The relationship between First Year Engineering Students' perceptions of workload and stress

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Abstract: Engineering degree programs are notorious for placing considerable demands upon their students. Balancing study and work is a challenge faced by an increasing number of undergraduate students. There is an implicit assumption that an increase in workload results in more stress for the students; however a closer examination of the situation reveals greater complexity. This paper presents data gathered in a semester-long weekly survey of first year engineering students. Students were asked to rate their stress levels and workload relative to normal, and they were also asked to give an absolute rating for their stress levels. Their self-reported levels of workload and stress are compared to each other and to the number of hours reported for study and paid employment. This comparison shows that while in general workload and stress are indeed linked, there is a substantial proportion of the cohort for whom these factors appear to be independent. In particular the link between absolute stress and workload appears weaker, suggesting that the issue may not be the actual level of stress, but rather the students' perceptions of what constitutes a "normal" workload at a university level.

Introduction

Engineering degree programs are notorious for placing considerable demands upon their students. Balancing study and other commitments, such as paid employment, is a challenge faced by an increasing number of undergraduate students (McInnis, 2001). These challenges are particularly difficult for first year students who are also dealing with the transition from high school student to the university environment.

The Graduate Course Experience Questionnaire is a key indicator of the teaching performance of Australian universities, and Engineering has historically underperformed against other degree programs. Average ratings on the Good Teaching Scale are consistently 10-20% lower for Engineering programs than the overall national average (Graduate Careers Australia, 2006), with excessive workload issues being a common theme in graduate responses.

There are a wide range of factors that cause stress in undergraduate students (Garrett, 2001). While academic-related issues certainly contribute, a significant number of non-academic-related factors also contribute heavily to the stress levels of students (Ross, Niebling, & Heckert, 1999). Academic workload is only one part of the issue; however it often misunderstood.

The concept of workload is potentially misleading as students' self-reporting of workload does not necessarily represent their ability to cope with their learning load. Jonkman et al (2006) showed students' perceptions of workload not being correlated to the amount of work that they do, but instead showing some correlation to the number of assignments that they are required to complete. Other studies have shown that the extent to which the work is perceived as meaningful impacts upon the students' ratings of workload (Kember, 2004; Marsh, 2001).

There are also issues with the way in which academics view student workload. High workloads are common expectation of academics; with this comes the fear that students will rate an instructor lower on teaching evaluations as a result. The work of Dee (2007) shows that the quality of instructional techniques can be more important than the level of workload in determining student satisfaction; however the challenge of balancing student workload and satisfaction remains.

This paper explores the relationship between students' perceptions of their workloads and their stress levels. The study was carried out with a large cohort enrolled in a first year Engineering Foundation

Principles and Communication (EFPC) unit at (Curtin University). Students were asked to complete an online survey on a weekly basis. The students' responses regarding their workload and stress levels over a full semester are presented in this paper.

The Survey Instrument

The Engineering Foundation Principles and Communication (EFPC) unit includes an activity called the Weekly Workload Reflection. This activity is an eleven question survey that students are encouraged to complete as a reflective exercise to help them with developing their time and workload management skills. The students are asked a range of questions dealing with the nature of their workload: How many tasks, of what size, difficulty and relevance? How many hours did they invest in their study? In paid work? What factors have contributed to their workload this week? Which one contributed the most? What strategies worked well this week? What will you do differently next week?

This weekly reflection serves two purposes: firstly (and most importantly), as a tool for developing the students' professional skills; and secondly as a source of research data regarding student workloads. This multiple purpose approach places some constraints upon the data collection; these constraints have the potential to confound the significance of any research findings.

The most obvious of the constraints is that the survey collects self-reported data. Students are asked to estimate their workloads, and the number of tasks that they have to complete each week. Relying upon this self-reported data introduces the risk of misreporting; however the steps necessary to avoid this risk are prohibitive to the exercise. The survey is intended as a non-invasive, quick, once-a-week activity. Monitoring 300+ students throughout the fourteen weeks of semester to ensure accurate reporting would require a substantial investment of resources, as well as placing a much larger burden upon the participants. Completion of the survey itself represents an increase in the students' workloads; this addition, presented at a time where their awareness of the extent of their workload is inherently heightened, can lead to frustration and resentment.

In order to make the results meaningful, students need to engage authentically with the exercise. There was a concern that if the purpose of the survey was seen to shift from a teaching exercise to a research instrument, students would be less likely to engage properly with the survey. Rather than seeing it as a learning opportunity, it would instead be viewed as an unfair burden using them as research "guinea pigs". For this same reason it was felt that compulsory participation would be unhelpful, as well as complicating the process of acquiring ethics approval for the work.

Consistency between responses was a major concern for the analysis of results, as it is for most self-reported data. A student who has done some forward planning may report a major project as a set of five small tasks rather than as one large task; a student who is not up to date on lecture material may report the hours of catch-up as part of the time taken to do an assignment. This potential weakness in the data is inherent in the nature of how it is collected; remedying this weakness, however, was deemed prohibitive for the context of the work.

For all that self-reported data may be a weakness of the data collection approach, however, many of the quantities of interest are inherently subjective. Stress levels are unique to each person, and the ultimate goal of this work is to reduce the negative effects of stress and workload upon students. Ultimately it does not matter whether a student moves from "Very stressed" to "Somewhat stressed", or from "Somewhat stressed" to "A little stressed" – the key is that they have in fact become less stressed.

The survey questions provided a measure of the overall cohort's perception of their workload and their stress levels. The data was gathered online, through the unit's WebCT interface. Students were given from the Thursday of the week until the Tuesday of the following week to complete the survey for that week. Completion of the survey was voluntary, but encouraged.

The overall data gathered from WebCT was anonymous – no individual student is identifiable. While this prevents the ability to follow a student longitudinally throughout the semester, it does promote honest and authentic engagement on the part of the students – they know that this cannot be used as an

assessment tool. Aggregation of the anonymous data does allow generalisations to be made about the overall cohort.

The Survey Questions

The students were also asked to provide a measure of their workload, and of their stress levels. These were each implemented on a five point scale:

How does your academic workload this week compare to your typical weekly academic workload?
- A. This week requires much less work than normal
- B. This week requires a little less work than normal
- C. This week is pretty typical
- D. This week requires a little more work than normal
- E. This week requires much more work than normal

How would you characterize your current level of overall stress?
- A. Not at all stressed
- B. A little stressed
- C. Somewhat stressed
- D. Very stressed
- E. Extremely stressed

How does your current stress level compare to your typical stress level?
- A. I'm much less stressed than normal
- B. I'm a little less stressed than normal
- C. My current stress level is pretty typical
- D. I'm a little more stressed than normal
- E. I'm much more stressed than normal

In addition, students were asked to report on their time commitments:
- How many hours did you put into your study this week?
- How many hours of paid employment did you do this week?

Time commitment responses were collated into five hour categories – 0, 1-5, 6-10, 11-15 etc

A total of 1392 useable data points were collected.

Findings

Each of the three individual variables shows distinct trends throughout the semester, and there is some consistency between these trends. It is also informative to look at pairs of variables together, to determine the extent of the coupling between workload and stress.

Relative stress vs Relative workload

One of the key goals of this work is to determine whether stress actually correlates with workload – is it workload that causes stress, or is it other factors that have a greater impact. To do this, it is useful to compare the students' reported levels of relative stress to those of relative workload (Table 1):

Table 1: Relative Stress vs Relative Workload

		Relative Stress					
		Much less	Little less	Typical	Little more	Much more	Total
Relative workload	Much less	59	44	38	10	2	**153**
	Little less	35	68	57	22	3	**185**
	Typical	15	52	234	77	8	**386**
	Little more	3	20	109	206	30	**368**
	Much more	2	4	24	117	153	**300**
	Total	**114**	**188**	**462**	**432**	**196**	**1392**

Table 1 shows that there is a good degree of overall correlation between the perceptions of workload and stress, but that there are outliers. There are responses for which students responded that their workload was much higher than normal, but their stress levels much lower than normal, and vice versa.

Overall, 52% of the recorded responses have a matching value for relative stress and relative workload, which are highlighted in green in Table 1. 37% of responses have a one-step difference (highlighted in yellow) and 11% of responses (highlighted in red) have a two-or-more category difference Relative Workload and Relative Stress.

The mismatch is relatively evenly spread between students who rate stress higher and those who rate workload higher. 27% of responses rate their relative workload greater than their relative stress, of which 4.9% rate the difference at two steps or greater (a-c, b-d, c-e etc). 21% rate their stress greater than their workload, of which 6.0% rate the difference at greater than one step.

This data shows that while Relative stress may correlate well with Relative Workload, the students' responses matched for just over half of their responses, suggesting that other factors influence the students' perceptions of workload and stress.

Absolute stress vs Relative stress

One key distinction made in this work is the difference between absolute stress and relative stress – whether the student is negatively impacted by their stress is different to whether their stress levels are higher or lower than usual. In order to explore this distinction, it is useful to compare the students' reported levels of relative stress to those of absolute stress (Table 2):

Table 2: Relative Stress vs Absolute Stress

		Relative Stress					
		Much less	Little less	Typical	Little more	Much more	Total
Absolute Stress	Not at all	64	43	122	7	2	**238**
	A little	47	118	141	76	2	**384**
	Somewhat	1	24	169	192	12	**398**
	Very	0	2	26	147	76	**251**
	Extremely	2	1	4	10	104	**121**
	Total	**114**	**188**	**462**	**432**	**196**	**1392**

Table 2 shows that there are responses representing almost all pairwise combinations of absolute and relative stress values, with some combinations being much more common than others. Three clusters of responses are highlighted, each representing a theme in the responses – essentially the aggregated version of the representative student model used earlier.

The first cluster, highlighted in red, represents students who consider "Not at all stressed" to be their "Typical" level of relative stress. For these students, "a little stressed" is "a little more than usual", and "somewhat stressed" is "much more than usual". These responses represent students for whom any stress is unusual – perhaps unchallenged at high school, they are not used to stress in any form. A total of 210 responses fit into this category, 15% of the overall dataset.

The second cluster, highlighted in yellow, represents students who represent "A little stressed" to be their "Typical" level of stress. For these students, "Not at all stressed" represents less than normal, while "somewhat" and "very" constitute more than normal. A total of 516 responses fit into this cluster, 37% of the overall dataset.

Taken together, these two clusters represent more than half of the responses – responses for whom the typical level of stress is "Not at all stressed" or "A little bit stressed". The perception of what is normal plays a big part in students' responses to stress and workload, and this data suggests that the majority of students perceive normal to be a predominantly relaxed state.

Conversely, of the 372 responses indicating that the student is either "very stressed" or "extremely stressed", the third cluster (highlighted in green) of 35 responses reported that this was "typical" or "less than normal". For these students (2.5% of the overall cohort, or 9.4% of those who were highly stressed) it is clear that stress is a common part of their student experience, and their definition of normal is diametrically opposed to that of the first two clusters.

This difference in opinion is clearly representative of the well-documented diversity of engineering student cohorts; however it also raises definite challenges for the teaching of these students. For half of the students any notable level of stress will be more than they are used to; for a minority of students highly stressed is their normal way of life.

Impact of Employment hours

When considering the impact of employment hours on Relative Workload (Figure 1), Relative Stress (Figure 2) and Absolute Stress (Figure 3), only responses up to the 30-34 hour category were considered. The higher categories contain only 6 of the 1392 responses, and are not representative of the dataset overall.
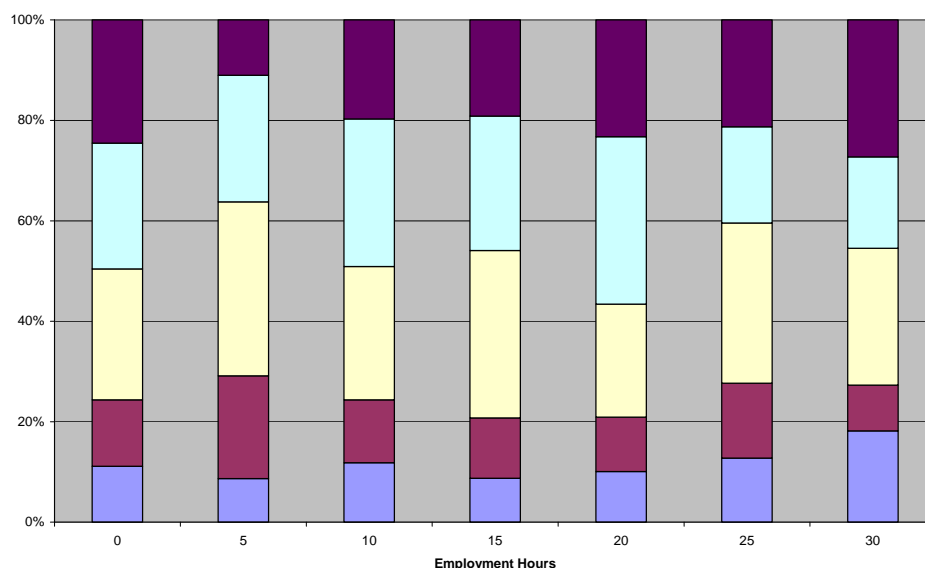

Figure 1: Relative Workload vs Employment Hours

Figure 1 shows that Relative Workload appears to be mostly independent of the number of hours worked, with the distribution of responses mostly unchanged across the different categories of responses. This suggests that the students' perceptions of relative workload are largely independent of how many hours they report working.
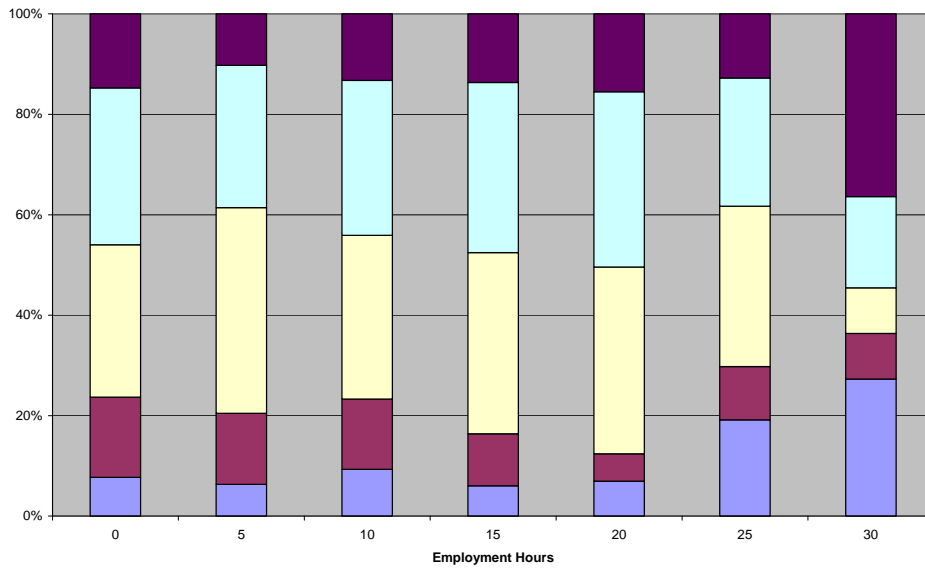
Figure 2: Relative Stress vs Employment Hours

Figure 2 shows that the distribution of responses remains similar for students who report less than 25 hours of paid employment. Above 25 hours of paid employment there is a tendency for students to report more extreme responses – both much more and much less than usual.

While the conventional wisdom is that students who work more will be more stressed, Figure 2 also shows that there is a subset of the cohort who are able to cope well with a high employment workload. Indeed, it is quite possible that it is the requirements of working so many hours that requires students to be organised, and that this organisation helps keep their academic work in check.
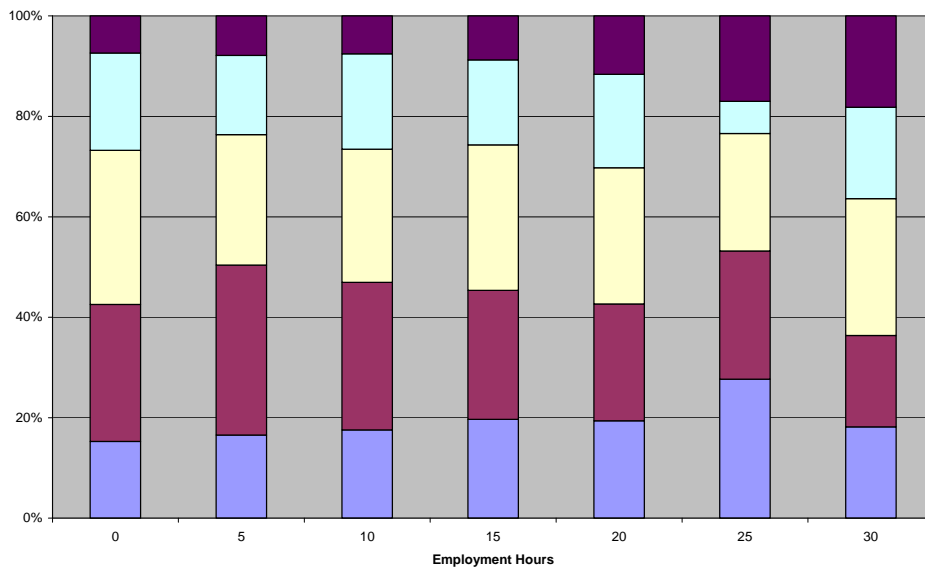

Figure 3: Absolute Stress vs Employment Hours

Figure 3 shows a strong similarity in the distribution of absolute stress responses between categories. There is a slight increase in the proportion who report higher than usual stress levels as the number of

hours worked increases to 20 and beyond, however overall the distribution is similar. This suggests that the students' overall levels of stress are largely independent of the number of hours of paid employment that they report.

Impact of Study Hours

When considering the impact of study hours on Relative Workload (Figure 4), Relative Stress (Figure 5) and Absolute Stress (Figure 6), only responses up to the 40-44 hour category were considered. The higher categories contain only 34 of the 1392 responses, and are not representative of the dataset overall.
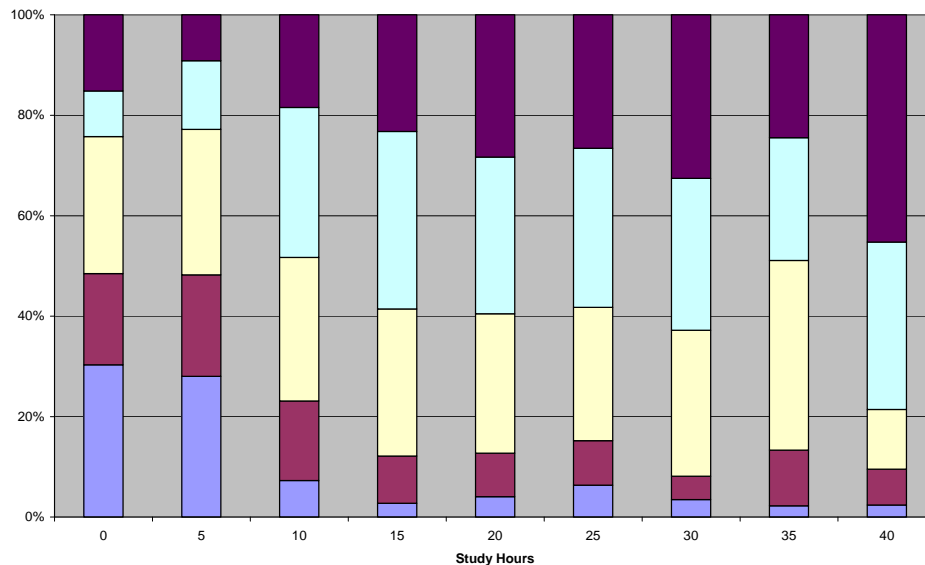
Figure 4: Relative Workload vs Study Hours

Figure 4 shows that there is a difference between the distribution of responses for students working five or less hours and those who work six or more. For students working five or less hours, half of the responses indicate that the week is less work than normal. For students working more than five hours, this proportion is less than 20%.

The distributions are similar across all of the 6+ hour categories, with a gradual increase in the proportion who report being much more stressed than normal.

Figure 5 again shows differences between the 0 and 1-5 categories and the 6+ categories. Around 40% of students studying five hours or less report less than usual stress levels, whereas this proportion is around 20% for the 10-20 hour categories, and around 10% for the categories where students are working 21+ hours.

The proportion of students who report being more stressed than normal also increases as the number of hours studied in the week increases. The proportion who report being much more stressed than usual is constant at around 20% for students reporting more than fifteen hours per week.

It is interesting to note that the overall proportion of students who report being more stressed than usual increases from the 5 hour category to the 20 hour category, then drops for the 25 hour category and rises again to the 40 hour category.
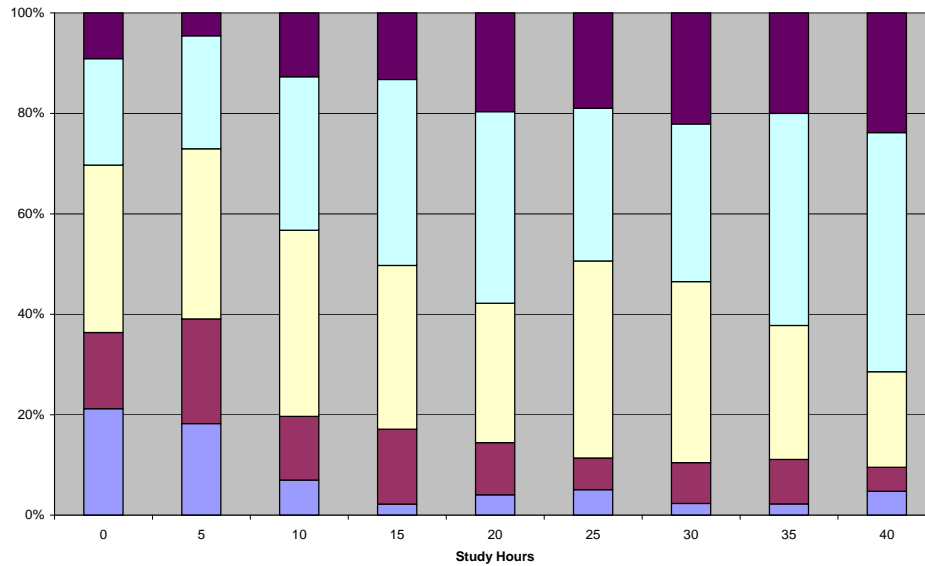
Figure 5: Relative Stress vs Study Hours
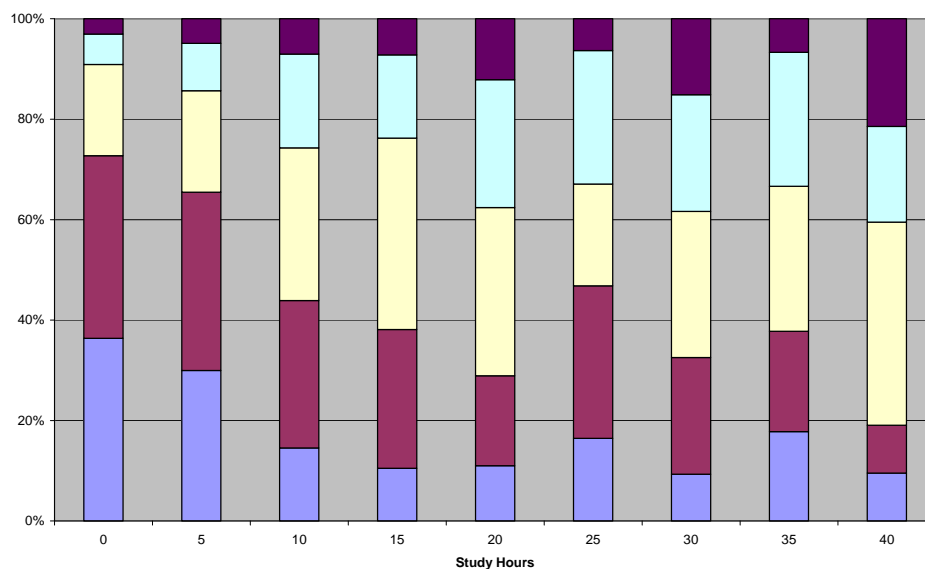
Figure 6: Absolute Stress vs Study Hours

Figure 6 shows that students who report low number of study hours also report low levels of absolute stress. As the number of study hours increases from zero to 15 the distribution of responses moves away from predominantly low-stress responses through to a balance of low and high-stress responses. The distributions in the categories above 20 hours are fairly similar, although there is an ongoing increase in the proportion of students who respond that they are "extremely stressed".

Recommendations

The underlying motivation for this work was to equip students with the skills to manage their workloads, and to provide academics with information as to the factors affecting their perceptions of these workloads and their stress levels. Stress and workload certainly appear to be related; however the data shows that they are not interchangeable.

Nearly half of the responses (48%) rated relative workload differently than their relative stress; 11% of of all responses had a two or more category difference between the two variables. Some students

reported workload but not stress; others stress but not workload. It is clear that more factors are at play. The student's perceptions of normal also clearly varied amongst responses. For some students, very high levels of stress are normal; for other students any level of stress whatsoever was more than usual.

It appears that there is a difference in the distributions of responses for categories where students spend more than twenty hours on a given activity. Figure 2 suggests that the distribution of relative stress responses indicating more than 20 hours of paid employment were different to those for less than 20 hours; Figure 6 shows that the distribution of absolute stress responses is different for those who report more than twenty hours when compared to those who study less than 20. There also appears to be a breakpoint at 20 hours for the way in which levels of relative stress increase in Figure 5.

Overall, it appears that while there is a link between workload and stress levels for the overall cohort, the relationship is not as simple as "more work equals more stress". Some students are always stressed; some are never stressed. More study is required to truly identify what factors lead to students' perceptions of their workloads.

References

Dee, K. C. (2007). Student Perceptions of High Course Workloads are Not Associated with Poor Student Evaluations of Instructor Performance. *Journal of Engineering Education, 96*(1), 69-78.

Garrett, J. B. (2001). Gender differences in college related stress. *Undergraduate Journal of Psychology, 14*.

Graduate Careers Australia. (2006). Course Experience Questionnaire Data. Retrieved April 13, 2007, from http://www.avcc.edu.au/content.asp?page=/policies_programs/graduates/

Jonkman, M., Boer, F. d., & Jagielski, J. (2006, December 11th-13th). *Are we over-assessing our students? The students' view.* Paper presented at the 17th Conference of the Australasian Association for Engineering Education, Auckland.

Kember, D. (2004). Interpreting student workload and the factors which shape students' perceptions of their workload. *Studies in Higher Education, 29*(2).

Marsh, H. W. (2001). Distinguishing between Good (Useful) and Bad Workloads on Students' Evaluations of Teaching. *American Educational Research Journal, 38*(1), 183-212.

McInnis, C. (2001). Signs of Disengagement? The changing undergraduate experience in Australian universities, *Inaugural Professorial Lecture*: Centre for the Study of Higher Education, The University of Melbourne.

Ross, S. E., Niebling, B. C., & Heckert, T. M. (1999). Sources Of Stress Among College Students. *College Student Journal, 33*(2), 1-5.