Learning and teaching in summer: is it better and why?

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Abstract: *There is some anecdotal evidence that students taking first year mathematics and statistics units have superior learning outcomes and overall course satisfaction by completing these units at Summer School rather than during the standard term-time. This paper examines some of the issues and evidence, with the intention of initiating scholarly enquiries that investigate reasons and influences for improved performance and the success or otherwise of intensive courses in general. Such enquiries should be encouraged: findings may have implications for giving students appropriate advice, particularly for those at risk, and also for improving teaching practices and the quality of learning generally and, in particular, during term-time.*

Introduction

The academic histories of mathematics and statistics students enrolled in Summer School at the University of Sydney reveal astonishingly high median increases, over several core units, in the final mark for those that failed the corresponding unit in term-time and then attempted it again in Summer School. A number of reasons for this may be postulated, and then tested in a variety of ways, using, for example, Unit of Study Evaluation (USE) survey data and interviews with students and staff. For this preliminary study, in particular, this paper benefits from the experience of three of the authors who have taught in both Summer School and term-time. One of the authors has extensive experience teaching mathematics and statistics in term-time and has been the Director of the Summer School Mathematics and Statistics Program in recent years. We have distilled, and offer below, what we believe could be useful questions or starting points for interviews with staff in subsequent research, and could be applicable to any area of study.

Three of the authors work in related disciplines in the agricultural sciences that require students to successfully complete mathematics. Some of these students enter the tertiary scene relatively unprepared or with weaker backgrounds than the main student cohort, and are particularly sensitive to issues raised in this paper. Such students have much to gain from teaching and learning environments such as those provided within Summer School, and from appropriate advice or early planning of pathways through their degrees. The views of such students and their ongoing experiences might provide valuable material for a future study.

This is a preliminary study as part of a research project (Reference Number 07-2009/11959) approved by the Human Research Ethics Committee of the University of Sydney.

Conceptual frameworks

The practical and comparative outcomes of Summer School and term-time provide fertile soil for examining several conceptual or theoretical models of teaching and learning by a range of authors, to which we briefly allude in this section, any one of which could be amplified into an interesting paper or discussion in its own right.

The concentrated framework and abbreviated six to eight week period of Summer School (including examinations) highlight degrees of *simultaneity* (Prosser and Trigwell (1999)) in student awareness of prior experiences, perceptions of learning contexts and outcomes, and the need for instructors to be flexible and accommodating. Rogers (1967), in his relational, client or student-centred approach that sees *facilitation of learning* as the aim of education, discusses three seminal qualities: *realness*, a quality of the instructor, and *prizing* and *empathy*, qualities that are intrinsic to the relationship between the teacher and student. Many Summer School lecturers appear to possess all of these qualities, in addition to the characteristics identified by

Scott (2003) in high-quality 'intensive' courses: *enthusiasm, accessibility* and *excellent communication skills*. Student motivation is a subtle phenomenon and can be destroyed by insensitive teaching. Extra effort is required to steer failing students away from approaches that do not lead to successful outcomes, and the relative success of Summer School courses may relate to features in common with *constructive alignment* (Biggs and Tang (2007)): students are able to find their own levels and construct their own learning against clear outcomes and criteria, supported by sleek and efficient resources and almost immediate feedback. Even the weakest students, who fail in term-time, surprise themselves with improved confidence, deepening engagement with the subject matter and outstanding learning outcomes. Many of these students appear to 'switch on' and get carried away, in the sense that Robinson (2009) describes as *being in 'the element'*. When this occurs, the issue of failing becomes subsidiary or even irrelevant as students seek and expect mastery of the material. Pirsig (1974) attempts to classify personalities of learners as either *classical* (strategic, technical and analytical) or *romantic* (intuitive and focusing on beauty and aesthetics) and discusses at length the elusive notion of *quality*, the experience of which embraces both classical and romantic viewpoints. One may investigate the extent to which Summer School units produce quality experiences and outcomes and whether, in the compressed time available, an appropriate balance is achieved between technical and aesthetic aspects.

Failure, particularly in term-time, may be related to syndromes in which less strategic learners become overwhelmed and adopt disintegrated approaches (in the sense of Meyer, Parsons and Dunne (1990)), by contrast with lack of effort or motivation. There are moments of paralysis as students switch from passive roles, watching others (such as instructors or authors) do mathematics, to an active role, engaging in producing mathematics and solving problems. Easdown (2006) refers to the *passive/active interface* and suggests strategies for helping students move through this barrier. This may be related to the *challenge by choice* philosophy used by teambuilding facilitators (Rohnke (1989)) and often placed in the context of *zones* (Pennsylvania State University (2002)). At the centre is the *comfort zone*, which may be pleasant but not where real learning or development takes place. The facilitator's task is to entice the student into the *stretch* or *growth zone*, but not as far as the *panic zone*, where irreversible physical or psychological damage may occur. If activities and assessment are properly aligned then the student is in an excellent position to construct his or her own learning and reach maximum potential. One may argue that this potential is not realised in environments where the teaching is in the nature of *Theory 1 (teaching as transmission or telling)* or *Theory 2 (teaching as organising activity)* rather than *Theory 3 (teaching as making learning possible)* in the sense of Ramsden (2003).

Comparative performance

We compared the results of students taking at least one of the four Summer School units after failing the same unit in term-time. These units, denoted *Courses 1*, *2*, *3* and *4* respectively, were chosen because they involve relatively high numbers of students (except possibly *Course 4*) and represent a spectrum of topics offered in mathematics and statistics in both term-time semesters, and at different levels. *Courses 1* and *2* presume the equivalent of HSC Mathematics with Extension 1, whilst *Courses 3* and *4* presume the equivalent of HSC Mathematics (without Extension 1). *Courses 1* and *3* are offered in first semester whilst *Courses 2* and *4* are offered in second semester in term-time. All of these are core mathematics units taken by the bulk of science students and by a range of students from other disciplines, such as engineering, economics and business, education and agricultural science. (There are more advanced versions of these units also in term-time that are not offered at Summer School.) For each student that failed the unit in term-time we calculated

$$D = \text{Difference} = (\text{Final Grade at Summer School}) - (\text{Final Grade in Term-Time}),$$

where Final Grade refers to the final numerical result (out of 100) returned to student records for that particular unit. We excluded students, regarded as outliers, who had received a mark

below 25 either in term-time or in Summer School, or had made more than one attempt at the unit in term-time or at Summer School. The table below summarises statistics for *D* for each of these units, where *N* denotes the number of students and IQR is an abbreviation for interquartile range. The most notable feature is the median increase in the final mark, ranging from 16.5 to 26. One might expect or hope that a student performs better on a second attempt at a unit. However, for an increase of 20 or more marks, this can represent an improvement from outright Fail to a high Pass or Credit. For those well above the median this can represent an improvement from Fail to Distinction or even High Distinction. Shifts of this magnitude at second attempts at units are rare in term-time and it could be one of the aims of a future study to quantify just how rare. The median is a good measure of central tendency to consider because it is not distorted by values of outliers.

Statistics for *D*	*Course 1*	*Course 2*	*Course 3*	*Course 4*
N	26	23	10	5
Min	-16	-5	9	15
Max	35	40	35	33
Median	21	22	16.5	26
Mean	18.7	21.9	18.4	24.0
IQR	8 (16-24)	14 (17-31)	4 (16-20)	15 (16-31)
Std Dev	10.2	12.4	7.1	8.2

Descriptive statistics of grade differences between term-time and Summer School

A number of possible causes for this median increase need to be considered or ruled out, such as cheating or favouritism, different standards of assessment, or lecturers ‘teaching to the test’. Even if undetected in isolated cases, cheating is unlikely to account for such large general movements in data. One cannot rule out bias in marking examination scripts or assessment tasks, particularly when Summer School lecturers get to know students quite well on an individual basis. However, unintentional bias would tend to permeate the entire cohort and then the overall effect, if any, might disappear by adherence to overall grade proportions following strict University guidelines. A more in depth study also would need to carefully compare the overall qualities of the Summer School and term-time cohorts, in case that influenced the cut-off points for higher grades, by, for example, putting downward pressure on the credit or distinction cut-offs when the cohort is weaker. There is no evidence that Summer School lecturers show favouritism in allocating grades to students based on their prior record and indeed it came as a complete surprise to the Director, who makes the final recommendation about cut-off points for grades without any personal knowledge of the students, that many students receiving credits and distinctions had been experiencing difficulties passing at term-time. There is some fine adjustment, typically around the pass-mark margin, involving special considerations and therefore personal knowledge of students, but in all such cases this has no effect on the median increases noted above. The bulk of the final grade in any given unit (typically 70 per cent) relies on written examination, conducted under rigorous examination conditions, and is designed on the term-time equivalents. This study did not consider the fine detail of the continuous assessment components (typically about 30 per cent of a given unit), and further work needs to be done to tease out any possible influences these might have on the statistics calculated above for the overall grades. The question of ‘teaching to the test’ is quite subtle (Bond (2009)) and also deserves further investigation. However there is no conclusive evidence that students in Summer School receive more overall guidance than term-time students, who have access to webpages with past examination papers and solutions and personal pre-examination consultations with lecturers. Term-time students also typically have a revision week (Week 13) focusing mainly on examination preparation; this is not available to Summer School students

(who lose the equivalent of term-time Week 13 in compressing the first 12 weeks into 6 weeks of classes), and should work against the trends noted above in the data.

There seems to be little doubt that there is a substantial qualitative difference, perhaps in their learning or understanding, or in their diligence, approach to study or examination preparation by this particular cohort of students. Further investigations are warranted, to see if this phenomenon is replicated in other years, and on wider subclasses of students. Student interviews and data on performance in subsequent years might also provide further insight as to the dynamics and perceived influence or otherwise of the different learning environments.

Unit of study evaluations and student comments

Unit of Study Evaluation (USE) survey data were available for eight units of study taught in Summer School 2008 (152 completed surveys from 297 students). These provide a variety of student perspectives on Summer School teaching and learning. Evaluations were highly favourable according to mean scores on a Likert scale (from 1, strongly disagree, to 5, strongly agree):

- Teaching helped me to learn effectively: 3.7 — 4.7,
- Staff were responsive to feedback: 3.5 — 4.3,
- Feedback helped me to learn: 3.4 — 4.0,
- Understood teaching staff clearly: 3.4 — 4.5,
- Overall course satisfaction: 3.4 — 4.4.

Scores over 4.5 are very rare, but scores from about 3.5 – 4.0 are quite typical in term-time. (A score below 3.0 is very rare and regarded as a flag by the Faculty of Science that something serious might need fixing.)

Open-ended comments were collated into the following broad categories and classified as either positive or negative within each category: (a) feedback and assessment (61 positive, 52 negative); (b) learning outcomes (52 positive, 15 negative); (c) content and pace of teaching (78 positive, 36 negative); (d) staff attitudes (65 positive, 19 negative). Regarding category (d), students often focused on staff attributes such as being ‘patient’, ‘helpful’, ‘approachable’ or ‘engaging’. The attitudes of staff were seen as important and contributed to a commonality of purpose, with comments such as:

> Staff clearly showed a great desire to see you do well.

When negative comments were given about staff, these often related to their pace of teaching or their use of particular teaching tools. This may have reflected inexperience on the part of some of the lecturers, who were relatively young postgraduates. However this did not seem to affect overall course satisfaction (as shown by the USE scores) and may have been counterbalanced by the increase in empathy from having instructors so close in age and experience.

A subset of comments that specifically compared the Summer School experience with term-time was identified and collated separately. Twenty-seven students made specific, positive comparisons between Summer School and term-time, such as:

> I understood the topic much more in the summer school course then [sic] I did in the statistics course I did in semester one.

Smaller class sizes in Summer School were also viewed favourably (12 of the 27 comments). Only five students made negative comparisons between Summer School and term-time, specifically that there was too much content presented in the condensed Summer School course. The USE surveys do not explicitly ask questions about motivation, though there are opportunities for students to make relevant comments if they wish. Perhaps surprisingly, students did not comment at all about fees or issues about getting ‘value for money’, despite the need to pay fees up-front in order to enrol in Summer School courses.

Developing protocols and a template for interviewing staff

The qualities of staff teaching or facilitating Summer School courses, and the relationships between students and staff, appear to be pivotal to the success of learning outcomes. Because of this, and the overall perspective of staff on all courses, and their wider ongoing experience of academic life, a future study would benefit greatly from properly conducted staff interviews. The authors were able to practise interviewing technique on each other (authors who are Summer School staff as 'interviewees', and others as 'interviewers'). We developed and refined a list of questions and tested them 'blind' on three coauthors. The questions are generic and could be useful for any area of study. The rationale for the design of the questions is as follows:

- not more than five questions should seed an interview lasting 30 or so minutes;
- questions should be open-ended and not reveal any predetermined bias or point of view;
- there should be a balance of questions that probe
    - attitudes and approaches of the teacher,
    - attitudes and approaches of the students (from the point of view of the teacher),
    - quality of learning outcomes,
    - reaction of staff to the strengths and weaknesses of students and the variety of ways that they respond to the learning environment,
    - possibilities for lateral thinking and new or novel ideas or approaches.

A list of recommended questions for semi-structured interviews with staff that have experience both in Summer School and term-time teaching:

1. You have experience teaching both at Summer School and in term-time. Have you noticed any differences in your own approaches and attitudes to teaching?
2. Do you notice any differences in student behaviour or attitudes between Summer School and term-time?
3. Do you notice any differences in the quality of your students' learning?
4. How do you become aware of your students' strengths and weaknesses? What do you do with this knowledge?
5. Do you have any suggestions as to how we may improve the quality of student learning, both at Summer School and in term-time?

Three of the authors have experience teaching at both Summer School and during term-time and it is worth noting, even briefly, some of the most important differences from their perspectives:

- a dominant factor is the length of the Summer School course: in a six week time-frame, the material remains fresh and immediate in the minds of students;
- in teaching during term-time, failing students are seen as an anomaly, rather than as a dominant group, that become invisible in large classes and regarded as impersonal 'names on a page';
- in term-time, students are constantly 'changing gears' between 'discrete pockets of learning';
- in Summer School it is easier to integrate ideas so that material is kept resonating in their minds;
- students get lost in detail, and it is easier to provide an overall framework in Summer School courses, so that details then fall into place;
- organising information and providing appropriate structures are critical to learning.

Summary and conclusions

Several conclusions can be drawn based on the results from the activities undertaken in this preliminary research (connections with models and theories of learning in the literature, analysis of data on student results, analysis of USE surveys, and personal experience of some of the

authors). The data analysis here is restricted to students who have failed in term-time, but is consistent with the hypothesis that there might be significant differences in student results in Summer School compared with term time, with marks achieved in Summer School tending towards being considerably higher. If this hypothesis is true, and it could be tested on wider classes of students and subjects in future research, then a number of possible explanations are identified by this study. These can be tentatively grouped into four main categories:

a. Student characteristics and approaches (enthusiasm, focus and motivation).
b. Teacher's approach to teaching and learning (student-focus, empathy, more problem based learning, greater freedom, less pressure, more time in Summer School).
c. Characteristics of the learning environment (smaller class sizes, intensive schedule of lectures and tutorials in Summer School, overarching framework and structure, as opposed to isolated pockets of learning or detail).
d. Constructive alignment (in general much better in Summer School, given the higher degree of flexibility and the possibilities of pinpointing content of individual lectures/tutorials against learning outcomes).

The nature of our investigation is preliminary and suggests a number of directions for more in-depth studies, possibly with a wider range of subjects and disciplines. We hope that these early findings might provide an impetus for discussion as to how any of the most successful or effective elements of teaching and learning pertinent to Summer School can be replicated in regular term-time sessions.

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