

## BLENDING LEARNING IN HIGHER EDUCATION: A CASE STUDY IN POSTGRADUATE APPLIED STATISTICS PROGRAMS

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*Blended learning describes the way e-learning is combined with traditional classroom methods and independent study to create a hybrid teaching methodology for accommodating an increasingly diverse student population. Swinburne's postgraduate Applied Statistics programs adopted the blended learning approach more than a decade ago for a mixed cohort of students. The learning design uses the thoughtful integration of learning and teaching approaches in 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 facilitate learning interactions across formal, informal and online learning and teaching spaces. This flexible approach has been well accepted among both online and on-campus students, which is verified by the feedback received from students during recent study periods.*

### INTRODUCTION

The term blended learning refers to an approach to curriculum development which 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). The main purpose of blended learning is to make learning flexible and effective for the learner. A blended design is the thoughtful integration of learning and teaching approaches, utilizing the benefits of each environment to enhance the student experience. This encompasses both 'process' that is pedagogically based, and 'product' (environment) with a mixture of components (Almary, Sheard & Carbone, 2014). A meta-analysis by Means, Toyama, Murphy, & Baki (2013) reported that students in the blended learning cohort performed better than the face-to-face cohort.

For many students, statistics is perhaps the most anxiety-provoking, difficult, or critical subject within their courses of study (Baharun & Porter, 2009) and is a subject area in need of improved teaching approaches. 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 (Bhowmik, Meyer & Phillips, 2016; Biggs & Tang, 2011). Statistics teaching has benefited from the development of new technological resources. Authors such as Tishkoveskaya, & Lancaster (2012) 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. Despite extensive literature on the topic, there is no agreed definition of "blended learning" (Alammary et al., 2014). All definitions however have one common component - 'an integration of different instructional methods. Alammary et al. (2014) propose three distinct designs for blending online and face-to-face teaching and learning: (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. This paper builds on Bhowmik et al. (2016), which presents an application of a medium impact blended learning model in applied statistics postgraduate programs as a case study.

The postgraduate applied statistics nested programs (graduate certificate, graduate diploma and masters) started at Swinburne University of Technology in 1989. The main vision of these programs was to focus on the practical real life-based application of statistical theory, statistical tools and techniques rather than concentrating on mathematical theory. Due to student demand, these programs were later also offered online at Swinburne and through Open Universities of Australia (OUA). To satisfy the demands of mixed cohorts (on-campus and online), and the course learning objectives, the academic team employed a medium-impact blended learning model for each of the units. As student and staff input was considered critical during the program re-design, at the end of every study period (semester) all units were reviewed and updated based on student feedback and teaching panel members' experiences.

## STRUCTURE OF THE APPLIED STATISTICS POSTGRADUATE PROGRAMS

Many professionals find the need for further statistical training to carry out routine statistical tasks, to interpret and report statistical results or to keep up to date with modern developments. To help facilitate this process, Swinburne offers flexible programs designed to 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, these programs have built an excellent reputation as a provider of quality statistics training. In 2015 there were a total of 207 enrolled students with 47 in the Certificate, 30 in the Diploma and 130 in the Masters program. A majority of these students are mature age, over than half work full-time and are from a variety of backgrounds, including graduates in physical sciences, health sciences, engineering, economics, business and marketing.

The current structure of the post graduate program consists of 4 units for the graduate certificate program: (Statistical Practice 1, Basic Statistical Computing, Research Design and Statistical Practice 2); 8 units for the graduate diploma program: (the 4 graduate certificate level units plus Multivariate Statistics, Further Statistical Computing, Forecasting and Survey Sampling); and 16 units for the master program: (the 8 diploma level units plus Structural Equation Modelling, Advanced Topics in Regression, Statistical Marketing Tools, Using R for Statistical Analysis, Bayesian Statistics, Scale Development and Evaluation, Statistical Consulting and Industrial/Research Project). A variety of statistical software is used throughout the program including SPSS, SAS, R, Mplus, AMOS and RUMM2030.

A major objective of the initiative taken in 2005 to adopt a blended learning model was to provide students enrolled in the same courses, with different modes of instruction while exciting, innovative and flexible opportunities for engaging in learning for all were ensured. The overall aim was 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, the programs were initially reviewed and redesigned to allow 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 largely implemented by instructors with prior long-term face-to-face experience in teaching the traditional courses, who have mentored less experienced staff. It is important to note that these changes have occurred over many years through an incremental replacement approach, with excellent institutional support from the university, including technical, technological training, educational designers and workload allocation.

A deeper look at the objectives of the units and programs and learning outcomes were considered before selecting those educational technologies that would best meet the students' requirements and Swinburne's 2020 visions. 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 Alammery et al. (2014). This included for most of the units the replacement of on-campus tutorials by virtual classrooms and other online activities.

On the basis of the contents and learning objectives the optimum balance has been found to vary at different course levels. In the master level units, a greater use of face-to-face components than online components has been found to be more appropriate compared to 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. For some units weekly on-campus tutorial classes were replaced or supplemented by Collaborate Live sessions, Camtasia recordings and discussion board activities, utilizing the learning/management Blackboard platform. The main objective of this paper is to describe how the selected blended learning model works for a mixed-cohort of learners.

## MAIN INSTRUCTIONAL METHODS USED IN LEARNING AND TEACHING SPACES

To allow a medium-impact model, existing units were redesigned by replacing some of the face-to-face activities with online activities. Learners acquire levels of knowledge defined by Bloom (1956) within a taxonomy of educational objectives (knowledge, comprehension, application, analysis, synthesis, and evaluation), which is still widely accepted today. These objectives describe several knowledge levels, intellectual capabilities, and skills that a learner can

achieve through learning and the learning can be optimised through the integration of a variety of instructional methods. The balance of different instructional/technological methods and pedagogies has been considered carefully during the design stage of the blending. Each of the instructional methods (activities) used in these postgraduate programs are briefly described below.

*Face-to-face instruction with Echo recording:* On-campus face-to-face evening classes are offered for all postgraduate units at the Swinburne Hawthorn Campus in Melbourne for those students who can attend. These sessions are recorded and uploaded to Blackboard so that all students can watch the recorded lectures. To improve the level of industry engagement, guest lecturers are used in some of the units which are also recorded and made available for students.

*Blackboard Collaborate class:* For many of the units, four to eight one hour real-time, live Collaborate/Elluminate sessions are offered through Blackboard so that learners can interact with their lecturer and fellow students in a virtual classroom. These virtual classrooms are very useful for students who cannot attend face-to-face sessions. In addition, for the master's level sessions, students are encouraged to give powerpoint presentations using Collaborate. Using Collaborate means that students can stay in touch and feel part of the unit community. These sessions are also recorded then made available for all enrolled students through Blackboard. Further, Collaborate is used to provide one to one online consultations which allows the flexibility of being able to demonstrate software, use apps on the web and draw on a whiteboard, all with live audio.

*Discussion board:* Blackboard's discussion board feature allows participants to carry out discussions online, at any time, with no need for the participants to be logged into the site at the same time. The discussion threads are created on each unit's site for all to review and respond to at their convenience. They also help the learner to develop thinking and writing skills.

*Camtasia recordings:* Camtasia is a user friendly TechSmith product which allows students to access computer generated audio visual training via online delivery. Camtasia captures both what the lecturer is doing on the screen and voice. In some of the units a number of Camtasia recordings (audio/video) are used along with lecture recordings and made available for students through Blackboard. These recordings are mainly used as a replacement of laboratory activities and to summarise topics included in unit content.

*Short audio/video clips:* Short audio/video clips are adopted in some units to engage students with weekly learning activities and to respond students queries. These materials are supportive for the lecture notes and workshops. There are many benefits for using video in education as shown in several decades of research (Allam, 2006).

Along with the instructional methods described above, many students use e-mail to make direct contact with the instructor/convenor, especially for urgent personal issues.

## FEEDBACK

The instructional methods described here have been well accepted and the feedback has been encouraging. At the end of each study period (semester) feedback is obtained through student surveys for the units. 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. A recent survey on 25 past graduates run by the University found that majority (84%) of the students studied the program either due to its flexibility or the blended learning structure. 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's 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%. A few qualitative responses received from the students during the period 2010-2016 regarding their experience with these programs are quoted below.

“This course felt like an on-campus course that I was watching online”.

“It is really good to know that there are so many modes of study in this course i.e. workshops, online discussions, print materials.

“Not sure if you've had any other feedback - just wanted to let you know that I am finding the Lectopia recordings excellent”.

“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”.

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, to ensure continuous improvement in our program. Despite mainly positive feedback, a few problems were reported, especially with internet access and limited IT support for some students in remote areas.

## CONCLUSION

For a mixed cohort of students, a 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. The flexible blended learning approach adopted for the applied statistics postgraduate programs has been highly appreciated by the learners. 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. It can therefore be concluded 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.

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