CHAPTER 3

Development of an intensive mode Neuroanatomy unit utilising the Flipped Classroom

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ABSTRACT

In 2011, Macquarie University opted for an intensive mode session three during the summer break, which compressed a traditional teaching program of 13 weeks into a shorter block session of five weeks. In that year, the Department of Chiropractic ran an intensive mode neuroanatomy unit. To do this, the traditional offering for that course was offered in the compressed timeframe without change to curriculum, learning outcomes, teachers or format of the course.

The pre-recorded lectures were made available online, and the practical and tutorial content and time was retained. The outcomes that were collected and compared with those attained that year in the traditional offering were the standard numerical grades (SNGs) and the results of a questionnaire that measured student satisfaction with the course. The cohort in session three did significantly worse *($p = 0.001$)*. However, the overall satisfaction with the course was the same for the two cohorts. This experience demonstrated the necessity for considerable change in teaching strategy when transitioning a unit taught traditionally to intensive mode delivery. Without such change, the quality of the learner experience may be severely impacted.

We have looked to the Flipped Classroom teaching model to redevelop this unit for the upcoming session three, 2013, and will compare the same outcome measures of this cohort to the first session three and to the traditional mode session two cohort of 2013, with the aim of measuring whether this is an effective way to improve learning and teaching in an intensive mode delivery of the course.

KEYWORDS intensive mode delivery, flipped classroom, neuroanatomy education; accelerated learning, compressed curriculum

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INTRODUCTION

The third semester as an intensive mode course over summer is already a successful venture at a number of academic institutions (Ho & Polonsky, 2009; Laves, 2010; Scott & Conrad, 1992). Over 320 US institutions provided such courses in 2005 (Davies, 2006). The intensive mode course offers multiple advantages for university students, including: a chance to make up failed units and graduate on time, spreading out units and reducing the load of units over the year, and accelerating student learning.

With the time being more than halved, the third semester relies on intensity to cover the learning outcomes and achieve the same level of content (Scott & Conrad, 1992). For this reason, the intensive mode delivery is also referred to as: fast tracking, block delivery, accelerated delivery, compressed curriculum, summer school, immersion or session three (Davies, 2006; Ramsay, 2011). One major disadvantage given for this mode of teaching is the perceived lack of depth in understanding achieved when content is crammed in this way (Rowan, 2010; Traub, 1997; Wolfe, 1998). This can pose a particular problem in a unit such as neuroanatomy, which is high in content as well as conceptual understanding. The challenge is to find a mode of delivery that can attain both in such a compressed span of time.

In 2011, the Department of Chiropractic at Macquarie University introduced a three session academic year. The neuroanatomy unit ran for 13 weeks in session two, and five weeks in session three. The structure of the unit, learning outcomes, and mode of delivery were unchanged. In effect, the traditional mode of delivery was retained, but the time to master the content was shortened. The outcomes were measured via standard numerical grades and responses to a questionnaire on satisfaction with the course, and this was compared with the session two cohort of the same year. The cohort in the intensive session did significantly worse ($p = 0.001$) (Whillier & Lystad, 2013). It was clear that this was not an effective approach to delivering the material in intensive mode.

Consequently, a 2013 Macquarie New Staff Grant was obtained to redevelop the neuroanatomy unit for session three. We aimed to design a more interactive model of teaching, with the idea of improving the grade outcomes. This decision followed recommendations for successful teaching in the intensive mode and aimed to maximise active engagement with the students, create discussion, engage in reading material, learning activities, problems and exercises (Kucsera & Zimmaroa, 2010; Nandi, 2000; Ramsay, 2011; White, 2010).

Because active learning has been shown to enhance learning outcomes and improve higher-order thinking, problem solving and critical analysis, our intention was to follow a format that engaged students in teamwork that fostered interactive engagement (Bonwell & Eison, 1991; Bransford, Brown, & Cocking, 2000; Freeman, O'Connor, & Parks, 2007). The Flipped Classroom model has been shown to effectively engage students in learning activities. In this approach "content is offloaded for students to learn on their own, and class time is dedicated to engaging students in student-centred learning activities" (McLaughlin et al., 2014, p. 1). In actuality, the work the students do on their own is well-structured and the student is guided through the material. The Flipped Classroom has been described in various ways. For example, in Tucker (2012) the model is said to centre on active learning and student engagement, where the traditional lecture is replaced by interactive tutorials. In Tune, Sturek, and Basile, (2013), the model is described as engaging the student in significant pre-class preparation, including watching prerecorded lectures, while traditional time is reserved for discussion and problem solving. Most descriptions suggest the use of various forms of recorded lectures which students work through out of the classroom, which frees up classroom time for student-centred interactive activities that apply the knowledge acquired in their own time (Pluta, Richards, & Mutnick, 2013).

The essential research question we asked is whether using face-to-face time with the students in interactive engagement on exercises based on independent pre-work, is an effective form of learning and teaching in the intensive mode of delivery. What follows is a methodological paper in which we describe the unit and the reasoning applied in its formulation. The aim was to consider an alternative mode of delivery to impart the content, ensure grade equivalency with the traditional mode of delivery, but not compromise the learning experience or student satisfaction with the course. The unit thus formulated will be tested in the summer of 2013-2014, and the student academic results will be compared to those of the previous offering to determine if it is indeed a more effective mode of delivery.

METHOD AND DISCUSSION

The intensive unit in neuroanatomy runs over five weeks; two weeks in December (10th - 20th, 2013) and three weeks in January (7th - 25th, 2014). The breakdown of topics scheduled in the period of five weeks is given in Table 1. The key concepts in neuroscience presented in Table 1 are based on the textbook Neuroscience (Lippincott's Illustrated Reviews Series) (Krebs, Weinberg, & Akesson, 2012).

Table 1: *Course Content*

FIVE WEEK PROGRAM BREAKDOWN	
WEEK OF STUDY	CONTENT COVERED
ONE	Introduction to the course and to neuroanatomy. Classification of the central nervous system. Axes of orientation.
TWO	The brain fluid (CSF) and the spinal cord.
THREE	Cerebellum and brainstem.
FOUR	Cerebrum, basal ganglia and blood supply to the brain.
FIVE	Limbic system, autonomic nervous system. Integration.

Before the tutorial and practicals, students are expected to work through prescribed readings, complete worksheets and listen to pre-recorded lectures. Both practical work, which runs in the wet labs, and tutorials, which run in an interactive lecture theatre, are organised in weekly four-hour sessions. The practical manual used in the traditional unit is to be used in the intensive unit. The tutorials, which are student-driven, are shaped around relevant clinical case studies, where tutors are expected to have the role of facilitator.

Students are expected to arrive at tutorials following completion of the recommended reading, prerequisite worksheets and online quizzes. They are then presented with a clinical scenario that will consolidate their knowledge and extend their understanding of the topic. The tutorial is an interactive exchange within groups of students, as well as between tutors and the class as a whole, small groups and individual students. The tutor has time to help individual students with specific areas of difficulty. At the end, the tutors highlight the important learning outcomes. An example of a tutorial case study follows:

> *Jack is brought to the emergency department with a stab wound to his lower back, conscious and responsive. The on-call surgeon-organised scans in order to plan the removal of the knife. Meanwhile, Jack recalls how a drunken person attacked him over a girlfriend argument. CT and MRI scans showed that the knife cut through the right half of his spinal cord, at approximately T12/L1. After the successful removal of the knife, Jack was examined by a neurologist who found that Jack could not move his right lower limb, and could not feel pain or temperature on the left from mid-thigh to below. In addition, Jack was not able to sense light touch, pain and vibration on his right lower limb.*

In the students' preparation for this tutorial, they would have learnt about the main pathways in the spinal cord that control muscle activity (motor pathways), and the pathways that carry sensory information from the periphery to the brain via the spinal cord (sensory pathways). With this knowledge, the student can understand the symptoms and signs presented in the case study.

Thus, the order of work is flipped, in that students construct their knowledge initially from well-designed course materials that lay the foundation of knowledge. Students extend their understanding in the social

interaction of the classroom by solving interesting, probing and challenging problems discussed in case studies. The anticipated outcome is that the reduced time available in the compressed unit focuses on providing the depth of knowledge required, whereas building foundation knowledge that previously occupied many hours of lectures is now completed by students prior to face-to-face teaching time.

Student knowledge is assessed in multiple categories which include: online quizzes (15% of the total mark), practical worksheets (10% of the total mark), a practical exam (25% of the total mark) and the final theory exam (50% of the total mark). The online quizzes and practical worksheets are issued on a weekly basis. The standard numerical grades (SNGs) attained in the 2013-2014 cohort will be compared to those achieved by the students in the 2011-2012 cohort. In addition, the same questionnaire that was given to the earlier cohort will be completed by the 2013-2014 cohort and the student satisfaction with the course will be compared.

Teaching in a compressed format is a huge challenge. Exhaustive workloads for teaching staff, and the risk of delivering a unit that lacks depth, cramming rather than understanding the content due to time constraints, are the greatest disadvantages (Rowan, 2010; Traub, 1997; Wolfe, 1998). The Flipped Classroom model tries to overcome this by using the face-to-face time most effectively. Case studies and problem solving exercises have to be chosen carefully so they provide a solid platform to launch interaction and discussion that will generate the desired learning outcomes. The dangers include: (a) students do not get sufficient foundational grounding; (b) students are not motivated to do the work prior to class; and (c) students form misconceptions when going through the preparatory work which are not noticed in the subsequent interactive work groups. The success of the Flipped Classroom approach depends very much on how well the material is prepared and how well the teaching staff are able to deliver it.

CONCLUSION

Failure to reach the same mean SNGs achieved in the traditional mode of delivery of a unit of neuroanatomy in session three 2011, prompted a redesign for the 2013 summer material. The expectation is that the questionnaire on student satisfaction and the SNGs for the 2013 cohort will be compared to that of 2011 and to the 2013 traditional mode results. The outcome will inform best practice in the delivery of intensive mode units, and will lead to further modification in the way this unit will be taught in session three.

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