USING BLENDED LEARNING IN POSTGRADUATE APPLIED STATISTICS PROGRAMS

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Received: 09/06/2018 **Accepted:** 01/10/2018

ABSTRACT

Blended learning refers to a method of teaching and learning in which some form of online learning is used in addition to the traditional on-campus/face-to-face learning experience in an integrated manner. Postgraduate Applied Statistics programs at Swinburne University of Technology, Australia adopted the blended learning paradigm almost a decade ago to accommodate an increasingly diverse student population. This paradigm allows for *flexibility in design approaches*, and accommodates the range of blended learning capabilities and experience of teachers and learners. The 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. 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 medium impact blended learning model adopted in these courses and the feedback received from students during recent study periods. The authors make the case that implementation of a successful blended learning model can enhance students' learning experience for a mixed cohort of participants.

Keywords: Blended learning, post graduate, applied statistics, online teaching activities, virtual learning environment, Blackboard, echo recording, impact, discussion board.

INTRODUCTION

The term blended learning has no single agreed upon definition, but it 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). 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. Increased demand for Self-Paced Learning Products and Services predicted has reduced the percentage of tertiary education students considering traditional face-to-face courses in favour of blended and online modalities (Ambient Insight, 2011).

This finding is not unexpected given the recent use of instructional teaching technologies and equipment for developing new learning environments. 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 (Almmary, Sheard & Carbone, 2014).

When comparing student performance across the different modes of instruction, a meta-analysis by Means, Toyama, Murphy & Baki (2013) 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. This supports the notion that the use of a blended approach leads to results at least as good as those obtained using traditional methods, but with other advantages including improved access to courses.

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 (Bhowmik, Meyer & Phillips, 2016; 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'. The notion of blended learning as a combination of face-to-face and online learning, has a focus on place and space (Norberg, Dziuban & Moskal, 2011). 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 & Carbone, 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. According to Moskal, Dziuban & Hartman (2013), for an institution to succeed in blended learning it must have a sense of what goals and outcomes it wants to achieve. Authors also demonstrated that these may be institutional goals, faculty goals, or student goals-preferably a combination of all three. This paper builds on a study by Bhowmik et al. (2016) which presents an application of a medium impact blended learning model in applied statistics postgraduate programs. In the medium impact blended learning model the existing course is re-designed by replacing some of the face-to-face activities by online and/or virtual components. The medium impact blended learning approach allows teachers to start simply and implement incrementally, replacing course components as required (Dunhaney, 2004). This model also allows teachers ongoing opportunities to experiment with different approaches to learning and more types of educational technologies without losing all the benefits of the traditional course (Alammary et al., 2014). According to Aycock, Garnham & Kaleta (2002), learning to employ technology in an appropriate and effective way is challenging and can improve with experience. This approach is achievable by teachers with medium to long-term prior experience in teaching traditional courses.

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 master's program and some full time students. By 2005, due to student demand, these programs were also offered online, then in 2008 through Open Universities Australia (OUA) as well. 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 program is also discussed at the annual course advisory committee (CAC) meeting and appropriate steps have been taken on the basis of the feedback given by the CAC members at these meetings to improve the students' learning experience. The main objective of this paper is to describe how the selected blended learning model works for a mixed-cohort of learners.

The remainder of this paper is structured as follows: First, the structure and objectives of the applied statistics program at Swinburne are briefly discussed. Second, the different instructional methods used in blended instruction are explained along with their benefits. Next, assessment tasks used in the program are described. 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, need 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 the Swinburne Applied Statistics post-graduate programs (initially known as Social and Health statistics) have provided 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 with 97% of the enrolment consisting of domestic students. About 50% of the enrolled students were female and a majority of them were of mature 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 study motivations of the students enrolled in the program are also mixed including *The career changer*: looking to enter a new career, *The career advancer:* looking to advance an existing career, *The up-skiller*: looking to improve career prospects, *The lifelong learner*: looking to pursue an interest, *The migrant*: looking to live and work in Australia, and *The research student*: needing statistical training to peruse their research and academic interests.

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.

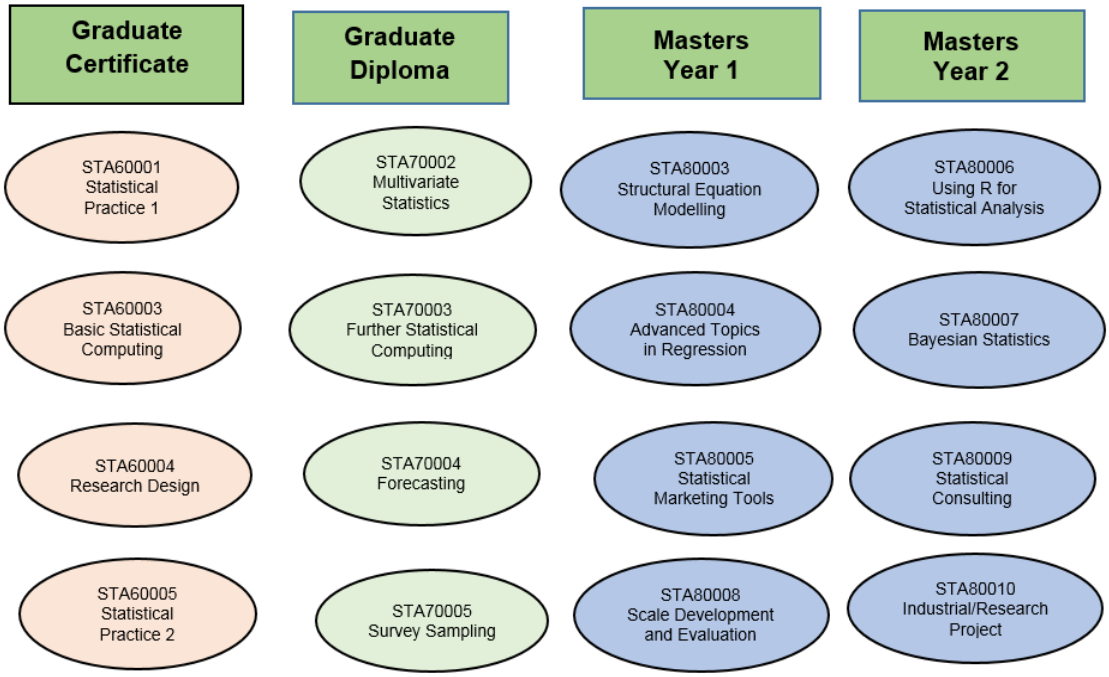

Figure 1. Swinburne Postgraduate Applied Statistics Programs Structure

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 traditional courses. Also, the instructors have extensive 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 very helpful institutional support which includes technical, technological training, educational designers and workload allocation. Researchers demonstrated that with proper support and planning, blended learning can result in positive institutional transformation (Moskal et al., 2013). Authors also made the case that implementation of a successful blended learning program requires alignment of institutional, faculty and student goals.

A deeper look at the units' and programs' objectives and learning outcomes 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). This included replacing on-campus tutorials by virtual class rooms, and other online activities in most of the units.

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, Skibba & Joosten, 2007. These extra activities have been adopted due to the pedagogical need of the units and to meet student demands. The breakdown of units in Swinburne's Applied Statistics programs is shown in Figure 1.

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 the main statistical package 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 staff members are also skilled and experienced with teaching technologies and software. The university have been providing all technical, timetabling, training and workload support to implement the medium impact blended learning model through the application of a range of technologies.

The balance of different instructional/technological methods and pedagogies has been considered carefully by the panel during the design stage of the blending. To satisfy the demand for blended teaching, a mix of methods and technologies 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.

Table 1. Instructional methods (activities) used in medium-impact blend at Swinburne

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

*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.

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 (see Figure 2 below). These sessions are offered in the evenings outside normal business hours. For the graduate certificate level units two day on-campus weekend workshops have been run during the study period so that all interested students could 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.

Figure 2. Face-to-face on campus lecture

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 (see Figure 3 below). 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 Collaborate. Using Collaborate means that students can stay in touch and feel part of the unit community. Research has also shown that students are requesting more interactive lessons (Brooks, 2016; Dahlstrom & Bichsel, 2014), such as live sessions, where students can interact with an instructor and other students in a virtual classroom setting. These live discussion with students are a partial replacement of on-campus classes. From 4 to 8 one hour sessions are conducted throughout the study period in many units. These sessions are also recorded 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 through the virtual classroom, which allows for the flexibility of being able to demonstrate software, use apps on the web, draw on a whiteboard and live audio. The main advantage of the Collaborate session is the enhancement of student engagement, participation and satisfaction with their learning experience.

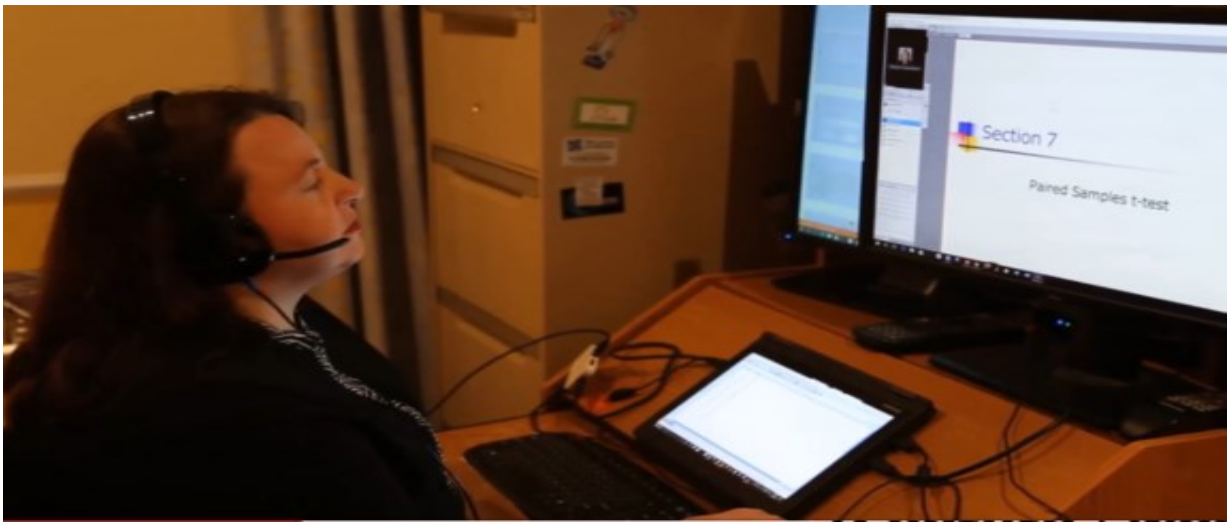

Figure 3. Blackboard Collaborate class

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 (see Figure 4 below). Often students post a question which other students and/or the instructor answer. Discussion is 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. In some units, these questions are converted into online trial quizzes for students to check their understanding on the topic. 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.

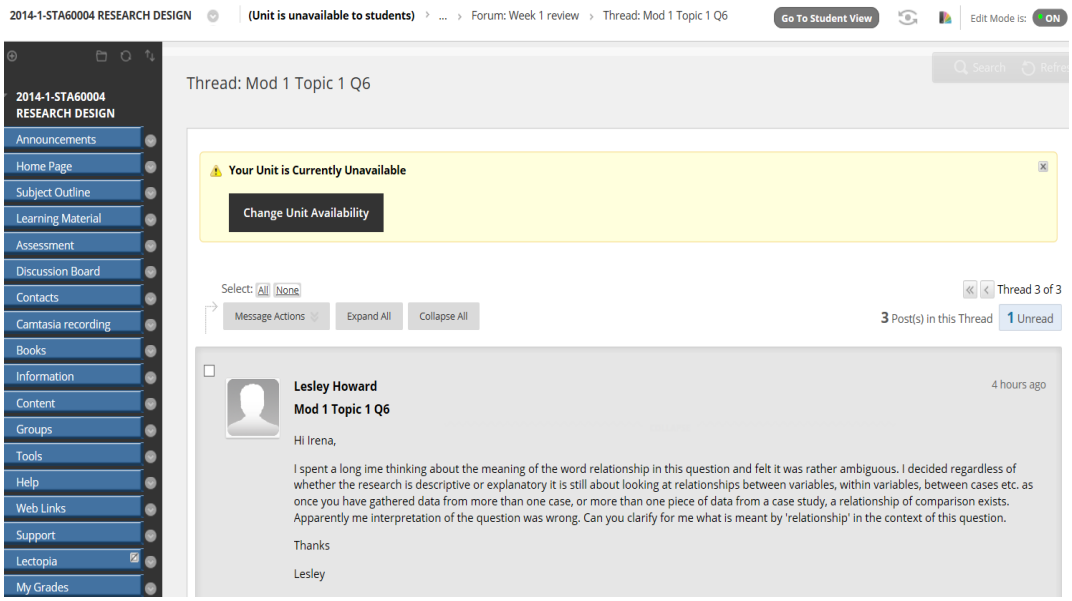

Figure 4. Discussion board

Camtasia Recordings

Camtasia is a user friendly TechSmith product which allows students to access computer generated audio visual training via online delivery. Both the screen and the voice are captured (see Figure 5 below). 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. Also in some of the recordings, responses to general queries about the unit are recorded and made available for all students through Blackboard.

Figure 5. Camtasia studio

Short Audio/Video Clips

In respose to requests from students short audio/video clips are provided 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 similiar 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. Research has shown that students are more likely to view/ engage with instructional videos that are concise and relatively short in length (Guo, Kim & Rubin, 2014). There are a number of possible explanations for this, including that students may be more motivated to watch a video if they do not have to devote so much time to it and if it is focused on a particular topic that they are most wanting to revise at the time.

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, especially for urgent issues. The instructional methods described here have been well accepted by the learners and the feedback has been encouraging.

Assessment

It is widely recognised that assessment is essential to student learning in higher education in terms of elevating student performance and achievement (Biggs, 2003; Bloxham & Boyd, 2007; Gibbs & Simpson, 2004; Harris, Brown & Harnett, 2014; Lunt & Curran, 2010). Bloom's Taxonomy of Cognitive Skills (Bloom, 1956) were carefully considered when instructional methods were matched with unit and course learning outcomes. Bloom, Engelhart, Furst, Hill & Krathwohl (1956), identified three domains of educational activities and these are cognitive, affective and psychomotor. The cognitive domain involves knowledge and the development of intellectual skills, (Bloom, 1956). This includes the recall or recognition

of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. In most of the units exams were conducted at the end of the teaching period to evaluate students' cognitive learning experience. The affective domain (Krathwohl, Bloom & Masia,1973) includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes. The psychomotor domain (Simpson, 1972) includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution. Formative assessment tasks and online weekly quizzes and discussion threads through Blackboard were included in most of the units to make sure that affective and psychomotor domains are not ignored in the program. Supportive information was provided in the unit outline for the learners and instructor to see the alignment between teaching objectives, teaching activities, assessments and learning outcomes.

The balance between units' learning outcome and the choice of assessment tasks were carefully considered and evaluated by the course and unit panels. Finding the balance between what is often referred to as the "backwash effect" to promote student learning and teaching activities is what Biggs (2003) calls "constructive alignment". There are a variety of assessment tasks (weekly online quizzes, discussion threads, major written assignment, presentation, final report and exam) in each of the units and different activities are provided for students by linking with these assessment tasks. These formative (weekly quizzes, written assignment, discussions) and summative (exam, presentation, final report) assessment tasks were designed by matching with the course and units' learning outcomes as required in the Australian Qualifications Framework (AQF). According to Biggs (1999) alignment of summative and formative assessments requires consistency among all of the core parts of the unit, that is, the objectives, the teaching and learning activities, and the assessment exercises. Many real life based practical examples were used in most of the assessment tasks to make sure that deep learning is established for the learners along with surface learning. Students adopt a deep approach for learning when their goal is to understand ideas and seek meaning by relating new knowledge to knowledge they already have. Prosser & Trigwell (1999) argue that students who adopt a deep approach to learning have the highest quality learning outcomes and report greater student satisfaction than students that adopt either surface or disintegrating approaches to learning.

FEEDBACK

The model has been evaluated through multiple surveys run by the student evaluation services department at Swinburne University and OUA. During the evaluation of the survey feeback many important issues including flexibility, convenience, learning opportunity, learning support, learning activities, learning outcomes, unit and course satisfaction were carefully considered.

The instructional methods described here have been well accepted and the feedback has been encouraging. In the latest survey, 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 till 2015 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, over the 2010-2014 reporting period, 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 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 are incorporated the next time the unit runs. This ensures continuous improvement in the program. A recent independent survey of 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. At the end of each study period (semester) feedback is obtained through a student feedback survey for the units offered through Swinburne and OUA. Despite mainly positive feedback, a few problems were reported, especially with unsatisfactory internet access and limited IT support for some students in remote areas.

CONCLUSIONS

Evaluation of the course objectives, institutional support, experienced teachers and information about the learners' backgrounds are important considerations when adopting a blended learning model. For a mixed cohort of students, a medium-impact blended learning structure has provided students with considerable flexibility and a variety of options and tools to engage with unit learning activities. Students have reported that guest lecturers are very helpful for professional learning. The flexible blended learning approach adopted

for Swinburne's applied statistics postgraduate programs has been highly appreciated by the learners. The adopted blending learning approach added value to the learning environment through incorporation of multiple instructional methods and online teaching resources. 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 mature aged postgraduate students. Prior experience in teaching the traditional course and familiarity with technology can help teachers in achieving success in a blended learning model of delivery.

Note: This paper is an expanded version of a paper submitted by the authors for the ICOTS conference in Kyoto, Japan, 2018. Blended Learning in Higher Education: A Case Study in Postgraduate Applied Statistics Programs. Also, an earlier version of this paper was presented at OZCOTS conference at Canberra in Australia in 2016 and was published in the proceeding as cited in this paper.

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