Impact of Integrated Sustainability Content into Undergraduate Business Education

ABSTRACT

The specific aim was to compare the findings from a survey of a cohort of students at an Australian regional university across two time points: immediately on commencing their first semester of study, and at the end of their final semester of study in order to determine whether, and in what ways, these students' views concerning sustainability appear to have changed. This paper reports on a longitudinal study of the attitudes, beliefs and perceptions of undergraduate business students regarding a range of sustainability issues. A paper-based questionnaire was delivered to approximately 250 first year and 150 third year students. A factor analysis shows small but statistically different positive differences, which indicate that the revised curriculum has been successful in raising student awareness and achieving behaviour change. The study focused on Australian undergraduate university business students, which reduced generalisability of the findings. The findings of this study can inform instructors in higher education of student attitudes towards sustainability and climate change adaption and in turn inform changes to tertiary curriculum in sustainability and climate change adaption. The authors confirm that the research is original and that all of the data provided in the article is real and authentic. As the paper reports on the third phase of the longitudinal study, some parts of the methodology have been previously published but differ as they reflect the third phase of the study. The results of this study have not been previously published

Keywords: sustainability education, business education, climate change, curriculum

INTRODUCTION

There are many assumptions regarding the role of universities in promoting sustainability, ranging from broad statements from the United Nations (Kelley & Nahser, 2014) through to individual government levels (see, for example "Living Sustainably", Australian Government, 2009), but these contain largely aspirational statements with no clear policy or strategy for achieving positive outcomes. The lack of policy or strategy is particularly important given that sustainability is increasingly recognized as a 'wicked' problem, i.e. complex, contested and lacking in a shared understanding of causes and effects let alone effective strategies to address key issues (Allen, Beaudoin, Lloyd-Pool, & Sherman, 2014; Dentoni & Bitzer, 2015; Waddock, 2013).

In spite of this, there appears to be a range of clear expectations regarding the role of higher education, as illustrated by the following assumptions: higher education is assumed to be a "*site of socialization for sustainability"* (Winter, Cotton, & Warwick, 2016, p. 1) and, more specifically, to:

- "*develop responsible managers*" (Cullen, 2016, p. 1),
- "*have an unavoidable responsibility*" (to address sustainability related problems) (Gale, Davison, Wood, Williams, & Towle, 2015, p. 248),
- "*develop the capability of students to be future generators of sustainable value*" (Kelley & Nahser, 2014, pp. 631, citing the UN Principles of Responsible Management),
- be "*significant contributors to the promotion of sustainability*" (Karatzoglou, 2013, p. 44).

However, while changes in student identity, world views and epistemology are known to occur across the undergraduate degree study time period (Myers & Beringer, 2010), the same focus has not been placed on sustainability per se.

International quality assurance organisations such as the Association to Advance Collegiate Schools of Business (AASCB) include sustainability in their Core values and Guiding Principles:

> *"The school must demonstrate a commitment to address, engage, and respond to current and emerging corporate social responsibility issues (e.g., diversity, sustainable development, environmental sustainability, and globalization of economic activity across cultures) through its policies, procedures, curricula, research, and/or outreach activities"* (AACSB International, 2016, p. 5).

Much research in the area has been case study based, with evaluation of the short term impacts of single subject content (Heiskanen, Thidell, & Rodhe, 2016; Kelley & Nahser, 2014). Such studies focussed on a single discipline such as marketing (Perera & Hewege, 2016; Rountree & Koernig, 2014), accounting (Coulson & Thomson, 2006; Hazelton & Haigh, 2010) or tourism (Benckendorff, Moscardo, & Murphy, 2012) or were undertaken at post graduate (MBA) rather than undergraduate level (Hesselbarth & Schaltegger, 2014; Stubbs & Cocklin, 2008). Further, many of these studies have focused on measuring knowledge rather than on attitude changes and, ultimately, on behaviours (Perera & Hewege, 2016).

Where a wider perspective on students' overall study experiences have been undertaken, mixed results have been obtained, with reports of increased knowledge but not attitude change or sustainability-related actions (Sammalisto, Sundström, von Haartman, Holm, & Yao, 2016). One study suggests the unexpected outcome of an increase in cynicism and ego-centricity, a factor that appears to vary by discipline, being particularly high among economics majors (Harring, Lundholm, & Torbjörnsson, 2017). This raises the issue of the challenges of integrating approaches across disparate disciplines (Bridges & Wilhelm, 2008).

A specific role for regional universities in sustainability and sustainable development is espoused in the literature, with the suggestion that the importance is underestimated (Sedlacek,

2013). The role is proposed "*to closely engage with local communities in networking and productive partnerships, amplifying the capacity of a region to self-organise and operate*" in addressing sustainability challenges (Karatzoglou, 2013, p. 44). The study reported in this paper was undertaken in an Australian regional university, drawing on undergraduate students enrolled in a three-year business degree with majors in Accounting and Finance, Economics, Management, Marketing, and Tourism. The degree included the option of both double majors and of taking elective subjects from disciplines other than the one in which the student intended to major.

RESEARCH AIMS AND INITIAL FINDINGS

The specific aim was to compare the findings from a survey of a cohort of students across two time points. The cohort was surveyed in their first semester and again in their last semester of their first year of university (2012, approximately 250 students) to provide a baseline of student's attitude to sustainability and climate change. Also surveyed were students in their last semester of study, having had minimal exposure to sustainability-specific curriculum content. The cohort of students who commenced studies in 2012 was surveyed again in their third semester of their final year at university (2015, approximately 150 students), having completed a curriculum which had been revised to include substantial sustainability-specific content. This survey aimed to determine whether, and in what ways, these students' views appear to have changed, acknowledging that there will be influences external to the educational environment, such as family and friends that may impact on these changes (Grønhøj & Thøgersen, 2012). The overall aim was to determine what, if any changes to the attitudes, beliefs and perceptions of undergraduates across their programme of study with and without specific sustainability content and to support ongoing curriculum fine tuning.

The earlier findings (2012) indicate that both new entrants and senior students had a superficial awareness of sustainability and environmental challenges. The students regarded major issues

as beyond their control and were easily influenced by friends and family and the students were reluctant to make personal changes to adapt to climate change challenges remove (Eagle, Low, Vandommele, & Li, 2014). This study found that, while there were no significant differences between students' knowledge, personal interest or perceived norms nor for their current behaviour, responsibility for action or unrealistic optimism, risk denial or alarmism, the third year students did appear to have significantly higher awareness of economic sustainability, sustainable development, conservation and climate change than the first year students did (Eagle et al., 2014).

In 2015, responses were captured from many of the students who were surveyed in their first semester, but also included students who had transferred onto the degree programme from other majors and other educational institutions. In the second phase of the longitudinal study, the responses were compared to those from the earlier final semester cohort (2012) prior to the introduction of the revised business syllabi into any subjects they were studying (Hay, Eagle, Saleem, Vandommele, & Li, 2019). The study focussed on a single cohort to establish baseline date with which to measure other cohorts. However, this limits the focus of change to only one cohort of students, which reduces the generalisability of the research. This limitation needs to be addressed in the next iteration of the study.

METHODOLOGY

This paper presents the third phase of a longitudinal study of first and third year undergraduate business students, as such it uses the same methodology as previous phases of the study as summarised below (Eagle, Low, Case, & Vandommele, 2015; Eagle et al., 2014). Both a paper-based and online survey form was used, with the timing as shown in the schedule of surveys by cohort in Table 1 below.

Table 1: Schedule of surveys by cohort

	Start Year 1	End Year 1	Year 2	End Year 3
New entrants into the first semester of study	2012			
Students in final year of study before sustainability content introduced		2012		
Major curriculum integration			2012/13	2015 (advanced subjects)
Students in final year of study having completed sustainability curriculum				2015

The anonymous survey was delivered voluntarily in class to final semester students (2015, approximately 150 students), who were free to choose to ~~not~~ participate or not in the research. The students were surveyed at a point in time when the university had undertaken a major curriculum review, which began to be integrated into introductory and second year subjects in 2012/ 2013 and in advanced subjects by 2015 (see Table 1). The new curriculum was offered to all subjects across a range of majors over three years in order to ensure that students were subjected to comprehensive integrated sustainability content included in the new curriculum (approximately 400 students in total). Consistent with other studies, an initial benchmark revealed naïve awareness of sustainability issues and a tendency to view many sustainability issues as beyond their own control (Eagle et al., 2015; Nerlich, Koteyko, & Brown, 2010; Wray-Lake, Flanagan, & Osgood, 2010).

The questionnaire contained nine key familiarity terms and 34 statements that were derived from existing instruments used in previous studies and themes commonly cited in the literature,

including: Michalos et al. (2011), Shephard et al., (2009); Kagawa (2007); Lidgren et al., (2006); Marcell et al., (2004) and Kaplowitz & Levine (2005). The statements used a five-point Likert scale with anchor points of 5 = strongly agree and 1 = strongly disagree. A sixth option of don't know / not interested was included. This latter option was intended to provide an alternative for those who have only vague understandings or no true opinion on the statements listed (Krosnick et al., 2002; Sturgis & Smith, 2010) rather than forcing an artificial pseudo-opinion (Malone, Dooley, & Bradbury, 2010). The familiarity items were tested for reliability where a very good internal consistency was evident ($\alpha = .88$. As in phase one and two of the longitudinal study, both parametric and non-parametric analyses were performed - drawing on the proposition by Norman (Norman, 2010) that the robustness of parametric statistics for this type of data is frequently unrecognised – and found no differences in the outcomes of the two types of tests. An independent samples t-test was performed to determine if there is a statistically significant difference between the two cohorts (Pallant, 2016, pp. 244-248). Ethics approval was gained: Approval Number H4991.

DEMOGRAPHICS

Three hundred and eighty (380) students completed the survey (Table 2). Of the students surveyed, 62% were female and 38% were male. The majority of students were studying accounting (28%) or management (including HRM) (25%), 18% were completing a double major, 9% were completing tourism/hospitality/sports management, and another 8% in marketing or economics (8%). The remaining students were studying finance (3%), information technology (2%) or international business (1%). Seventy three percent of students were Australian, 9.5% were from Asia, 5% from Europe, and 6% from Papua New Guinea. The remaining 6.5% were from other countries.

Table 2: Breakdown of students who completed the survey

Year of study	Year questionnaire administered	Total

	2012	2015	
First year	167	0	167
Final year undergraduate	80	133	213
Total	247	133	380

FINDINGS / DISCUSSION

Familiarity with key terms

Three sustainability concepts (economic, environmental and social) modelled on the "triple bottom line" (Parker, 2011) were introduced to the curriculum after the first round of data was collected in 2012. The results show a significant statistical difference in the mean scores for seven of the familiarity terms (see Table 3). Only two, climate change and environmental protection showed no significant difference in student familiarity with the terms between cohorts. The mean scores show a stronger familiarity to key terms in third year students (2015) than in first year students (2012).

Table 3: Self-reported familiarity with key terms and their meaning

Significant differences between curriculum change	**2012**		**2015**	
	Mean	**SD**	**Mean**	**SD**
Economic sustainability *p=0.000	3.63	1.14	4.17	0.774
Environmental sustainability *p=0.000	3.89	1.021	4.32	0.722
Social sustainability *p=0.000	3.30	1.166	3.87	0.900
Sustainable development *p=0.000	3.63	1.100	4.02	0.801
Conservation *p=0.007	3.77	1.168	4.05	0.856
Climate change	4.10	1.033	4.27	0.845
Climate change adaptation *p=0.014	3.92	1.060	3.64	0.990
Environmental protection	3.91	1.087	4.11	0.828

Energy conservation *p=0.017	4.21	1.033	3.95	0.940

*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*

In the following section students were asked how strongly they agreed or disagreed with statements focusing on students' attitudes, behaviours, knowledge, normative influences, perceived self-efficacy, and optimism versus pessimism regarding the future. The statements again used a five-point Likert scale with anchor points of 5 = strongly agree and 1 = strongly disagree. A sixth option of don't know / not interested was included.

STUDENT KNOWLEDGE

Current Behaviour

Third year student responses showed a significant positive change in the 'current behaviour" section, post curriculum change, for the more personal actions towards sustainability and environmental issues (

Table 4). For example in 2015, students were saving water (p=0.006), switching off the lights (p=0.044), walking or riding instead of taking the car (p=0.000), and recycling as much as they can (p=0.000). The remaining three behaviours (environmentally friendly light bulbs, choices about products and services, and not purchasing from companies who show no concern for the environment) are most likely outside of the student's top of mind awareness, because this type of "private sphere environmentally friendly behaviour" (Ojala, 2012) usually targets adults.

Table 4: Self-reported statements about current behaviour toward sustainability and environmental issues

Statements about:	**2012**		**2015**	
Current behaviour perceived norms	**Mean**	**SD**	**Mean**	**SD**

I save water by taking a shower instead of a bath (in order to spare water) *p=0.006	3.32	1.446	3.73	1.285
I always switch the light off when I don't need it *p=0.044	4.03	1.180	4.27	0.978
I walk or bike to places instead of going by car *p=0.000	2.35	1.374	3.02	1.446
At home I try to recycle as much as I can *p=0.000	3.57	1.298	4.05	1.072
I have changed to environmentally friendly light bulbs	3.40	1.404	3.52	1.357
Sustainability is important to me in making choices about which products or services I choose	3.04	1.202	4.33	0.577
I avoid buying from a company which shows no concern for the environment	2.80	1.309	3.04	1.255
*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*				

Climate Change, Greenhouse Effect and Ozone

Students were given knowledge statements about contributing factors to climate change. The difference between the means shows that there is a significant improvement in knowledge for third year students post curriculum change. Third year students were significantly more aware that climate change is happening at some level (p=0.002), that oil and gas contribute to climate change (p=0.001) and that their personal computer contributes to climate change (p=0.000). However, there was no significant difference between the 2012 cohort and the 2015 cohort in regard to carbon dioxide being the primary gas responsible for the greenhouse effect (Table 5).

Table 5: Self-reported knowledge statements about climate change, greenhouse effect and ozone contributing factors, correct or incorrect

Statements about:	**2012**		**2015**	
Climate change, greenhouse, ozone perceived norms	**Mean**	**SD**	**Mean**	**SD**

Human induced climate change is occurring at some level *p=0.002	3.82	1.158	4.20	0.973
Every time we use coal, oil or gas we contribute to climate change *p=0.001	3.75	1.152	4.16	0.991
My personal computer use contributes to climate change *p=0.000	3.12	1.31	3.60	1.094
Carbon dioxide is the primary gas responsible for the greenhouse effect	3.19	1.263	3.70	1.164
The greenhouse effect is caused by an ozone hole in the earth's atmosphere *p=0.000	3.37	1.385	3.60	1.291
*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*				

Personal Interest in Sustainability, Environmental Issues and Climate Change

There is a significant difference in only two of the personal interest statements between the two cohorts (2012/2015). The difference in means between 2012 and 2015 student responses for the statement 'Environmental issues are very important to me' show that the latter cohort ~~has~~ agrees significantly more with the statement ~~knowledge~~ than the 2012 cohort. This is supported by the standard deviation (SD=0.937) for 2015, which shows that many of the response were close to the mean indicating a higher agreement with the statement. While there was a significant difference between the cohorts for the second statement "I often look for signs of ecosystem deterioration", the standard deviation (SD 2012= 1.271; 2015=1.268) indicates a larger spread in responses showing a lower agreeance with the statement amongst the cohort. The next two statements means indicate that the students were undecided or may not have

agreed with the statement with no significant difference between cohorts. The final statement was not asked of the 2012 cohort, therefore a comparison cannot be made.

Table 6: Self-reported statements about personal interests in sustainability, environmental issues and climate change

Statements about:	**2012**		**2015**	
Personal interest and perceived norms	**Mean**	**SD**	**Mean**	**SD**
Environmental issues are very important to me *p=0.000	3.37	1.249	4.03	0.937
I often look for signs of ecosystem deterioration *p=0.000	2.20	1.271	2.69	1.268
My friends and family believe they should alter their behaviour to prevent global climate change	2.81	1.277	2.77	1.140
The average JCU student is not at all concerned with the issue of climate change	2.99	1.322	2.98	1.158
It is probably unrealistic to expect JCU students to alter their behaviour to prevent global climate change	n/a	n/a	2.00	1.033

*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*

Unrealistic optimism and risk denial

There is a significant difference between the 2012 and 2015 cohorts for unrealistic optimism and risk denial with the cohort holding a higher agreeance with most of the statements in 2015 compared to 2012. 'Worrying about the environment often holds up development projects' was significantly ~~different~~ higher agreeance (p= 0.000) as was 'The so-called 'ecological crisis' facing human beings has been greatly exaggerated' (p=0.004) and 'Humankind will die out if we don't live in tune with nature' (p=0.005). There was also a significant higher agreeance ~~difference~~ between cohorts (2012/2015) for the statement that' If things continue on their

present course we will soon experience a major ecological catastrophe' (p=0.000). However, the high standard deviations for each of these statements indicate that the answers were largely spread indicating an overall lower agreeance with the statements. There was no significant difference between the pre curriculum change and post curriculum change for the other statements (see Table 7).

Table 7: Self-reported statements about unrealistic optimism and risk denial

Statements about: ***Unrealistic optimism and risk denial perceived norms***	**2012**		**2015**	
	Mean	**SD**	**Mean**	**SD**
Society will continue to solve even the biggest environmental problems	3.19	1.200	3.29	1.021
Worrying about the environment often holds up development projects * p=0.000	3.19	1.202	3.66	1.121
Our planet has unlimited resources	1.89	1.231	1.95	1.453
Nature is always able to restore itself	2.32	1.278	2.29	1.152
Humans have the right to change nature as they see fit	2.24	1.265	2.16	1.260
People worry too much about pollution	2.38	1.240	2.37	1.270
People worry too much about climate change	2.58	1.322	2.55	1.292
The so-called 'ecological crisis' facing human beings has been greatly exaggerated *p=0.004	2.97	1.317	2.56	1.305
There is little action that I can take to reduce the threat of climate change	2.75	1.313	2.74	1.235
Humankind will die out if we don't live in tune with nature *p=0.005	3.25	1.370	3.65	1.201

If things continue on their present course we will soon experience a major ecological catastrophe *p=0.000	3.09	1.257	3.65	1.232
We cannot slow the rate of climate change	2.55	1.324	2.55	1.270
*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*				

Responsibility for action

There is a significant difference in all of the statements about responsibility for action. Students agreeance was higher, representing a ~~There was a~~ large change between the 2012 and the 2015 cohorts for the statement 'Taxes on polluters should be increased to pay for damage to communities and the environment' (p=0.000). This is consistent with findings from similar studies in the UK where the onus for change is seen as lying primarily with government (Brennan, Kapetanaki, Eagle, Hay, & Low, 2017). The remaining statements were all significantly different (with higher agreeance) between the 2012 and the 2015 cohorts with about the same difference in change between the years (see Table 8).

Table 8: Self-reported statements about responsibility for action

Statements about:	**2012**		**2015**	
Responsibility for Action	**Mean**	**SD**	**Mean**	**SD**
The government should take an active role in the global effort to curb the problem of rapid climate change *p=0.000	3.66	1.296	4.24	0.780
We must set aside areas to protect endangered species	3.99	1.191	4.11	1.061
Economic development, social development and environmental protection are all necessary for sustainable development *p=0.000	3.75	1.269	4.35	0.863

Overuse of our natural resources is a serious threat to the health and welfare of future generations *p=0.000	3.82	1.213	4.42	0.889
Taxes on polluters should be increased to pay for damage to communities and the environment *p=0.000	2.98	1.316	3.88	1.066
We, as a society, should radically change our way of living to offset the danger of climate change *p=0.000	3.13	1.134	3.73	1.122
*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*				

Students were then asked ~~where~~ what source they used to ~~they~~ get their information from about sustainability and climate change and for each source and how often they used it (Table 9) and how trustworthy they believed the information to be (Table 10).

The reduction between means between 2012 and 2105 may indicate that students are using many of the sources less than they did in 2012. The use of cinema (<p=0.0001) as a source is statistically significantly different between the cohorts, with students using cinema less to find information about sustainability and climate change in 2015 than in 2012. This may be due to increased access to online entertainment (Belson, 2015) and hence less cinema participation or to less reference to sustainability/climate change advertising. Students are sourcing information more often from the internet (<p=0.001), social media (<p=0.001) and friends (<p=0.001), all of which were statistically significantly different between 2012 and 2015. In addition, the change in use of magazine editorials as a source of information about sustainability and climate change was also statistically significant.

Table 9: Self-reported statements about where students source information about sustainability and climate change

	2012	**2015**

	Mean	Std. Dev	Mean	Std. Dev
Television News Items	3.89	1.314	3.72	1.564
Television Documentaries	2.60	1.442	2.88	1.382
Television Advertising	3.61	1.654	3.32	1.676
Radio News Items	3.37	1.789	3.18	1.766
Radio Advertising	3.19	1.926	2.92	1.830
Magazine Editorial *p=0.047	2.38	1.503	2.06	1.424
Magazine Advertising	2.12	1.402	1.87	1.416
Cinema *p=0.000	2.95	1.760	2.11	1.268
Word of mouth (family or friends)	3.83	1.530	3.54	1.333
Internet *p=0.000	3.61	1.789	4.44	0.885
Social media *p=0.000	2.49	1.994	4.05	1.375
Direct mail	2.89	1.881	1.96	1.827
Family	3.43	1.758	3.35	1.553
Friends *0.000	1.64	2.023	3.56	1.378
Other Sources	2.21	1.724	1.41	1.902

*Note: * Significant difference between years of study; 6-point scale where 5=Daily, 4=Weekly, 3=Monthly, 2=about 2 – 3 times a year, 1=Perhaps once a year, 0=rarely or never*

The students were also asked how trustworthy they thought the source of information was, with responses ranging from 5=Totally trust-worthy, 4=Highly trust-worthy, 3=Fairly trust-worthy, 2=Slightly trust-worthy, 1=Not trust-worthy at all, 5=N/A – do not use this source.

While the students were using most sources less in 2015, the means in the independent samples t-test indicates that the students trusted all of the listed sources more in in the first year (2012)

than they did in the third year (2015). Sources that were statistically significant in terms of being less trustworthy were television documentaries (p=0.000), radio news items (p=0.000), magazine editorials (p=0.020), cinema (p=0.003), word of mouth (p=0.002), internet (p=0.039), social media (p=0.001) and other sources (p=0.000). Other sources include Facebook, Twitter, webpages belonging to environmental groups, geology class at uni and lectures. Most of the significant sources were indicated to be fairly trustworthy, while other sources were only selected to be slightly trustworthy.

Table 10: Self-reported statements about trustworthiness of sources of information about sustainability and climate change

	2012		2015	
	Mean	Std. Dev	Mean	Std. Dev
Television News Items	3.15	1.243	3.63	4.520
Television Documentaries *p=0.000	2.67	1.289	3.48	0.974
Television Advertising	2.61	1.332	2.62	1.179
Radio News Items *p=0.000	2.53	1.315	3.01	1.184
Radio Advertising	2.38	1.213	2.51	1.251
Magazine Editorial *p=0.200	2.23	1.290	2.55	1.213
Magazine Advertising	2.31	1.436	2.25	1.181
Cinema *0.003	2.11	1.259	2.51	1.153
Word of mouth (family or friends) *p=0.002	2.67	1.234	3.05	1.047
Internet *p=0.039	2.86	1.196	3.10	1.007
Social media *p=0.001	2.19	1.391	2.67	1.217
Direct mail	2.28	1.521	2.39	1.413

Family	2.98	1.331	3.11	1.144
Friends	2.93	1.306	3.05	1.069
Other Sources *p=0.000	0.93	1.566	1.74	1.833

*Note: * Significant difference between years of study; 6-point scale where 5=Totally trust-worthy, 4=Highly trust-worthy, 3=Fairly trust-worthy, 2=Slightly trust-worthy, 1=Not trust-worthy at all, 5=N/A – do not use this source*

While several statements about sustainability and the environment recorded a positive change in student knowledge after the curriculum change, the magnitude in the difference of the means for each statement was very small (eta squared at 95% confidence was between 0.003 and 0.006)., . Hindicating that between 3% and 6% of the change in knowledge can be attributed to the curriculum change.

Conclusions and Directions for Future Research

The inclusion of specific sustainability-related content in the business curriculum appears to have achieved small but statistically positive differences in familiarity of most terms, and some self-reported pro-environmental behaviours for example recycling. This indicates that the revised curriculum has been successful in raising awareness and achieving behaviour change. However, the findings indicate that an increased focus on personal relevance on some issues (personal interest and perceived norms, unrealistic optimism and risk denial, and responsibility for action) is warranted, together with fine tuning of the curriculum to strengthen coverage of areas in which change was non-significant or negative.

Two additional studies are planned, one focusing on alumni at various temporal distances from completion of their undergraduate degree and the second focussing on employers. The alumni study asks them to indicate their attitudes, beliefs and perceptions on the same range of issues as used for the undergraduate studies and to reflect on their study experiences. It asks the

alumni to comment on what sustainability issues they have faced in the workplace and to critique their learning experiences in terms of what was valuable about sustainability issues and what was missing and should have been included in the curriculum.

Given that 93% of the world's CEOs are reported to view sustainable development as a key factor in future success (Lans, Blok, & Wesselink, 2014), a modified version of the alumni questions will then be used with ~~a~~ major employer organisations in the region. The survey will include questions relating to the perceived skill set of graduates recently employed by individual firms relative to the firm's expectations and requirements. A match between these is deemed important for employability (Teijeiro, Rungo, & Freire, 2013), and also to comment on proposed sustainability competency skills sets discussed in the academic literature (see, for example, Heiskanen et al., 2016; James & Casidy, 2016). These two studies will assist in further refinement of the business curriculum, particularly in relation to strategies that are claimed to improve work-relevant competencies (Heiskanen et al., 2016).

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Table 1: Schedule of surveys by cohort

	Start Year 1	**End Year 1**	**Year 2**	**End Year 3**
New entrants into the first semester of study	2012			
Students in final year of study before sustainability content introduced		2012		
Major curriculum integration			2012/13	2015 (advanced subjects)
Students in final year of study having completed sustainability curriculum				2015

Table 2: Breakdown of students who completed the survey

Year of study	**Year questionnaire administered**		**Total**
	2012	**2015**	
First year	167	0	167
Final year undergraduate	80	133	213
Total	247	133	380

Table 3: Self-reported familiarity with key terms and their meaning

Significant differences between curriculum change	**2012**		**2015**	
	Mean	**SD**	**Mean**	**SD**
Economic sustainability *p=0.000	3.63	1.14	4.17	0.774
Environmental sustainability *p=0.000	3.89	1.021	4.32	0.722

Social sustainability *p=0.000	3.30	1.166	3.87	0.900
Sustainable development *p=0.000	3.63	1.100	4.02	0.801
Conservation *p=0.007	3.77	1.168	4.05	0.856
Climate change	4.10	1.033	4.27	0.845
Climate change adaptation *p=0.014	3.92	1.060	3.64	0.990
Environmental protection	3.91	1.087	4.11	0.828
Energy conservation *p=0.017	4.21	1.033	3.95	0.940
*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*				

Table 4: Self-reported statements about current behaviour toward sustainability and environmental issues

Statements about:	**2012**		**2015**	
Current behaviour perceived norms	**Mean**	**SD**	**Mean**	**SD**
I save water by taking a shower instead of a bath (in order to spare water) *p=0.006	3.32	1.446	3.73	1.285
I always switch the light off when I don't need it *p=0.044	4.03	1.180	4.27	0.978
I walk or bike to places instead of going by car *p=0.000	2.35	1.374	3.02	1.446
At home I try to recycle as much as I can *p=0.000	3.57	1.298	4.05	1.072
I have changed to environmentally friendly light bulbs	3.40	1.404	3.52	1.357
Sustainability is important to me in making choices about which products or services I choose	3.04	1.202	4.33	0.577
I avoid buying from a company which shows no concern for the environment	2.80	1.309	3.04	1.255

*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*

Table 5: Self-reported knowledge statements about climate change, greenhouse effect and ozone contributing factors, correct or incorrect

Statements about:	**2012**		**2015**	
Climate change, greenhouse, ozone perceived norms	**Mean**	**SD**	**Mean**	**SD**
Human induced climate change is occurring at some level *p=0.002	3.82	1.158	4.20	0.973
Every time we use coal, oil or gas we contribute to climate change *p=0.001	3.75	1.152	4.16	0.991
My personal computer use contributes to climate change *p=0.000	3.12	1.31	3.60	1.094
Carbon dioxide is the primary gas responsible for the greenhouse effect	3.19	1.263	3.70	1.164
The greenhouse effect is caused by an ozone hole in the earth's atmosphere *p=0.000	3.37	1.385	3.60	1.291

*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*

Table 6: Self-reported statements about personal interests in sustainability, environmental issues and climate change

Statements about:	**2012**		**2015**	
Personal interest and perceived norms	**Mean**	**SD**	**Mean**	**SD**
Environmental issues are very important to me *p=0.000	3.37	1.249	4.03	0.937

I often look for signs of ecosystem deterioration *p=0.000	2.20	1.271	2.69	1.268
My friends and family believe they should alter their behaviour to prevent global climate change	2.81	1.277	2.77	1.140
The average JCU student is not at all concerned with the issue of climate change	2.99	1.322	2.98	1.158
It is probably unrealistic to expect JCU students to alter their behaviour to prevent global climate change	n/a	n/a	2.00	1.033

*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*

Table 7: Self-reported statements about unrealistic optimism and risk denial

Statements about:	**2012**		**2015**	
Unrealistic optimism and risk denial perceived norms	**Mean**	**SD**	**Mean**	**SD**
Society will continue to solve even the biggest environmental problems	3.19	1.200	3.29	1.021
Worrying about the environment often holds up development projects * p=0.000	3.19	1.202	3.66	1.121
Our planet has unlimited resources	1.89	1.231	1.95	1.453
Nature is always able to restore itself	2.32	1.278	2.29	1.152
Humans have the right to change nature as they see fit	2.24	1.265	2.16	1.260
People worry too much about pollution	2.38	1.240	2.37	1.270
People worry too much about climate change	2.58	1.322	2.55	1.292
The so-called 'ecological crisis' facing human beings has been greatly exaggerated *p=0.004	2.97	1.317	2.56	1.305

There is little action that I can take to reduce the threat of climate change	2.75	1.313	2.74	1.235
Humankind will die out if we don't live in tune with nature *p=0.005	3.25	1.370	3.65	1.201
If things continue on their present course we will soon experience a major ecological catastrophe *p=0.000	3.09	1.257	3.65	1.232
We cannot slow the rate of climate change	2.55	1.324	2.55	1.270
*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*				

Table 8: Self-reported statements about responsibility for action

Statements about:	**2012**		**2015**	
Responsibility for Action	**Mean**	**SD**	**Mean**	**SD**
The government should take an active role in the global effort to curb the problem of rapid climate change *p=0.000	3.66	1.296	4.24	0.780
We must set aside areas to protect endangered species	3.99	1.191	4.11	1.061
Economic development, social development and environmental protection are all necessary for sustainable development *p=0.000	3.75	1.269	4.35	0.863
Overuse of our natural resources is a serious threat to the health and welfare of future generations *p=0.000	3.82	1.213	4.42	0.889
Taxes on polluters should be increased to pay for damage to communities and the environment *p=0.000	2.98	1.316	3.88	1.066

We, as a society, should radically change our way of living to offset the danger of climate change *p=0.000	3.13	1.134	3.73	1.122
*Note: * Significant difference between years of study; 6-point scale where 5 = very familiar, 1 = not familiar at all and 0 = don't know*				

Table 9: Self-reported statements about where students source information about sustainability and climate change

	2012		2015	
	Mean	**Std. Dev**	**Mean**	**Std. Dev**
Television News Items	3.89	1.314	3.72	1.564
Television Documentaries	2.60	1.442	2.88	1.382
Television Advertising	3.61	1.654	3.32	1.676
Radio News Items	3.37	1.789	3.18	1.766
Radio Advertising	3.19	1.926	2.92	1.830
Magazine Editorial *p=0.047	2.38	1.503	2.06	1.424
Magazine Advertising	2.12	1.402	1.87	1.416
Cinema *p=0.000	2.95	1.760	2.11	1.268
Word of mouth (family or friends)	3.83	1.530	3.54	1.333
Internet *p=0.000	3.61	1.789	4.44	0.885
Social media *p=0.000	2.49	1.994	4.05	1.375
Direct mail	2.89	1.881	1.96	1.827
Family	3.43	1.758	3.35	1.553
Friends *0.000	1.64	2.023	3.56	1.378
Other Sources	2.21	1.724	1.41	1.902

*Note: * Significant difference between years of study; 6-point scale where 5=Daily, 4=Weekly, 3=Monthly, 2=about 2 – 3 times a year, 1=Perhaps once a year, 0=rarely or never*

Table 10: Self-reported statements about trustworthiness of sources of information about sustainability and climate change

	2012		2015	
	Mean	Std. Dev	Mean	Std. Dev
Television News Items	3.15	1.243	3.63	4.520
Television Documentaries *p=0.000	2.67	1.289	3.48	0.974
Television Advertising	2.61	1.332	2.62	1.179
Radio News Items *p=0.000	2.53	1.315	3.01	1.184
Radio Advertising	2.38	1.213	2.51	1.251
Magazine Editorial *p=0.200	2.23	1.290	2.55	1.213
Magazine Advertising	2.31	1.436	2.25	1.181
Cinema *0.003	2.11	1.259	2.51	1.153
Word of mouth (family or friends) *p=0.002	2.67	1.234	3.05	1.047
Internet *p=0.039	2.86	1.196	3.10	1.007
Social media *p=0.001	2.19	1.391	2.67	1.217
Direct mail	2.28	1.521	2.39	1.413
Family	2.98	1.331	3.11	1.144
Friends	2.93	1.306	3.05	1.069
Other Sources *p=0.000	0.93	1.566	1.74	1.833

*Note: * Significant difference between years of study; 6-point scale where 5=Totally trust-worthy, 4=Highly trust-worthy, 3=Fairly trust-worthy, 2=Slightly trust-worthy, 1=Not trust-worthy at all, 5=N/A – do not use this source*