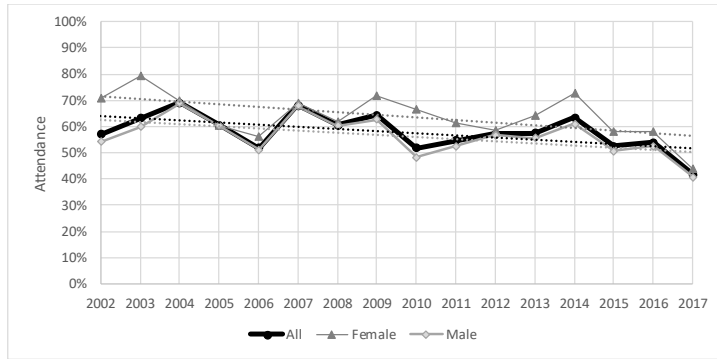


Figure 1: Year by year attendance rate by gender

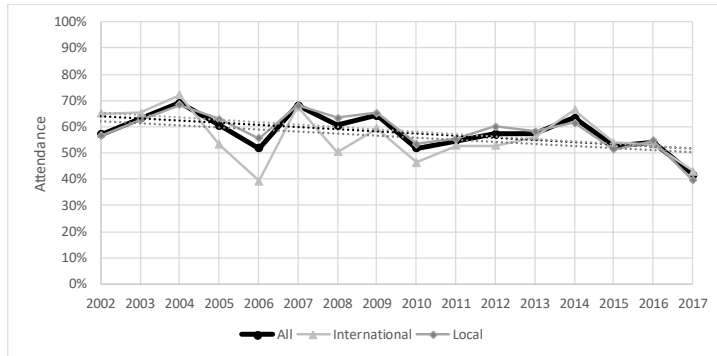


Figure 2: Year by year attendance rate by international status

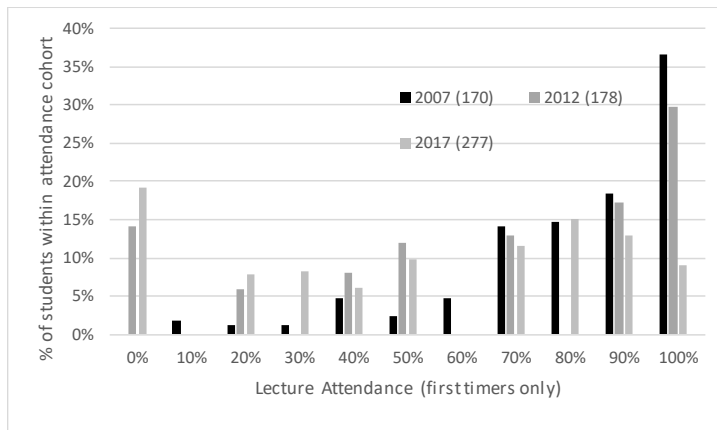


Figure 3: Attendance distribution (first timers only) in selected years

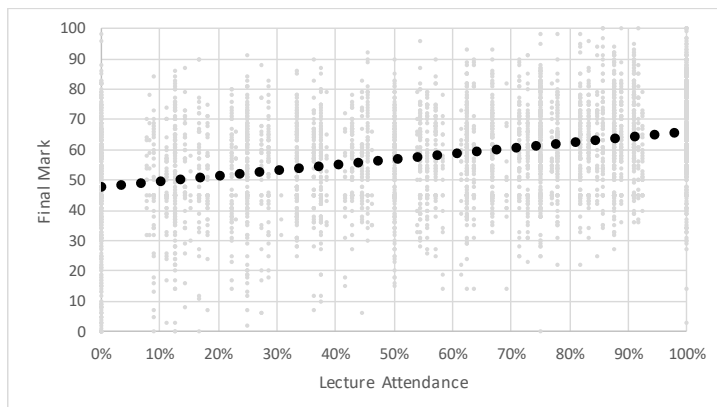


Figure 4: Lecture attendance vs final mark (2002 - 2017 aggregated data – 4327 students)

Figure 4 gives the distribution of lecture attendance vs marks across the 16 years of the study. There is significant scatter of results but there is some level of correlation ($r = 0.36$). One must be mindful that “correlation does not indicate causation”, and hence attendance *per se* is not the factor that ensures good final grades. However, reasonably common factors in both attendance and performance are motivation and engagement (Massington and Herrington 2006).

Lecture recording usage

As mentioned above, lecture recordings were introduced in 2009. There is no evidence of a sudden drop in attendance on a year by year basis, nor a sharper linear regression associated with the introduction of lecture recording.

However, lecture recordings does cause much anecdotal concerns amongst teaching staff, most frequently along the lines of “if they watch online, they won’t get the full nuanced experience of attendance and cannot ask questions.” If anything, the presence of recordings can allow keen (or confused) students to replay certain segments of a lecture.

Figures 5 and 6 have mapped lecture attendance and recording usage at an individual level. The key observations from this data are:

- From 2009-2016, approximately 60% of students in a given year watched at least one recording. In 2017 this jumped to 75%.
- From 2009-2016, the number of students in each year who watched more than 50% of lectures was low – each year ranging from 1 % - 6 %. There was a notable jump in 2017 when 12 % watched at least half the lectures.
- Very few students watch (nearly) every lecture – only 1.5% had lecture watching of 90% or higher.
- It is rare for non-lecture attending students to watch a large number of recordings. Half of the (first attempt) zero attendees watched 10% or less of online recordings.
- It is very rare for high attending students to watch many videos (eg only 5% of 100% attendees watch more than 30% of videos), but students with good attendance are still watching some videos (eg 20 % of the students with at least 60% lecture attendance watch at least 10% of the videos).

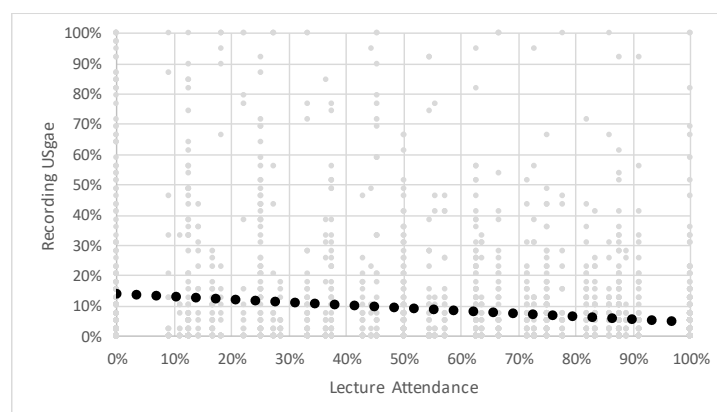


Figure 5: Lecture attendance vs recording usage (2009 - 2017 aggregated data – 2786 students)

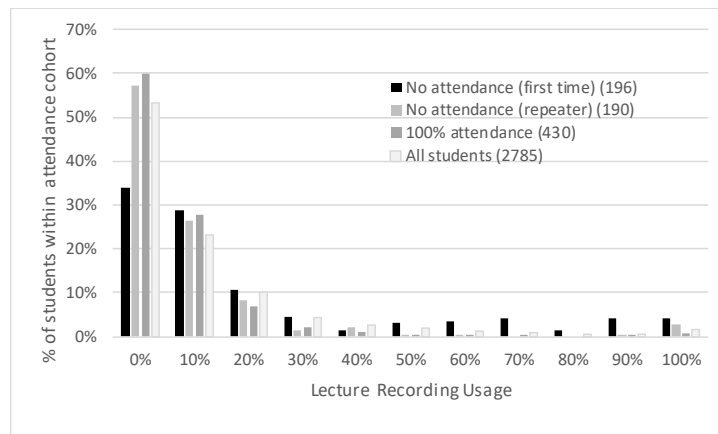


Figure 6: Distribution of lecture recording usage for various attendance cohorts (2009 - 2017 aggregated data – 2786 students)

Conclusions

This paper has presented long term data linking individual student lecture attendance, recorded lecture viewing, and marks. The main observations appear to be consistent with findings of similar much shorter term studies, but the added strength of spanning 16 years. This paper, combined with others on attendance, can aid other teaching staff in making decisions around assessment and teaching methods from the following points:

- There has been slow and steady decline in lecture attendance, with no evidence of changed rate of decline caused by the introduction of lecture recordings.
- Only a small percentage of low attending students make significant use of recordings.
- The decline appears to be characterised by increasing percentage who attend a minimal number of lectures, rather than the entire cohort attending slightly less.
- Given other studies show student comments about the benefits of being able to revise or catch up on missed content, this author concludes that lecture recordings alone are not a cause of reduced live attendance rates, and that an engaged value added lecture is the best approach for maintaining student interest.

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