Making Neuroscience Important and Relevant: Online Learning in an Innovative Bachelor of Dementia Care Program

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Abstract. Neuroscience is an important component of STEM disciplines and fundamental to understanding dementia, a growing worldwide public health issue. Understanding the neuropathology and clinical manifestations of dementia is important for those who need to provide effective daily care for adults with dementia. Dementia care workers form a non-traditional student cohort and the Wicking Dementia Research and Education Centre at the University of Tasmania (Australia) has developed a fully online Bachelor of Dementia Care degree to facilitate their educational and professional development. This paper documents the success of 65 adult learners as they completed four neuroscience units in the degree. Adult learners with no previous university experience performed similarly to those with university experience suggesting that this unique online degree is appropriately designed for students with limited educational backgrounds. Analysis of students' comments on the impact of their neuroscience learning indicated increased understanding and confidence in the care they provided.

Keywords: Dementia · Effective care · Neuroscience · Neuropathology · Online learning

1 Introduction

Neuroscience, the study of healthy and disease-related brain function, is an important component of the challenging academic Science, Technology, Engineering, and Mathematics (STEM) disciplines. Knowledge of neuroscience has many applications but is particularly relevant to understanding dementia, a progressive, neurological, age-related, and life-limiting condition. As the number of people aged 65 years and over increases rapidly worldwide, dementia is becoming a global public health issue [1–4]. To address this issue, there is a need for society to be offered quality education about ageing and age-related diseases such as dementia. This education is particularly important for people who provide daily care to adults with dementia. Care workers

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need to understand what is changing in the brains of people with dementia and how these changes are reflected in the adults' cognitive decline and altered behaviour. This understanding is integral to effective person-centred care.

People who provide dementia care are often of mature age, with lower-level qualifications, working in lower-level positions with limited opportunities for advancement, and frequently managing additional, family-related, responsibilities [5]. Typically, these workers, many of whom are women, are not required to have experience or formal qualifications to work with adults with dementia [6–8]. Consequently, their knowledge of dementia and approaches to care is limited [9]. Thus, these care workers form an important non-traditional student cohort for whom knowledge of neuroscience would potentially benefit their provision of effective care.

Online learning provides this non-traditional student cohort with the opportunity to learn about neuroscience [6, 10]. Online learning for these students needs to be flexible, yet structured, with clear learning expectations to reassure and support those who are new to higher education [11]. The learning environment needs to promote active, problem-based, and meaningful learning, comfort with technology, a sense of psychological safety, interest in academic writing, and engagement with others [12–15]. Successful online learning for these students also needs to be supported institutionally with easy access to learning materials, even spacing of assessments across a semester, and timely and in-depth feedback to enable ongoing self-reflection [16]. The purpose of the current paper is to outline the innovative, fully online Bachelor of Dementia Care (BDC) degree program that has been developed by the University of Tasmania (Australia) specifically for this non-traditional student cohort and to detail the neuroscience learning of 65 students as they progress through the degree. Three research questions were posed to explore the impact of the neuroscience units within the BDC on these students' learning:

(1) How successfully has this cohort of 65 students completed each neuroscience unit in their two years of study?
(2) Did students with previous university experience receive higher grades in the neuroscience units compared to students without prior university experience?
(3) Has students' learning in neuroscience units had a positive impact on their work with, or understanding of, people with dementia?

2 The Online Bachelor of Dementia Care (BDC) Degree

This program began as a blended delivery Associate degree in 2012 and transitioned to a fully online Bachelor degree in 2013 with students exposed to a diverse set of technological tools and resources across the learning modules. It is open to any student but is designed for adults employed in aged care who are providing care for people with dementia. The learning pathway is premised on full-time study, i.e., enrolment in four units (courses) per semester. However, part-time enrolment is welcomed and frequently is the most practical approach for students who are also in employment. If students are new to university study, they complete a series of preparatory foundation units, one of which focuses on neuroscience. Then, over the three years of the degree, all students

complete 24 units (20 required and 4 elective) in two streams: (a) Models of Healthcare, and (b) Understanding Dementia, which includes the neuroscience of dementia. Each unit is 12–13 weeks in length, fully online and characterised by evidence-based techniques to facilitate the learning of non-traditional students [11–17]. Multiple assessments are offered within each unit. These include case-based reports, quizzes, short answer questions, essays, live presentations online, creative design opportunities (e.g., poster presentations), and participation in interactive discussion boards. There are no traditional examinations. If students have completed tertiary level studies, or have demonstrated professional skills, they can apply for Recognition of Prior Learning (RPL) equivalency for any relevant unit.

Five of the 20 required units focus on neuroscience, four of which are core units that increase in complexity from a foundation to an advanced level. The fifth unit began in 2015 and, as of this submission, has not yet concluded. The learning outcomes of these units are to develop students' (a) knowledge of the neuropathology of dementia and how it presents clinically across the trajectory of the condition, and (b) ability to critically evaluate the science behind approaches to care to optimise the health and quality of life of people with dementia. The first students to complete this degree will graduate at the end of 2015. For this paper, the focus is on data from a cohort of students who began the course in 2012, where they took foundation units, through to their completion of a second year neuroscience unit, CAD201: *The Biology of Ageing and Dementia*, in 2014.

3 Methods

Participants. Sixty-five (76 %) of the 86 students who completed the CAD201 unit gave their informed consent for the study. All resided in Australia with the majority from the states of Tasmania and New South Wales (Tasmania = 31; New South Wales = 23; South Australia = 5; Victoria = 2; no state listed = 4). Most were female and over the age of 40 (20–30 years = 6[9 %]; 31–40 years = 9[14 %]; 41–50 years = 19[29 %]; 51–60 years = 30[46 %]; 61 + years = 1[1 %]). Nearly all (94 %) were working: 40 (62 %) full-time and 21 (32 %) part-time, with 56 (86 %) working with adults with dementia. Their level of education varied: 21 (32 %) had completed a university degree, 10 (15 %) had completed some university studies but not a degree, and 34 (52 %) had completed high school but had not previously studied at a university or tertiary level. Together, these students formed two groups: experience with university study (n = 34; 52 %) and no experience with university study (n = 31; 48 %). In addition to English, 12 students spoke either French, German, Greek, Japanese, and/or Mandarin.

Assessments. Two sets of data were documented to measure students' learning:

(i) Grades for each completed neuroscience unit, and
(ii) Ranked thematic responses to an open-ended question, *How has your understanding of dementia changed as a result of completing this unit?,* to document the impact of the most advanced neuroscience unit to date (CAD201) on their learning.

Procedures. The grades of the students who agreed to participate and their demographic data were documented and the files were de-identified.

Data analysis. The dependent variables in this study were the four completed neuroscience units: CAD004, CAD101, CAD110, and CAD201. The independent variable was experience or no experience with university-level study. Students' data were entered into an SPSS program Version 22.0 for Windows, for analysis. As the data were not normally distributed within each unit, non-parametric Mann-Whitney *U* tests were run to identify any differences in academic performance between those who had prior university experience compared to those who did not. Responses to the open-ended question were collated into a text document and analysed using the qualitative computational linguistics program, Leximancer [6, 18]. This program identifies key terms from the uploaded text and derives word-related concepts and overarching themes; then ranks, by percentage, the most important themes, relative to one another.

4 Results

The neuroscience units offered in the degree program were initiated in 2013. The number of students who have completed them to date are presented in Table 1. All 65 students in this study completed the four neuroscience units over a 15 month period in 2013–2014. Seventeen students received RPL equivalency for CAD004 and this resulted in the smaller number of 48 students in this unit. CAD110 was an elective unit which 18 of the 65 students completed.

Table 1. Number of students enrolled in neuroscience units 2013–2015.

Unit	Year of enrolment		
	2013	2014	2015
CAD004: Neurospeak – Understanding the Nervous System	297 (2 deliveries)	416 (3 deliveries)	172 (1 delivery)
CAD101: Introduction to Ageing, the Brain, and Dementia	160 (1 delivery)	293 (2 deliveries)	251 (1 delivery)
CAD110: Negotiated Studies in Understanding Dementia (elective)	299 (1 delivery)	412 (1 delivery)	258 (1 delivery)
CAD201: The Biology of Ageing and Dementia	–	86 (1 delivery)	137 (1 delivery)
CAD301: Neuroscience Research in Dementia	–	–	41 (1 delivery)
Total	756	1293	859

Note. CAD301 was offered for the first time in 2015 (February–May). Thirty-seven of the 65 students in the study cohort are currently enrolled.

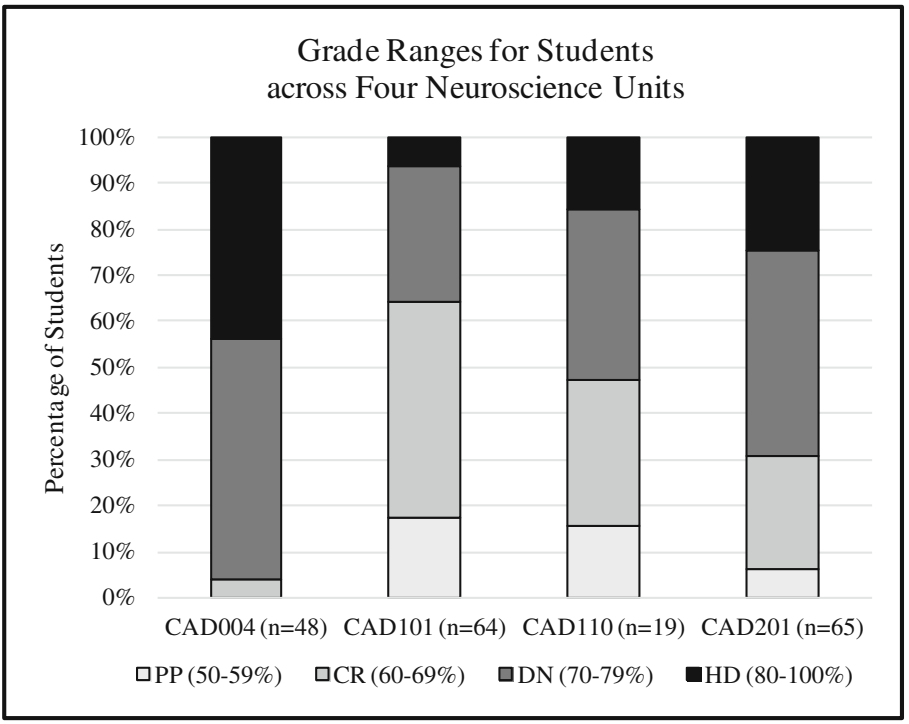

Fig. 1. Comparison of students' grades in four neuroscience units in order of completion and increasing complexity by year.

All of the 65 students received at least a passing grade for the four neuroscience units with the majority achieving a credit-level grade or higher for each unit. There was a trend for increasing achievement as the complexity of the neuroscience content increased from year 1 units to year 2 (Fig. 1). Students with university experience scored significantly higher than students with no university experience in CAD101 (U = 357.50, p = 0.04; Cohen's d = 0.51); there was a trend in the same direction toward significance in CAD201 (p = 0.07). However, the mean scores for both groups of students were within the same grade band, i.e., both groups of students in CAD101 received an average score between 60 % and 69 % equating to a credit grade; both groups of students in CAD201 received an average score between 70 and 79 % equating to a distinction grade (Table 2).

All 65 participants responded when asked about the impact of CAD201 on their learning. The Leximancer analysis of their comments identified four themes: improved care (29 %), increased understanding (28 %), increased knowledge (23 %), and increased confidence in their work (20 %). These themes are reflected in the comments that follow Fig. 1.

The more I learn the more relaxed and confident I am in my approach. Having the knowledge and understanding of the different functions of the brain gives me a better understanding of why people with dementia behave the way they do. This increased knowledge helps my care which

Table 2. Effect of previous university experience on students' grades in four neuroscience units.

	n	Mean±*SD*	Mean Rank	Mean Grade Band	*U*	Sig.
CAD004						
All students	48	79.31±5.31				
Univ. experience:						
Yes	15	79.93±4.79	25.87		227.00	0.65
No	33	79.03±5.58	23.88			
CAD101						
All students	64	66.16±8.86				
Univ. experience						
Yes	30	68.50±8.23	37.58	Credit	357.50	0.04*
No	34	64.09±8.99	28.01	(60-69%)		
CAD110						
All students	19	69.63±8.52				
Univ. experience						
Yes	9	70.67±9.76	10.83		37.50	0.54
No	10	68.70±7.65	9.25			
CAD201						
All students	65	73.26±8.53				
Univ. experience						
Yes	31	75.35±8.05	37.40	Distinction	390.50	0.07
No	34	71.35±8.63	28.99	(70-79%)		

SD = standard deviation; *$p \leq 0.05$. Mean grade bands are included only for the units with a significant difference, or trend, between the two groups of students.

has changed dramatically. I see dementia differently and I find myself taking more notice of small differences and changes in the residents. More knowledge has enabled my inclusion and advice in some areas and this has meant that I have more input in my workplace. I would absolutely love to be involved in dementia research at some stage in the future and this unit has provided me with a solid foundation to look further into this possibility.

The greater understanding I am developing around the trajectory of dementia has impacted the care I deliver for residents with dementia living in our facility. I work in a supervisory/management position and therefore I have the ability (albeit limited at times) to influence change.

Having a better understanding of what the changes are in the brain and how this is reflected physically and cognitively helps to better tailor physiotherapy (my profession) for people with dementia and whether they are capable of doing exercises or if massage or another modality would be more appropriate.

I now have a greater understanding of, and time for, those with dementia. Their brain works very differently than ours and knowing this has allowed me to be more aware and able to share this with others. Understanding more about the biomarkers in the neuropathology of dementia has also helped me to communicate better with doctors.

I am now able to recognise the triggers of many more behaviours that I previously had little comprehension of. I find myself talking more about issues of dementia with colleagues at work either from a research point of view or a TV or newspaper article we may have covered or discussed. This in itself gets people talking and thinking and reflecting on how to improve and change the way we care for people living with dementia.

I now have a much deeper understanding of changes in the brain and resulting effects on function. I think it's important for those employed in aged care to understand that dementia is not just one disease and people are affected very differently depending on the type of dementia they are diagnosed with. This is essential knowledge for us to be able to tailor our approaches to care.

5 Discussion

In response to question 1, all 65 students successfully completed the four neuroscience units in this study, achieving a passing grade or higher. In response to question 2, mean scores were comparable in three out of the four neuroscience units between students with and without prior university experience. Although there was a statistically significant difference in one unit, the average scores for students fell within the same grade band. This suggests that students with no prior academic experience performed at a similar level to their counterparts with prior university experience. Further, this indicates that, for this student cohort, the online teaching of dementia-related neuroscience was effective and the unique online degree is appropriately designed with scaffolded learning to support non-traditional students with limited educational backgrounds [11–16].

In response to question 3, students' comments reflected their positive experience in applying their learning from the neuroscience units to their work with, and understanding of, people with dementia. These comments demonstrated their increased knowledge of the neuropathology of dementia, how it presents clinically across the trajectory of the condition, and how alterations in the brain are reflected in changes in adults' cognitive ability and behaviour. Qualitatively, this increased knowledge positively affected students' ability to critically evaluate the science behind approaches to care, and use evidence-based approaches to optimise the health and quality of life of people with dementia. Such results confirm the value of this e-learning Bachelor of Dementia Care initiative in its innovative support of non-traditional students, facilitation of their understanding of neuroscience, and continued educational and professional development in the care of adults with dementia.

6 Conclusion

This study addresses the importance of providing quality education in neuroscience to people who provide daily care for adults with dementia. Neuroscience is fundamental to understanding the alterations that occur in the brain with dementia and the cognitive decline and changes in behaviour that follow. The neuroscience units offered in the innovative, fully online Bachelor of Dementia Care degree were completed successfully by all students in the study cohort and students' comments confirmed their increased understanding of the importance and relevance of neuroscience to their provision of effective dementia care.

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