

Beyond the First Year Experience in Science: Identifying the Need for a Supportive Learning and Teaching Environment for Second Year Science Students

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Abstract

The Second Year (sophomore) Slump is a well-defined phenomenon affecting American undergraduate students in the middle years of their degree. In the Australian context, minimal attention has been given to identifying or addressing potential concerns with the transition and satisfaction of students beyond their first year of study in science degrees. A case study of second year students ($n = 165$) studying a bioscience course is presented. Potential student demographic factors, including low social economic status, non-English speaking background, first in family to attend University (>60%), and Grade Point Average (GPA) progression, were examined. An academic slump based on GPA trend of a decrease of GPA greater than 0.35 was observed for 33% of the student cohort, irrespective of their program of study or background. We surveyed the second year students to identify their concerns in this year of study and their preferences for various support activities. The survey indicated that academic workload/expectations and work experience were of most concern to students. The survey results were considered in the context of an institutional focus on strategies to enhance student engagement and retention throughout the student lifecycle. We propose that a strategic design approach, with alignment between curricular and co-curricular activities, is more likely to have success in enabling science academic staff to engage and support second year students.

Introduction

The Second Year (sophomore) slump (Wilder, 1993; Freedman, 1956) is a known recognized phenomenon that has been shown to affect second year college students in the United States: the 'slump' refers to a decrease in student engagement with college life (Gump, 2007). The slump is associated with a phase in the degree studies during which some students experience developmental confusion and a range of pressures, and struggle with engagement in learning, motivation (Granuke & Woosley, 2005), perceived academic competence along with personal issues, self-confidence, autonomy, and sense of purpose with their studies (Hunter, Tobolowsky, Gardner, *et al.* 2010; Lemons & Richmond, 1987). Student self-reporting of the sophomore slump, including comments such as 'burnout', 'a lot tougher', 'academic dead zone' and 'directionless', lends support to other studies of sophomore slump (Schreiner & Pattengale, 2000; Anderson & Schreiner, 2000). Second year often represents the point at which a

commitment to a specialised area of study is made, including a choice of discipline area (major) in the sciences, and thus has a significant impact on future career directions of students. Targeted initiatives to turn the slump experience around and improve retention rates at second year have been implemented in universities within the United States (Tobolowsky, 2008; Burke, 2007). These initiatives focus on providing social and professional networking opportunities, leadership and seminar series for student development (Hanover, 2009; Gahagan & Hunter, 2006).

In the tertiary education sector, both in Australian and international contexts, the last twenty years has seen significant change from an elite system to a mass system, generating considerably wider participation in higher education. The Review of Australian Higher Education Report (Bradley, Noonan, Nugent, & Scales, 2009) highlighted the need for wider participation and increased participation of groups, such as low socio-economic status students. Student diversity has increased as a consequence of the increase in numbers of students studying for a tertiary qualification. Student engagement issues have been highlighted as a consequence of the increase in diversity of the student population and increased wider participation over the past decade (Coates, 2008; Lawrence, 2005). In conjunction with an Australian Government policy that included a commitment to first year students as a core area of strategic planning (DEEWR, 2009), universities have focused recently on institutional strategies to enhance student engagement and retention, primarily at the first year level (Kift, Nelson, & Clarke, 2010). There are few studies on student engagement at the second year level, but correlations between the Second Year (sophomore) slump in the American university system and the corresponding stage in the Australian university system are starting to emerge (McBurnie, Campbell & West 2012; Harrison & Gregory, 2012; Gregory & McDonnell, 2012; Quinlivan, 2010; Harrison, 2007).

There is a declining trend in qualified graduates and professionals in science and technology within Australia (Australian Council of Deans of Science, 2003; Dobson, 2003; Australian Council of Deans of Science, 2001; McInnis, Hartley & Anderson, 2000) and a lack of student interest in science (Harris, Jenz & Baldwin, 2005). Given these trends, it is critical to retain science students that are attracted to science study and graduate scientists. Australian higher education government priorities indicate a need to sustain and enhance scientific programs and produce science graduates (Office of the Chief Scientist, 2012). Current initiatives within Australia aim to stimulate renewed interest in the study of science through curriculum-based activities within the science discipline area (Jones & Yates, 2011; Johnstone, 2007). In addition, alignment between curriculum and co-curricular activities has been shown to be pivotal to the holistic experience of students throughout their higher education studies (Tinto, 1998).

Purpose of the study

We here report on a case study of a cohort of second year bioscience students enrolled in seven science based bachelor (3 year) degrees at Griffith University. We examine whether the Second Year Slump can be identified in an Australian science student context, both in terms of academic performance and student perceptions of their second year studies. This study also aims to identify effective strategies to address student engagement and persistence in second year studies. This study examines the student first year demographic factors, such as low social economic status, non-English speaking background, first in family to attend university, and Grade Point Average (GPA) at commencement of second year (student academic capital). Data from a survey of student perceptions within the cohort and student GPA progression is

presented in relation to these pre-second year student demographics. This study also aims to identify effective strategies to enhance student engagement and persistence in second year.

Methodology

Course context

The student sample was drawn from within a single second year course (unit of study/subject) in the bioscience area that was listed in second year of the degree program structures of science, bioscience, medical science and forensic science degrees offered at Griffith University (Nathan campus). The second year bioscience course (Metabolism) is theory based and comprised of lectures to explain and discuss concepts based on knowledge of scientific content in the bioscience area together with workshops to provide active engagement and participation in the learning processes required to gain a thorough understanding of the course material and content. The structure of the course has been shown to support student learning (Gregory & Cock, 2012). The course received strong results on the compulsory university student evaluation of course survey at the end of the semester of offer (semester 1, 2012) with an overall satisfaction rating, consistent with previous years, of 4.3 out of 5 (49% response rate of students enrolled). Within their second year, students in this course could be enrolled in different degree programs (see below) with different entry requirements.

Participants

Within the second year bioscience course, 175 students were enrolled. For all the students, data was de-identified prior to analysis. The data was clustered by student background type; Low Socio-Economic Status (SES), Non-English Speaking Background (NESB), and GPA ≥ 4 prior to enrolment in the course and GPA < 4 prior to enrolment in the course, where a GPA of 4 represents obtaining an average of a passing grade in each semester of study. Further data was obtained from degree entry data; First in Family, Primary Carer and Primary Income Earner. Students enrolled in the course comprised two sub-cohorts: those students who were progressing directly into a second year course after completing one full year of study (second year students); and students who were progressing into the second year course/subject after completing more than one year of university or credit bearing study (second year plus students). Students were typically taking the required course load (40CP, 4 courses over 1 semester) for the semester of study in their degree program, which included the 10CP second year bioscience course. At census date (end of week 4 of a 13 week semester), 10 students (representing 6% of the cohort) had withdrawn or dropped their enrolment, and thus their data were not included in the detailed analysis of the study.

Survey design and survey data collection

Students enrolled in the study course were asked to respond to an anonymous survey at the commencement of their second year (see Figure 1). Only students who self-identified as second year students, having already studied one year (80CP) at University, completed the survey. In 2012, there were 80 respondents, representing 46% of the total student cohort and 65% of the 'second year' student cohort. The survey was designed to determine the level of student concerns in their second year of study at university and preferences for support activities using three close-ended questions. The survey questions were selected to identify the broad concerns of students and activities for development for student support. In this context the questions were designed from existing literature on concerns identified by students suffering the Second Year (sophomore) Slump and activities that have been identified as successful interventions (Hunter, Tobolowsky, Gardner et al., 2010; Hanover, 2009; Granuke & Woosley, 2005). The survey started with an optional question that allowed students to identify which program they were enrolled in. Question 1 was a key question to

identify the level of student concern about their second year. The responses were ranked on a ten-point Likert rating scale from Very Much (10) through to Not at All (1).

Q1. How much do you worry about what 2 nd year will be like?					
1	2	3	4	5	6
7	8	9	10		
Not at all			Very much		
Q2. I am concerned about the following aspects of 2 nd year university: (SD = strongly disagree, D=disagree, N=neutral, A=agree, SA=strongly agree)					
	SD	D	N	A	SA
Academic workload	1	2	3	4	5
Academic expectations	1	2	3	4	5
Timetabling	1	2	3	4	5
Personal development (leadership skills, confidence etc.)	1	2	3	4	5
University social life	1	2	3	4	5
Balancing my job with my university studies	1	2	3	4	5
How the content of 2 nd year will help my career	1	2	3	4	5
How to gain work experience before I graduate	1	2	3	4	5
Other	1	2	3	4	5
Q3. Would you participate in any of the following activities if they were offered during your 2 nd Year?					
<input type="checkbox"/> Content refresher course revising key 1 st year concepts pertaining to 2 nd year courses (NOTE: If you have chosen this activity, then in which Week of Semester 1 of 2 nd Year would you like to have the refresher course run? (Please Answer Here:Week.....))					
<input type="checkbox"/> Effective study strategies course (NOTE: If you have chosen this activity, then in which Week of Semester 1 of 2 nd Year would you like to have the effective study strategies course run? (Please Answer Here:Week.....))					
<input type="checkbox"/> Exam strategies revision					
<input type="checkbox"/> Social activities throughout year (please provide examples of activity type and timing below)					
Examples:.....					
<input type="checkbox"/> Career information opportunities					
<input type="checkbox"/> Opportunities to hear about the research that your lecturers undertake (chat session, podcast, other)					
<input type="checkbox"/> Opportunities to hear from science professionals (chat session, podcast, other)					
<input type="checkbox"/> Opportunities to hear from Alumni about their coping strategies, employability					
<input type="checkbox"/> Learning how to better balance university with work and life					
<input type="checkbox"/> Work experience opportunities related to your discipline					
<input type="checkbox"/> Development/presentation workshop on professional resume writing					
<input type="checkbox"/> Allocation to informal study groups					
<input type="checkbox"/> Peer mentors specifically for 2 nd year students					
<input type="checkbox"/> Common time in 1 st semester for students in the same program					
Q4. Do you have any other suggestions of activities that you feel would enhance your ability to succeed in 2 nd year?					

Figure 1: Student Survey entitled ‘The School is interested in how to enhance your 2nd year university experience’

Question 2 shows the questions (ranked from strongly agree (5) to strongly disagree (1)) that students were asked when evaluating their perceptions of second year of university. Question 3 sought student feedback on initiatives that they considered would support them in their second year studies. Students were also given the opportunity to respond to an open ended question about success in 2nd year. The survey results were tabulated into *Microsoft Excel*TM for processing and are presented in the Results section.

De-identified student data collection and analysis

For each de-identified student, their background (demographics) data were identified as (i) program enrolled in, (ii) low SES status, and (iii) NESB. The de-identified academic records were used to calculate the GPA prior to enrolment in the second year course. GPA has been shown to correlate with susceptibility to slump in second year cohorts (Quinlivan, 2010). The GPA values were then ranked as (i) $GPA \geq 4$ prior to enrolment in the course and (ii) $GPA < 4$ prior to enrolment in the course. In addition, the GPA for the semester of this study (semester 1, 2012) was calculated. The de-identified academic records were also examined for the courses and course load studied prior to enrolment in the second year course and for semester 1, 2012 to establish whether the student was a full time second year student (completed 80CP/8 first year courses) or had withdrawn or dropped enrolment in their first year. All student data was recorded in a de-identified manner and then grouped according to the number of students by degree and by category (e.g. low SES, NESB) for the purposes of this study.

For each degree cohort represented in the course, the anonymous Starting@Griffith Survey (Griffith University) data for 2011 (the year that the study participants commenced their studies) was used to identify student backgrounds as (i) First in Family, (ii) Primary Carer and (iii) Primary Income Earner. The degree programs were categorised as follows on the basis of entry requirements and discipline area where very high entry requirements is equivalent to an Overall Position (OP) of 1 or Australian Tertiary Admissions Rank (ATAR) of 99 and lower entry requirements equivalent to an OP of 16 or ATAR of 67: Program type A (Biomedical Science, high entry requirements, 62 students); Program type B (Science, lower entry requirements, 45 students); Program type C (Forensic Science, moderate entry requirements, 34 students) and Program type D (Medical Science, very high entry requirements, 34 students). All the above student data was tabulated into *Microsoft Excel*TM for processing and analysis.

The de-identified student data was analysed as follows. The enrolled cohort of 165 students was grouped according to degree program type (type A, $n = 62$; B, $n = 45$; C, $n = 34$; D, $n = 34$). Each group was subdivided into the following categories: Low SES status, non-English speaking background, First in Family, Primary Carer, Primary Income Earner, $GPA \geq 4$ prior to enrolment in the course, $GPA < 4$ prior to enrolment in the course. Data was expressed as a percentage of the total cohort ($n = 165$), 'second year' cohort ($n = 124$, students who had completed one full year of study) or 'second year plus' cohort ($n = 41$, students who were beyond their first semester of second year studies) as applicable. The GPA for each student in the semester of study containing the second year bioscience course was compared to the GPA obtained in year 1 and prior to enrolment in the course. A GPA deviation of greater than 0.35 on a 7 point scale, which represents an overall change from one grade bracket to another for the semester (e.g. all credits 65-75% to all pass grades 50-65% for the semester) was considered, by this study, an indicator of a positive or negative change and thus an indicator of a second year slump. The data for subsequent GPA in third year was not available at the time of this study.

Results

Evaluation of student background on academic progression in semester 1 of Year 2

Figure 2 shows the breakdown of the background of second year student (124 students) in each category (Low SES, NESB, First in Family, Primary Carer, Primary Income Earner, GPA < 4 prior to enrolment in the course) aggregated by Program type (type A-D) and expressed as a percentage of the total second year student cohort. The results indicate that a high percentage (> 60%) of students are First in Family students and are in degree programs with high to lower entry standards (A-C).

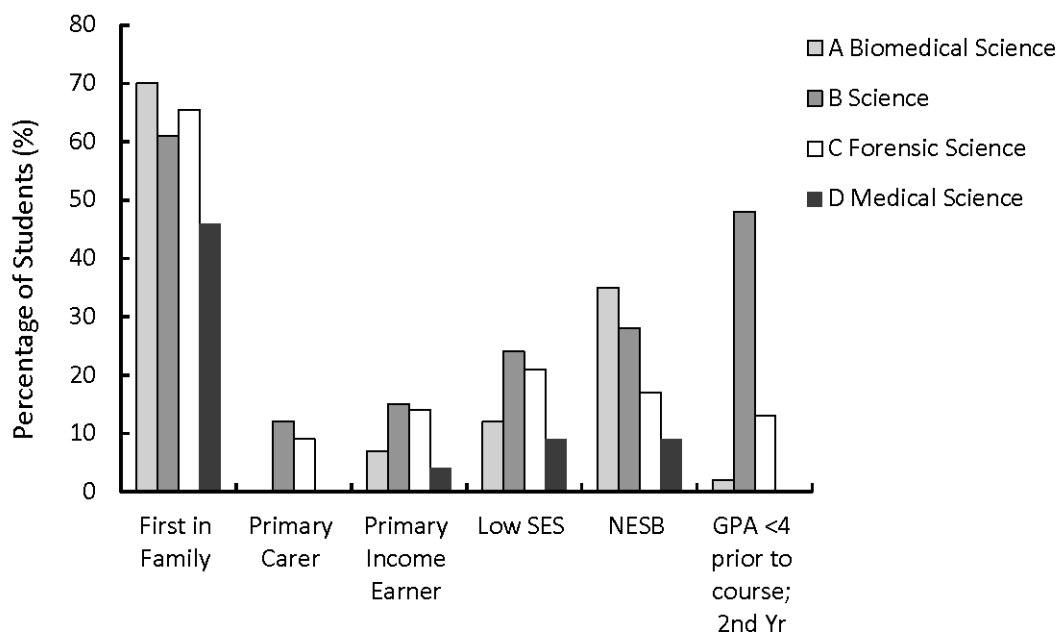


Figure 2: Background demographics of second year students (n = 165) enrolled in Bioscience course (prior to enrolment in second year Bioscience course/unit expressed as percentage of the students with that background (First in Family to enter University, Primary Carer, Primary Income Earner, Low Socio-Economic Status (SES), Non-English Speaking Background (NESB) and Grade Point Average (GPA) prior to second year) and by enrolment in degree program (A, Biomedical Science; B, Science; C, Forensic Science; D, Medical Science)

Higher percentages of students that were primary carers, primary income earners, and from low SES backgrounds were enrolled in the programs with moderate and lower entry standards (Type B and C; Science, Forensic Science). Notably, the 'type B Science' programs had students with the poorest academic capital entering into second year, with 48% of students having a GPA <4 prior to starting their second year course. Students that were in the NESB category were enrolled in higher percentages in the type A Bioscience (35%) and type B Science (28%) programs. By contrast, students in the type D Medical Science program (which has a very high entry standard) had the lowest First in Family percentage of 45%. This is still high compared to the 31% average for domestic students at Australian universities (James, Krause & Jennings, 2010). Students in the type D Medical Science program also had the lowest representation of Primary carer (0%), Primary Income earner (4%), Low SES and NESB (9%) as compared to students in the other programs (type A-C), and the strongest academic capital entering into second year (100% with GPA \geq 4).

The program types and background categories were then compared with the GPA analysis for the

semester of study for second year students, having already studied one year at University. The clustered data were organised into a GPA deviation of ± 0.35 or a GPA deviation within 0.35 and separated into academic capital entering into second year ($\text{GPA} < 4$ or $\text{GPA} \geq 4$). The students (16 students; 13% of cohort) with poor academic capital ($\text{GPA} < 4$ prior) generally maintained their grades, albeit often poor ones. A decrease of $\text{GPA} > 0.35$ was observed for the programs with moderate and lower entry standards (Type B and C; Science, Forensic Science). Only one program (Type C, Science) showed an increase of $\text{GPA} > 0.35$: no students with a $\text{GPA} < 4$ prior were from the type D Medical Science Program.

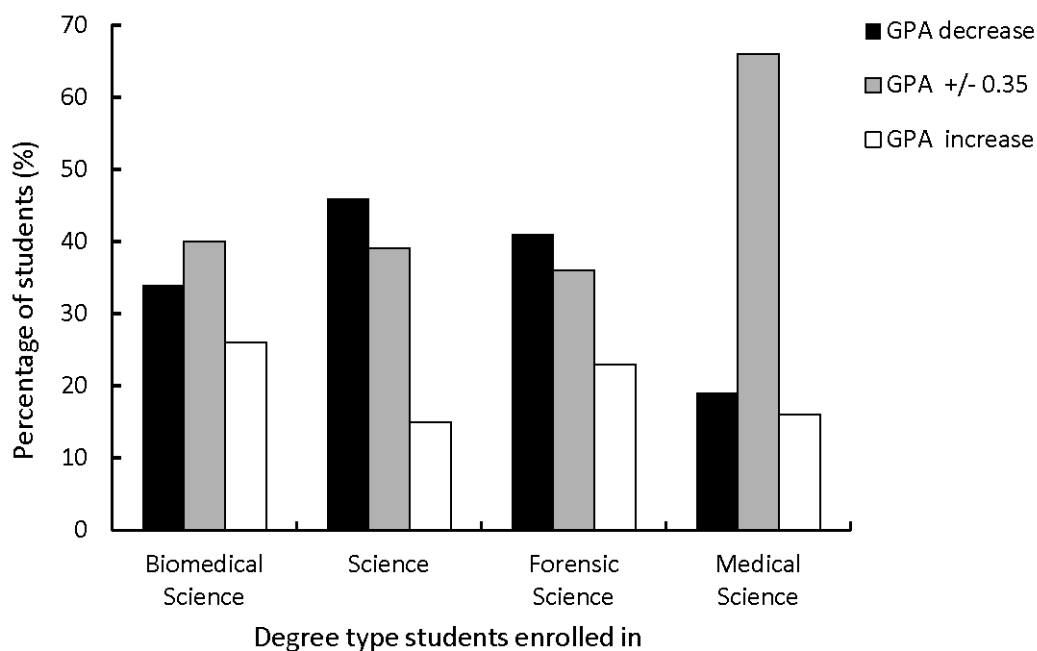


Figure 3: Percentage of students with a GPA increase > 0.35 , GPA ± 0.35 or GPA decrease > 0.35 by program type for second year students ($n = 108$ students) with a prior GPA > 4

The students with good academic capital ($\text{GPA} > 4$ prior) represented 87% of the second year cohort. These students improved their performance (between 15-26%), maintained their performance (36-66%) and decreased (GPA decrease of > 0.35) their performance, irrespective of their entry requirements or student backgrounds (e.g. 19% in Medical Science, Figure 3). Overall, in the second year only cohort (124 students), 41 students representing 33% of the cohort had a decrease of > 0.35 in their GPA.

The GPA analysis was extended to students who were beyond their first semester of second year studies (40 'second year plus' students), generally due to poor academic performance. Of the second year plus students, 40% had an increase of $\text{GPA} > 0.35$, 28% had a GPA within ± 0.35 and 33% had a decrease of $\text{GPA} > 0.35$ (identical to the second year only cohort).

Student perceptions of second year

Figure 4 shows responses to the question identifying the level of student concern about second year. Responses (80 students of the 164) in the survey indicated that 19% of students were experiencing a high level of concern while 60% of students had moderate levels of concern and 21% had low levels of concern.

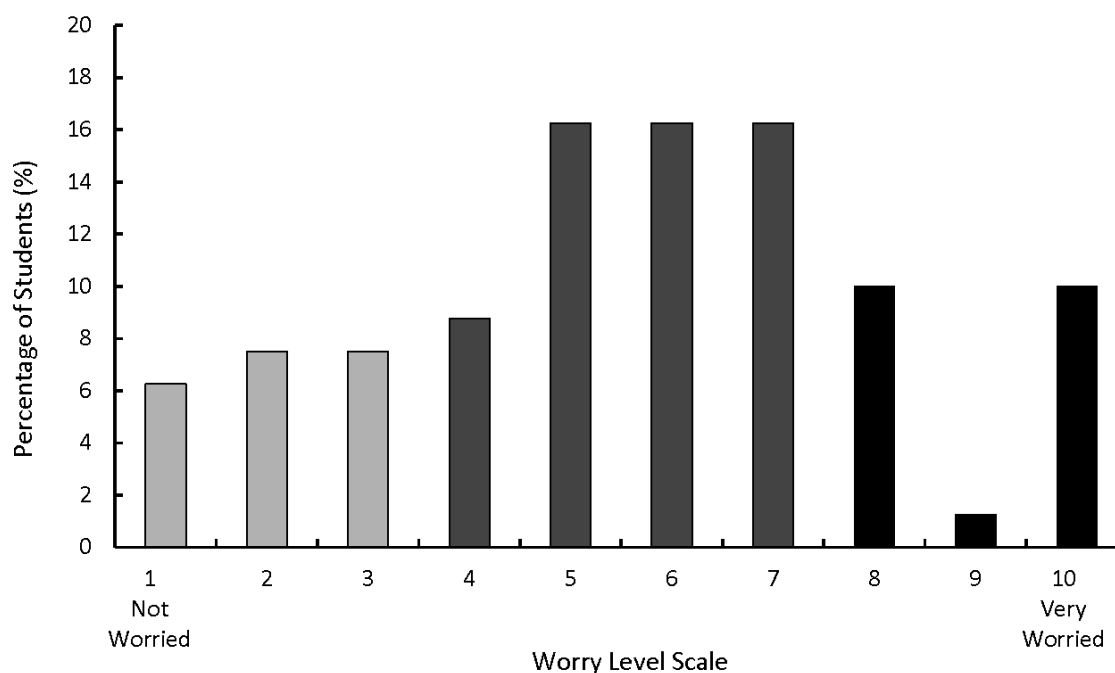


Figure 4: Survey responses (n = 80) expressed as a percentage indicating level of worry of survey respondents regarding second year of study

Student responses to questions that asked what aspects of second year they were most concerned with indicated that their greatest concerns related to academic workload (82%), academic expectations (71%), how to gain work experience (55%), whether second year content will help with their career (53%), and balancing a job with study (45%) (Figure 5). These responses were linked back to the students program of study if provided on the survey. Comparison of the clustered data responses about balancing a job with study with the degree program type (A-D) that students were enrolled in indicated the following general observation. Students experiencing a high level of concern about balancing a job with study (4-5 on the scale, 40-56% of the student program cohort from the survey responses) were typically from Type A, B and C programs (with lower to moderate entry standards) and were reflective of the higher percentages of Primary Income earner and low SES background categories of these programs. Students enrolled in the Type D Medical Science program showed low concern about balancing a job with study (1-2 on the scale, 72% of the student program cohort).

The majority of respondents to Question 3, which sought student feedback on initiatives that would support them in their studies, indicated more than one preference (n = 21-58 for each preference) (Figure 6). Refreshment of content was of the highest importance to respondents (72%). Of next highest importance (49-62.5% of respondents) were activities that would assist students gaining employment, such as discipline-specific work experience, opportunities to hear from science professionals, career information and opportunities to hear about research. Effective study strategies and exam strategies revision were then of some importance (44%) to respondents. Students rated 'Common time' (a scheduled one hour student support time independent of course curricula) lowest of all suggested activities (Figure 6).

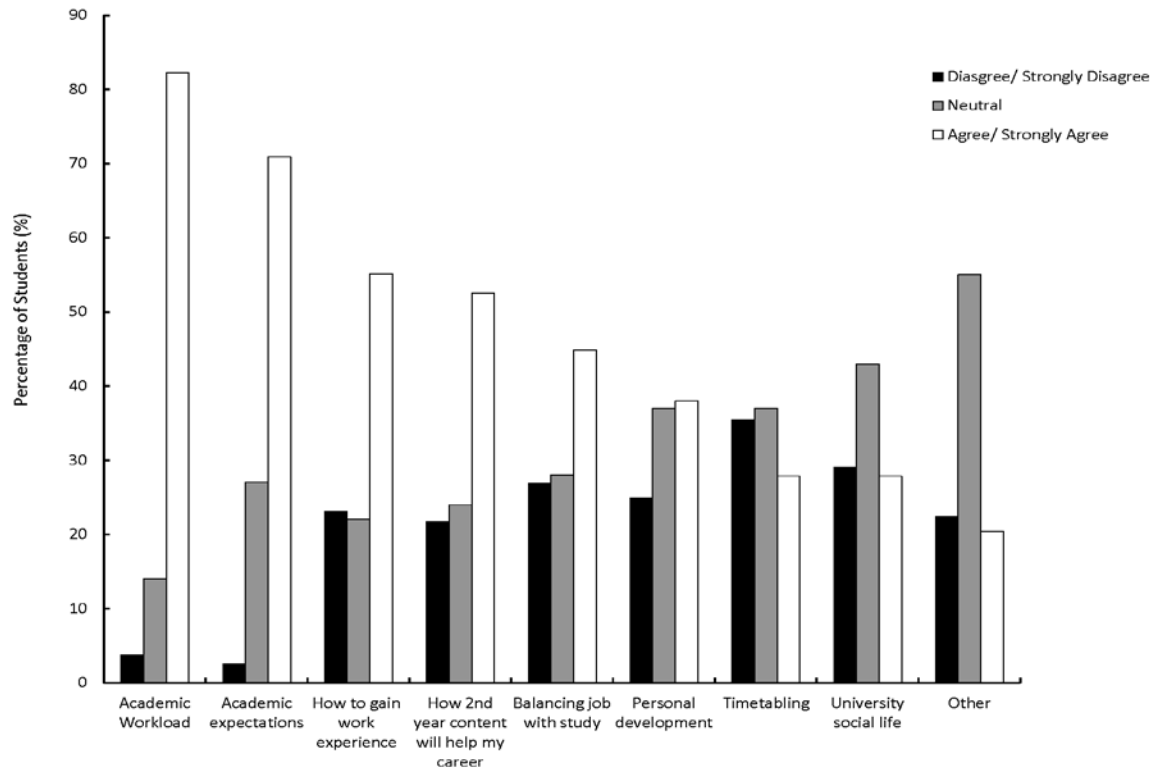


Figure 5: Survey responses (n = 80) regarding concerns of second year students in their second year of study

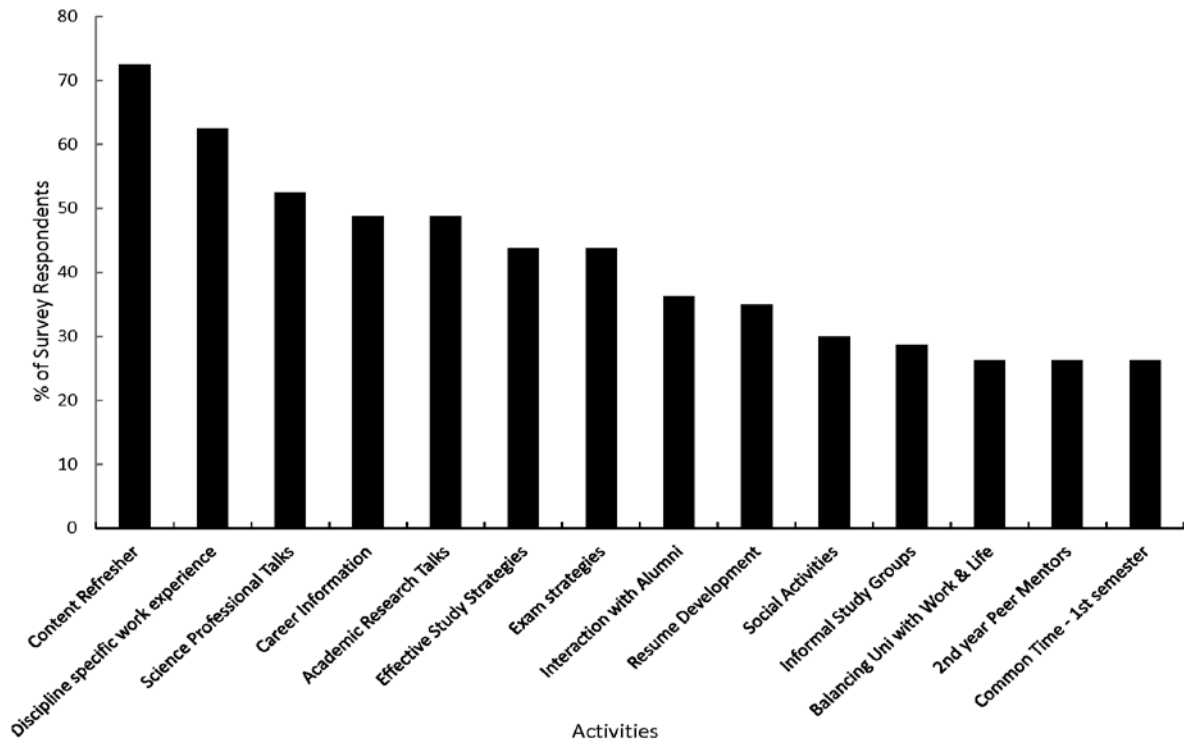


Figure 6: Activities that second year student survey respondents (n = 80) indicated they would participate in during their second year of study

The final open ended question of the survey asked for suggestions of activities that students would enhance their ability to succeed in second year. There was a very poor response to this question (n=6) and thus no analysis was carried out. In addition to the student responses above, *ad hock* feedback was sought from staff at a school meeting and through general discussions. The primary concern of staff was the impact on academic workload in the context of balancing a teaching and research academic profile.

Discussion

A case study of a cohort of second year bioscience students was examined, where potential student demographic factors involved in sophomore slump; such as low SES, NESB, First in Family to attend University, Grade Point Average progression, were identified. Some of the challenges First in Family students may face beyond first year and into the second year of their studies include, doubting their ability to study at a more advanced tertiary level, finding a balance between family commitments, work commitments and study and having family members not approving/supporting University studies (Pike & Kuh, 2005).

A student survey (80 responses from 175 students) established the level of concern of 46% of the student cohort early in their second year of study. The second year bioscience course at Griffith University presents an interesting case study of student diversity under the Bradley agenda (Bradley, Noonan, Nugent, & Scales, 2009) of wider participation and increased participation of groups such as low socio-economic status students. The survey was run very early in semester, when students had attended some lectures but not workshops or laboratories in other courses. This may account for the high percentage of students in the middle category of 'some concern', and who may have a developing understanding of the expectations and requirements for second year at the time of the survey. In the survey, students were given the option to identify which program they were enrolled in. Of responses, only 52 students declared their program (29% of the total cohort). Due to the lower program identification rate, only a general observation was made. Students experiencing a strong level of concern (8-10 on the scale) were typically from Type A, C and D, the programs with moderate to very high entry standards, however some level of concern was observed across all program types.

The data clearly show that at this stage of their degree studies, many second year students are concerned with academic engagement, career exploration and, to a lesser extent, with balancing extracurricular pressures (such as work) with study. The students reported that they would respond to initiatives aimed at improving academic engagement, student-staff-industry interactions, and career exploration, and to a lesser extent, social activities. These observations echo key aspects of the *sophomore slump* phenomenon reported at American colleges, where second year students often struggle with self-confidence, autonomy and academic commitment (Schreiner, 2010; Graunke & Woosley, 2005).

Collaboration between curriculum and co-curricular activities: A proposal

This case study was considered in the context of an institutional focus on strategies to enhance student engagement and retention throughout the student lifecycle of a degree program (Years 1-3). Concomitant with wider participation (Bradley, Noonan, Nugent & Scales, 2009), while Australian universities have focused recently on institutional strategies to enhance student engagement and retention, these have primarily been aimed at the first year level (Kift, Nelson & Clarke, 2010). In light of this case study and student lifecycle approaches, we propose that a strategic design approach, in which alignment between

curriculum and co-curricular activities occurs at the second year (and above) level, is more likely to have success in enabling academic staff to engage and support science students with the best possible learning experiences and outcomes during the student's scientific education. The need for synergies between curriculum and co-curricular activities also has been shown to be pivotal to the holistic student experience of higher education overseas and indeed student persistence (Tinto, 1998). To this end, this study has been following guidance to address this issue, provided by Wenger *et al.* (2002), on the principles and development of communities of practice (COP) coupled with the academic theory of Becher and Trowler (2001) that concerns in the academic community are reflecting on academics research interests as well as their teaching patterns.

So what is the way forward? At the curriculum level, academic staff could design (re-design) curriculum and learning environments across the student lifecycle and use the Threshold Learning Outcomes (TLO's) (Jones & Yates, 2011) that are being introduced into Australian universities as opportunities to engage second year students. A holistic degree program view could be considered in which the second year experience is developed as an 'enabling year' that compliments and extends the transitional initiatives of the first year experience, and looks forward to the career and work focus of students as well as support through academic activities such as content refreshers during second year. Content refreshers could take the guise of allocated 'help sessions' during semester, which replace selected tutorials or workshops, or self-paced support resources such as online writing tutorials. Initial co-curricular activities that encompass social, networking and career activities may include, for example, dodgeball games in the gym, networking lunches with staff and second year students, a careers website with separate sections addressing different year group levels and a career night that starts collectively (Years 1-3) and then splits out into different year levels with appropriate direct information. Successful integration of co-curricular activities requires support from key stakeholders in the institution (such as careers and employments services) and willingness to adapt and create new partnerships with existing stakeholders in an institution. As a step forward, a community of practice -a group of interested academics who share a concern for second year students (Zimitat, 2007) – called the *Second Year COP*, has been recently established for Science at Griffith University to focus on investigating both how core issues of student experience specifically affect second year students and how to better address these within curriculum offerings. The COP approach allows gaps in support for second year students to be identified and new initiatives to be developed. It provides a forum for discussion on issues that are broader than just curriculum which affect student outcomes, a forum for enhancing staff awareness of issues for second year students, and a forum for the development of a strategic design approach to alignment of curriculum and co-curricular activities.

Conclusions

From this study it was noted that the academic progression of up to 33% of second year students is hindered by grade slump. This slump was observed for all types of science programs (Biomedical Science, Science, Forensic Science, Medical Science). Addressing this issue is critical in the context of retaining and graduating Science students. Students expressed concerns with academic engagement, career exploration and to a lesser extent balancing extracurricular pressures (such as work) with study. The students would thus welcome second year initiatives aimed at improving academic engagement, student-staff-industry interactions and career exploration, and to a lesser extent social activities. This highlights the need for better integration of curriculum and co-curricular activities. An academic community of practice (Second Year COP) was established for staff as a focused way forward in addressing

core issues of student experience and how to better address these issues within curriculum and co-curriculum offerings to engage and support science students. A focus on second year curriculum and teaching is important in the context of engaging students in science as a career, and timely as Australian Universities consolidate and scrutinise their threshold learning outcomes and assessment in science degree offerings under a new regulatory framework.

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