Blended Learning in Postgraduate Applied Statistics Programs

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The term blended learning refers to an approach to curriculum development where some form of an online learning environment supports and enhances the traditional on-campus or face-to-face experience in an integrated manner (Oliver & Trigwell, 2005). Postgraduate applied statistics programs at Swinburne University of Technology adopted the blended learning almost a decade ago. This allows for flexibility in design approaches, and accommodates the range of blended learning capabilities and experience of teachers and learners. Blended learning design adopted in these programs has involved the thoughtful integration of learning and teaching approaches in both on-campus, face-to-face and online/virtual learning environments by utilising the benefits of each of these environments to enhance the student learning experience. These programs focus on designing learning interactions across formal teaching spaces, informal learning spaces and online learning and teaching spaces. This flexible approach has been well accepted among both online and on-campus students. This paper describes the blended structure adopted in the applied statistics programs at Swinburne and the feedback received from students during recent study periods.

Key Words: curriculum, flexibility, virtual, learning environment and feedback.

INTRODUCTION

Blended learning is a term increasingly used in higher education to describe the way e-learning is being combined with traditional classroom methods and independent study to create a new, hybrid teaching methodology. The main purpose of blended learning is to make learning flexible and effective for the learner. A meta-analysis by Means, Toyama, Murphy, & Baki (2013) has reported that students perform significantly worse with face-to-face only learning than with blended learning. Furthermore, student performance was found to be similar for face-to-face and purely online learning.

Statistics is always a challenge for teachers as well as learners because it involves many conceptual and mathematical concepts. It has been observed that students are more engaged with applied statistics subjects when a variety of activities are used in the different instructional methods (Biggs, 2003; Biggs & Tang, 2011; Kember & McNaught, 2007). Statistics teaching has benefited from the development of new technological resources. Several authors claim that teachers need to understand how to integrate the technology effectively within the blended learning structure to maximize its impact on student learning outcomes and support their learning (Park, 2009; Tishkoveskaya, & Lancaster, 2012; Ghahari, 2013).

From the literature review it can be seen that the term blended learning has been defined either in a broad or in a very specific way. However, all definitions of ‘blended learning’ have one common component - ‘an integration of different instructional methods’. A thoughtful integration of different instructional methods (e.g. face-to-face and online components) needs to follow a suitable design approach at the planning stage of blending (Alammary, Sheard & Carbome, 2014). After examining different processes for designing blended learning courses, Alammary et al. (2014) classified three distinct design approaches: (1) Low impact blend: adding extra activities to an existing course, (2) Medium-impact blend: replacing activities in an existing course and (3) High-impact blend: building the blended course from scratch.

At Swinburne University of Technology, the postgraduate applied statistics nested programs (graduate certificate, graduate diploma and masters) started in 1989 with about 20 on-campus local part-time students. The main vision of the programs was to focus on the practical real life based application of statistical theory, statistical tools and techniques rather than concentrating too much on the theory. The program evolved during the 1990’s with the addition of a coursework masters program and some full time students. By 2005, due to student demand, these programs were offered online, then in 2008 through Open University Australia (OUA). To satisfy the demands of different student cohorts (on-
campus and online), and the course learning objectives, the academic team employed a blended instructional approach for each of the units. The approach used in these programs can be classified as medium-impact blend, as defined by Alammary et al. (2014). Furthermore, according to Sharpe, Benfield, Roberts, & Francis (2006), iterative course redesign should consider student feedback as a critical success factor for course improvement with the medium-impact blending approach. Therefore, since 2005, at the end of every study period (semester), all units have been reviewed and updated based on student feedback and teaching panel members’ experiences.

The remainder of the paper is structured as follows: First, the structure and objectives of the applied statistics program at Swinburne is briefly discussed. Next the different instructional methods used in blended instruction are explained along with their benefits. In addition, recent student feedback on the blended learning approach is presented. Finally, some concluding remarks are given.

POSTGRADUATE PROGRAMS IN APPLIED STATISTICS AT SWINBURNE

Many professionals use statistics for routine data collection, data mining analysis and interpretation in order to assist decision-making and ongoing work-related activities. Others, who rely on research articles and reports to stay ahead of developments in their industry, require an understanding of statistical methods to accurately interpret and comprehend reported results and relationships. The broad application of statistics demands that professionals, for example psychologists, market researchers, doctors, nurses, and scientists, have a sound knowledge of the statistical methods applicable to their discipline so that the decisions they make are well-informed. Statistical techniques are regularly under review and the technology available to carry out analysis is constantly developing. As a result, many professionals find the need for further training to keep up to date with the latest developments. To help facilitate this process, Swinburne University of Technology offers flexible postgraduate programs in applied statistics that focus on practical applications. These programs develop competencies in areas ranging from practical and basic statistical knowledge at the graduate certificate level, to the development of higher level statistical and research skills at the master level. Since its inception in 1989 the Swinburne Applied Statistics programs (initially as Social and Health statistics) have built an excellent reputation as a provider of quality statistics training. In 2015 there were a total of 207 enrolled students in these programs with 47 in Graduate Certificate, 30 in Graduate Diploma and 130 in Masters program where 97% of the enrolment was domestic students. About 50% of the enrolled students were female and a majority of them are matured age with a large number of students in their late 30’s. More than half of the students work full time and are from a variety of academic backgrounds, including graduates from physical sciences, engineering, health sciences, economics, business and marketing.

The current structure of the post graduate program consists of 4 units (50 credit points) for the graduate certificate program, 8 units (100 credit points) for the graduate diploma program and 16 units (200 credit points) for the master’s program, as shown in Figure 1. A major objective of the initiative taken in 2005 to adopt blended tuition was to provide students enrolled in the same courses, but in different modes, with exciting, innovative and flexible opportunities for engaging in learning, to achieve unit and course outcomes with career relevance while gaining life-long learning and development skills and having a positive university experience. For this purpose, initially the programs were reviewed and redesigned to implement learning interactions across formal teaching spaces, informal learning spaces and online learning and teaching spaces through a medium-impact blend approach. This approach has been appropriate for these programs and has been greatly helped by instructors with prior long-term face-to-face experience in teaching the traditional courses. Also, the instructors have excellent technological knowledge for online teaching and have had great support from the university. It is important to note that these changes have not been made overnight, rather they have occurred through an incremental replacement approach involving excellent institutional support which includes technical, technological training, educational designers and workload allocation.

A deeper look at the units’ and programs’ objectives were considered before selecting those educational technologies that would best meet the students’ requirements. To reach a harmonious balance between online and face-to-face components for each of the units a number of changes were made during 2005-2008 along the lines recommended by Alammary et al. (2014). For most of the units on campus tutorials were replaced by virtual class room and other online activities.

The optimum balance has been found to vary at different course levels. In the higher level units, a greater use of face-to-face components than online components have been found to be

appropriate. The opposite was found for the lower level units. Added activities such as audio and video clips and Camtasia recordings, were integrated into the graduate certificate level units in order to achieve more of a balance between on-campus and online learning spaces, as suggested by authors such as Chen & Looi, 2007; Kaleta and Skibba & Joosten, 2007. These extra activities have been adopted due to pedagogical need of the units and to fulfil students’ demand. The breakdown of units in Swinburne’s Applied Statistics programs is shown in Figure 1.

![Figure 1: Postgraduate Applied Statistics Program Structure](image)

The underlying mathematics is introduced gradually on a need-to-know basis. A variety of statistical software is used throughout the program; IBM SPSS Statistics software (SPSS) is used for the graduate certificate level units, SPSS and SAS are used for graduate diploma level units and various software including SAS, R, Mplus, Amos, RUMM2030, are used in the master’s level units. In 2005, weekly on campus tutorial classes for the graduate certificate level units were replaced by Collaborate/Elluminate Live sessions, Camtasia recordings and Blackboard discussion board activities. For all other units, the on campus weekly classes were supplemented by one or more of Camtasia recordings, discussion board threads and short audio/video clips. During 2010-2015 optional on campus evening classes were replaced by weekend workshops for five of the eight graduate certificate and diploma level units.

MAIN ACTIVITIES (INSTRUCTIONAL METHODS) COVERED IN TEACHING AND LEARNING SPACES

In the selected medium-impact approach, existing units were redesigned by replacing some of the face-to-face activities with online activities. These activities were developed by the teaching staff most of whom had medium to long-term prior experience in teaching the traditional applied statistics courses, while others were mentored by experienced staff members.

The balance of different instructional/technological methods and pedagogies has been considered carefully during the design stage of the blending. To satisfy the demand for blended teaching, a mix of methods have been used in each of the units. Each of the instructional methods (activities) used in the applied statistics postgraduate programs are listed in Table 1.

**Face-to-face instruction with Echo recording:** On-campus face-to-face classes are offered for all postgraduate units at the Swinburne Hawthorn Campus in Melbourne for those students who can attend. These sessions are offered outside normal business hours. For the graduate certificate level units two day on-campus weekend workshops are run during the study period so that all interested students can join the sessions, even those living interstate. These sessions are recorded through the Echo System and uploaded on Blackboard so that all students can watch the recorded lectures. On-campus evening classes (3 hours weekly) are offered for graduate diploma and masters level units throughout the study period. To improve the level of industry engagement guest lecturers are used in some of the units including the
masters level unit called “Statistical Consulting”. These sessions are also recorded through Lectopia/Echo360 and made available for students through Blackboard. Learning occurs in face-to-face sessions through the study period with online recordings of these sessions also available to all students.

**Blackboard Collaborate class: (Formerly Elluminate Live session)** This is a real-time, virtual classroom that gives instructors and students the opportunity to meet online to learn, rather than in a traditional classroom. For many of the units, live Collaborate sessions are offered through Blackboard so that learners can interact with their lecturer and fellow students. These virtual classrooms are very useful for students who cannot attend face-to-face sessions, either because they live remotely, or because tight schedules prevent them meeting at the same time in one place. In addition for the masters level sessions students are encouraged to give powerpoint presentations using Collorate. Using Collaborate means that students can stay in touch and feel part of the unit community. These live discussion with students and these sessions are a partial replacement of on-campus classes. About 4-6 one hour sessions are conducted throughout the study period in many units. These sessions are also recoded then made available for all enrolled students through Blackboard. Collaborate is also used to provide one to one consultations, where students can meet with the lecturer online, which allows for the flexibility of being able to demonstrate software, use apps on the web, draw on a whiteboard and live audio.

**Discussion board:** Blackboard’s discussion board feature allows participants to carry on discussions online, at any time of the day or night, with no need for the participants to be logged into the site at the same time. The discussion is recorded on the course site for all to review and respond to at their convenience. Discussion threads are run through Blackboard throughout the study period for all postgraduate units. Often students post a question which other students and/or the instructor answer. They are also often driven by the instructor by posting questions on a specific learning activity or creating an activity in which students can participate. In some discussion threads instructors provide a link or a series of links and students follow the link(s) and report back through an instructor-defined set of questions. The discussion board builds class community by promoting discussion on unit topics and allowing time for in-depth reflection- students have more time to reflect, research and compose their thoughts before participating in the discussion. This helps the learner to develop thinking and writing skills.

**Camtasia recording:** Camtasia is a user friendly TechSmith product which allows students to access to computer generated audio visual training via online delivery. They capture both what the lecturer is doing on the screen and the voice. In some of the units a number of Camtasia recordings (audio/video) are used along with lecture recordings. These recordings are mainly used as a replacement of laboratory activities and to summarise topics included in unit content. Sometimes instruction about how to use a specific statistical tool or software are recorded in Camtasia and made available for students through Blackboard. In some the recordings, responses to general queries about the unit are recorded and made available for all students through Blackboard.

**Short audio/video clip:** In response to requests from students short audio/video clips are adopted in some units to engage students with weekly learning activities. These materials are supportive for the lecture notes and weekend workshops. Short video clips help students to follow the steps when using statistical software (e.g. SPSS, SAS). These short clips are created using movie maker or similar software or by an in house publisher called Swinburne Commons. There are many benefits to using video in education as shown in several decades of research. Allam (2006) demonstrated that the creative challenge of using moving images and sound to communicate a topic is indeed engaging and insightful, but adds that it also enables students to acquire a range of transferable skills.

Along with the instructional methods described above, e-mail communications are always appreciated as some students find it easiest to make direct contact with the instructor/convenor by email for urgent issues. The instructional methods described here have been well accepted by the learners and the feedback has been encouraging.
Table 1: Instructional methods (activities) used in medium-impact blend

<table>
<thead>
<tr>
<th>Units</th>
<th>Delivery Type</th>
<th>Name of the method</th>
</tr>
</thead>
<tbody>
<tr>
<td>All units</td>
<td>On-campus</td>
<td>Face-to-face (lecture/workshop)</td>
</tr>
<tr>
<td>All Graduate Certificate level units.</td>
<td>Virtual Classroom*</td>
<td>Blackboard collaborate class</td>
</tr>
<tr>
<td>STA60001, STA60004, STA60005</td>
<td>Virtual Classroom*</td>
<td>Elluminate Live session</td>
</tr>
<tr>
<td>All units</td>
<td>Online</td>
<td>Echo/Lectopia recordings (Lecture /workshop)</td>
</tr>
<tr>
<td>STA60001, STA60004, STA6005, STA70002, STA70003, STA70004, STA80006</td>
<td>Online*</td>
<td>Discussion board</td>
</tr>
<tr>
<td>All units</td>
<td>Online*</td>
<td>Camtasia recordings</td>
</tr>
<tr>
<td>STA60001, STA60004, STA6005, STA70002, STA70003, STA70004, STA80006</td>
<td>Online*</td>
<td>Short audio/video clips</td>
</tr>
</tbody>
</table>

*Just like in a real-world classroom, a student in a virtual classroom participates in synchronous instruction, which means that the teacher and students are logged into the virtual learning environment at the same time. Online refers to having the learning information provided and certain assessments like quizzes available on a website at any time, where the learning and teaching do not occur at the same time, i.e. asynchronous instruction.

**FEEDBACK**

At the end of each study period (semester) feedback is obtained through a student feedback survey for the units offered through Swinburne and OUA. The vast majority of students, 80% out of 102, responded positively on the current learning structure. The feedback reveals that the flexible course structure with classes outside business hours and the blended learning structure are appropriate in postgraduate applied statistics programs for a mixed-cohort of students. The application of a medium-impact blended learning structure using a variety of extra online activities along with face-to-face on-campus classes has been appreciated by past and current students. The unit satisfaction ratings received through the surveys run by Swinburne through student feedback survey (SFS) and OUA have been excellent. During the last 3-4 study periods the overall mean satisfaction rating was above 80% and for many of the units the satisfaction rate was 100%. The overall mean satisfaction rate was 84.5% (study period 1: 84%, study period 2: 85%) for the period 2010-2014 with a response rate of 60% and it was 100% for international students with a response rate of 74%. Numeric ratings of teaching satisfaction (SFS) and units is very high, out of a maximum possible rating of 6, average over the reporting period (2010-2014), the satisfaction with teaching averaged 5.10 and 5.13 for semesters 1 and 2 respectively, and satisfaction with units averaged 4.81 and 4.82 for semesters 1 and 2 respectively. The response rates for these surveys were between 40% and 55% for student cohorts of 120 and 200. A few randomly selected qualitative responses received from the students during the period 2010-2015 regarding for their experience with these programs are quoted below.

“It is really good to know that there are so many modes of study in this course i.e. workshops, online discussions, print materials. And it is good to see that you are keeping an eye on our progress. I am planning to attend workshop 3”.

“Not sure if you've had any other feedback - just wanted to let you know that I am finding the Lectopia recordings excellent. I haven't been able to attend the lectures in person yet, and I feel that I haven't missed anything! It works really well as I have the recording going as I work through the demonstrations at the same time.

“I pop the recordings on in quicktime or media player - make sure the video file always appears on top, and run the lecture / my R console side by side. Works really well.”

“Just wanted to drop you a line to thank you for running such a well-organised course”.

“I graduated from the Masters of Science in Applied Statistics last year and I just wanted to thank you for all your efforts in running the course. I enjoyed the course and found it worthwhile, although I didn't make it particularly easy on myself working full time all the way through. However, the online format and the responsiveness of lecturers to any problems made it much smoother though”.

“Jahar, thank you very much for your mentoring this term, I have learnt a lot this term. It was tiring, but more importantly it was a very fulfilling time too. What I have taken from this course will definitely help me to succeed in the career which I want to pursue”.

“I am graduating after this and just wanted to say that I have thoroughly enjoyed your courses. I have managed to get a …promotion and a step up in the company so the program has definitely paid off for me :-)".

“I am really getting a lot out of what I learned at Swinburne in my Masters course for Applied Stats. I use what I learned every day in my current role, and am really enjoying myself”.

“I want to say that I thoroughly enjoyed the unit and that I think I’ll find it very useful professionally”.
“Thanks again for all your help over the degree; it’s been an absolute pleasure. In particular, I feel like I am taking truly practical skills away that I am already using in the real world”.
“This course felt like an on-campus course that I was watching online”.

As well as such comments, student feedback for each of the units offered through Swinburne and OUA are collected and evaluated at the end of each study period. These are evaluated by the unit and course panel and, where appropriate, changes incorporated the next time the unit runs. This ensures continuous improvement in our program.

CONCLUDING REMARKS

Overall, the medium-impact blended learning structure has provided students with very useful flexibility and a variety of options and tools to engage with unit learning activities. Students have reported that guest lecturers are very useful for professional learning. The flexible blended learning approach adopted for the applied statistics postgraduate programs has been highly appreciated by this mixed cohort of learners and made the courses available to a much larger group. Finally, the sustained level of student ratings and the satisfaction ratings obtained by Graduate Careers Australia (GCA) for these postgraduate programs show that the quality of teaching and overall satisfaction in the blended learning structure has been maintained and is well accepted by the students. Our experience suggests that appropriate choice, integration and balance of different instructional methods, using a combination of technologies and pedagogies, are important in statistical education, especially for part-time post graduate students.

REFERENCES
