A unique assessment of stress and stress factors on engineering academics in the research and teaching environment

K R Davey (Corresponding Author)
The University of Adelaide, Adelaide, Australia
kenneth.davey@adelaide.edu.au

J C K Cheung
The University of Adelaide, Adelaide, Australia
john.cheung@adelaide.edu.au

R Visvanathan
The University of Adelaide, Adelaide, Australia
renuka.visvanathan@adelaide.edu.au

J W Willison
The University of Adelaide, Adelaide, Australia
john.willison@adelaide.edu.au

Abstract*: This research study was designed to determine the prevalence of stress, and identify the stress factors (stressors), experienced by academic engineers that both research and teach in a combined faculty of Engineering, Computer and Mathematical Sciences at a research intensive Australian University. Results reveal a high* prevalence *of stress, as indicated by the Likert score of the standard General Health Questionnaire (GHQ-12), above the health threshold value of 12. The major stressor has been identified as lack of understanding of responsibilities of the appointed role. The study consisted of a new research questionnaire in two parts: the established (standard) GHQ of 12 questions; and, 15 questions designed specifically to solicit information to identify particular stressors. Likert-type scoring was used. The Questionnaire was carried out on-line in Survey Monkey®. The valid response rate from 152 eligible respondents was 38.2% (9 female and 49 male). Academics clearly welcomed the survey as indicated in comments. Although the scope of the research was limited to one university, the results can be reliably extrapolated to other universities that research and teach in professional engineering programs as findings are broadly in line with those independently reported elsewhere for Australia and the UK.*

Introduction

It is now widely acknowledged that academics do not live in ivory towers, but rather in stressful real–world environments with responsibilities for teaching and publishing, in addition to administrative duties. It is a salient fact that export income to Australia from education services is now ranked third after coal and iron ore (DFAT, 2008) and is currently valued at $18.6 billion (DFAT, 2010). In addition contemporary students at University find learning stressful because many have to work part-time to support themselves financially. Many now see a University qualification simply as the minimum requirement for entry into a reasonable "job". To understand and address the

needs of these students a number of initiatives in tertiary institutions are being developed. Student Centred Learning and Studies of the First-Year Experience are exemplars.

However, the impact that these significant changes have on academics in the research and teaching environment does not appear to have been widely acknowledged. For example, recent studies in Australia and UK, where higher education trends are similar, show stress to be generally wide-spread amongst academics, and significantly, that it affects a half to 80% (e.g. Kinman, Jones, and Kinman, 2006, Winefield, Gillespie, Stough, Dua, Hapuarachchi, and Boyd, 2003). Research studies reveal three areas of stressors can be identified: Emotional/Cognitive (e.g. Feeling irritable, Negative self-talk), Physical (e.g. Muscle tension, Unexplained rashes or skin irritations, Unable to sleep or excessive sleep) and effects on the Autonomic Nervous System **(**Fight-or-Flight reactions that are affected by stress).

Against this background a research study was undertaken to quantitatively assess the level of stress and identify individual stress factors (stressors) on contemporary academic engineers that both research and teach. In this paper the research findings from a quantitative assessment of academic engineers at a research intensive Australian University in a combined faculty of Engineering, Computer and Mathematical Sciences (ECMS) is reported.

Aims

The aims of the research were to:

- Determine the prevalence of stress amongst academic engineers who both research and teach in ECMS as defined by the standard instrument, General Health Questionnaire (GHQ-12) (del Pilar Sanchez-Lopez and Dresch, 2003)
- Identify stressors associated with increased likelihood of reported stress amongst these academics using a new survey instrument developed for this purpose.

Materials and Methods

A new research Questionnaire of two parts was designed and developed. Part 1 was the validated instrument (standard) General Health Questionnaire (GHQ-12) with Likert scoring that consists of 12 questions (del Pilar Sanchez-Lopez and Dresch, 2003). Unique to this research was Part 2; a stressor identification that we created and piloted with a small interfaculty group (10) of academics at The University of Adelaide in 2009; the purpose of which was to identify salient stress issues that could be corroborated as those of concern. This was refined to consist of 15 questions.

It was believed that with Part 2 of the Questionnaire, information specific to academic experience in the research and teaching environment could be solicited. Part 1 results would permit comparison of findings with the literature "norm".

Timely approval for the research was obtained from the University, both from the Survey Committee (who look to balance the timing and number of surveys that academics are asked to participate in) and the Ethics Approval Committee. Support from the Dean, ECMS, was also obtained for the research together with the use of the ECMS Secretariat for global dispatch of survey information within the faculty.

The Questionnaire

The research Questionnaire, as it appeared to respondents, is presented as Appendix A. The two parts can be clearly delineated. Following a number of tests, it was initiated on-line in *Survey Monkey*® on the particular University intranet on 10 May 2010. The Questionnaire was closed on 26 May 2010. This timing coincided with weeks 9, 10 and 11 of Semester 1.

Eligible Participants

The number of eligible participants in ECMS was 152. This number was determined based on the special report commissioned from Human Resources of the University that showed there were 15

approved absences at the time of the survey from a total of 167. However, of these, respondents who stated they worked <20 h per week were excluded from later analyses.

Participation

The invitation to participate in the research, together with the appropriate intranet-link to *Survey Monkey*, was emailed from the ECMS secretariat to all academic engineers. In accordance with appropriate University approvals for the research, participation was voluntary.

Data Analyses

For Part 1, questions 1.1 to 1.12 (i.e. the GHQ-12 General Health Questionnaire) responses were assigned a score value of, respectively, 0 through to 3 (del Pilar Sanchez-Lopez & Dresch, 2003) to give a possible total Likert score of 36. Using this scoring, the health threshold for unhealthy stress was a Likert score of >12 (del Pilar Sanchez-Lopez and Dresch, 2003).

To gain an overall picture of trends, the individual responses were grouped in nine arbitrary age categories of five years: 26-30, 31-35 etc.

For Part 2, the raw scores (1 through 5) were stored in a convenient spreadsheet and the ratio of respondents that agreed / disagreed was determined within each of four arbitrary categories of Likert scores, namely, Likert <12.5; 12.5< Likert <17.5; 17.5< Likert <22.5; and, 22.5< Likert. In this way the ranking of issues could be readily highlighted from key stressor(s) to issues of lesser stressors.

Results

The total number of validated on-line responses was 58 (9 female, 49 male). This number was derived from a total of 81 responses. Some 23 were ruled invalid. The criteria for discarding included: stated working hours was less than 20 h; anomalies in the data (such as ages that meant in effect that the academic started lecturing at 15 years); and, more than one response from a given computer. Participants were completely anonymous. The only information available to researchers was identification of the computer; however, its location, and therefore user, could not be determined. There were nearly equal numbers of tenured (32) and un-tenured (26) respondents. A good overview of the results can be gleaned from the tabulated summary, Table 1. This shows an overall mean Likert score of 15.1 for all respondents.

Table 1: Results Summary for Part 1 of the Research Questionnaire

	Age Group									
	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	Overall
Male (No. of Tenured)	4 (0)	11 (2)	7 (5)	6 (5)	7 (4)	4 (3)	5 (4)	3 (3)	2 (1)	49 (27)
Female (No. of Tenured)	1 (0)	1 (0)	1 (1)	4 (3)	2 (1)	0 (0)	0 (0)	0 (0)	0 (0)	9 (5)
Total (No. of Tenured)	5 (0)	12 (2)	8 (6)	10 (8)	9 (5)	4 (3)	5 (4)	3 (3)	2 (1)	58 (32)
Mean Age (Work hours/wk)	29.2 (55)	32.4 (44.8)	38.9 (50.6)	42.5 (49.3)	48.3 (50.8)	52.8 (48.8)	57.8 (58.0)	62.0 (48.3)	69.0 (57.5)	43.6 (50.2)
sdev. Age (Work hours/wk)	1.30 (21.8)	1.5 (6.4)	1.2 (13.2)	1.1 (12.4)	1.6 (7.9)	1.7 (11.1)	1.1 (7.6)	1.0 (7.6)	0.0 (3.5)	
Min. Age (Work hours/wk)	27 (35)	31 (38)	37 (40)	41 (32)	46 (40)	51 (40)	56 (50)	61 (40)	69 (55)	27 (32)
Max. Age (Work hours/wk)	30 (90)	35 (55)	40 (80)	44 (70)	50 (60)	55 (65)	59 (70)	63 (55)	69 (60)	69 (90)
Avg. Year of Acad. Service	2.4	4.3	8.3	12.3	11.1	14.5	19.6	26.0	33.5	
Mean Likert Score	16.6	19.3	18.6	14.0	16.6	10.5	15.0	17.7	8.0	15.1
Sdev Likert Score	7.1	6.1	5.2	3.5	4.4	5.1	7.8	4.0	2.8	
Minimum Likert Score	12	11	9	9	9	6	8	14	6	6
Maximum Likert Score	29	32	24	19	23	17	27	22	10	32

Figure 1 presents a summary plot of mean Likert score *versus* the nine-age categories for Part 1 (GHQ-12) of the Questionnaire. The smooth curve (bold) shows the "best fit" trend of Likert score across all age categories. The health threshold of a Likert score of 12 can be clearly seen on the figure. The Likert score maximum (continuous line) and minimum (dashed line) are shown for each age category to illustrate the scatter obtained in responses. The scores of tenured (▲) and un-tenured (Δ) academic engineers that both research and teach are delineated on the figure.

Figure 2 is a summary plot of mean Likert score *versus* age categories for Part 1 (GHQ-12) of the Questionnaire. The distribution of male and female responses is highlighted and contrasted. It can be seen from the figure that there were no female responses in the > 50 years age categories.

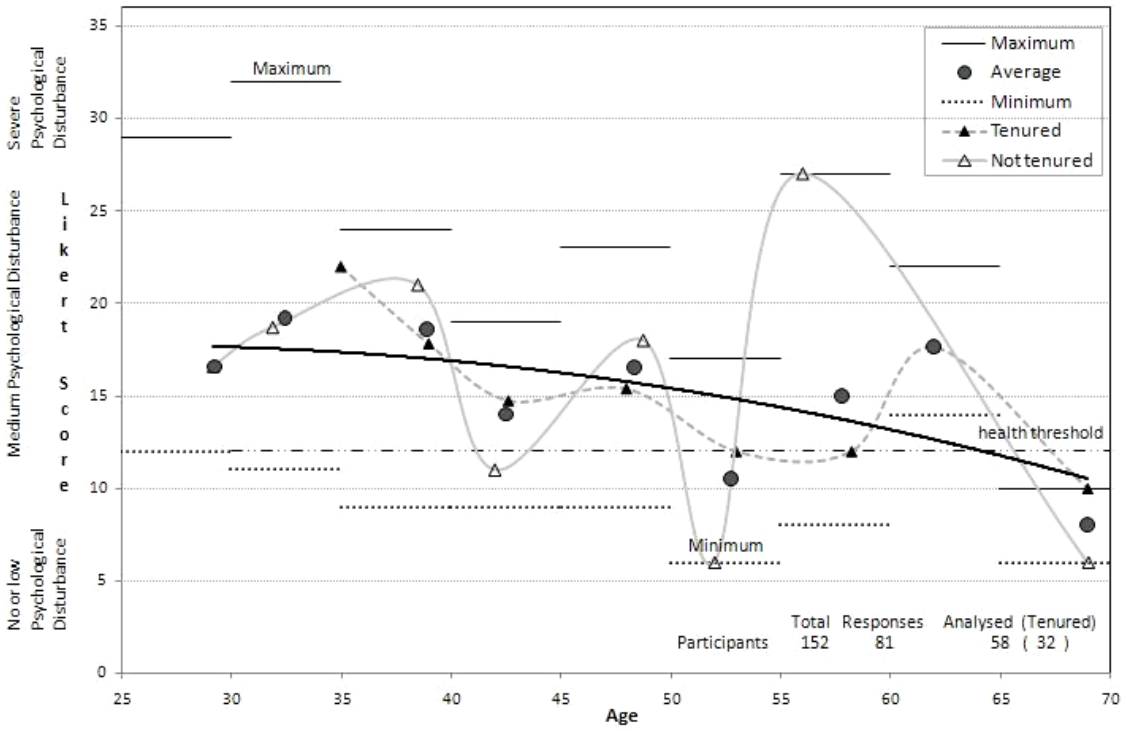


Figure 1: Mean Likert score *versus* Age

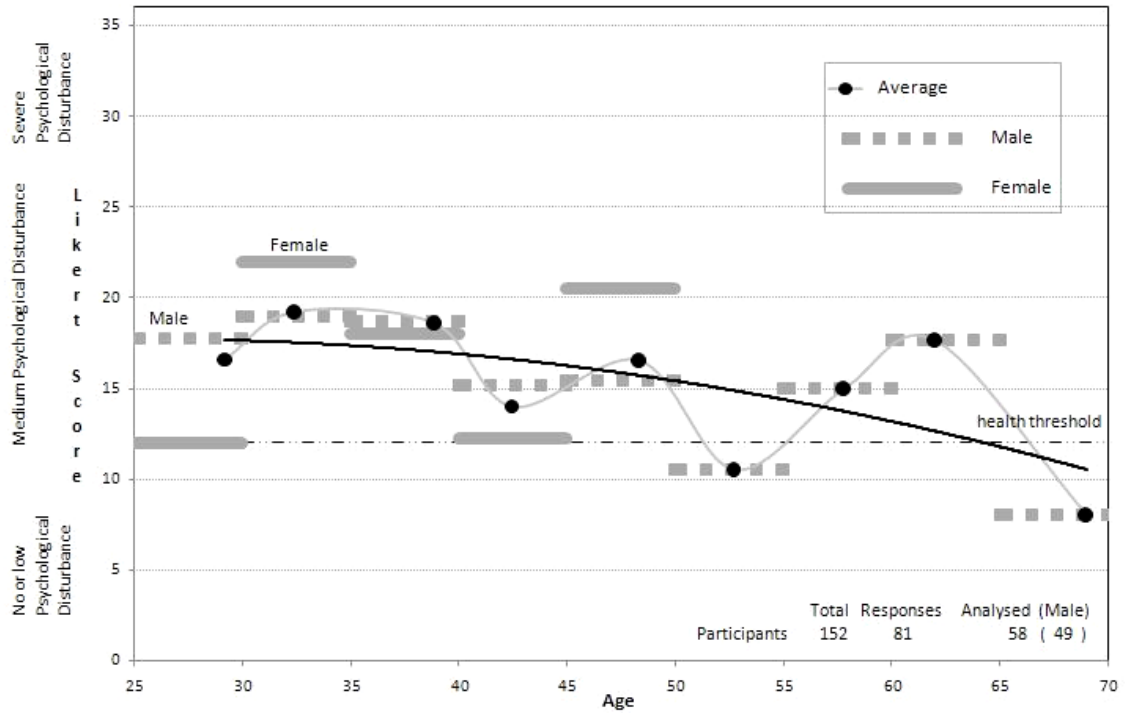


Figure 2: Mean Likert score *versus* Age of Male and Female Respondents

Figure 3 is a convenient bar-graph summary of the responses to the 15 questions of Part 2 of the Questionnaire. The data are presented as the ratio of respondents that agreed / disagreed with the 15 statements for each of the four categories of Likert-type scores: Likert <12.5; 12.5< Likert <17.5; 17.5< Likert <22.5; and, 22.5< Likert.

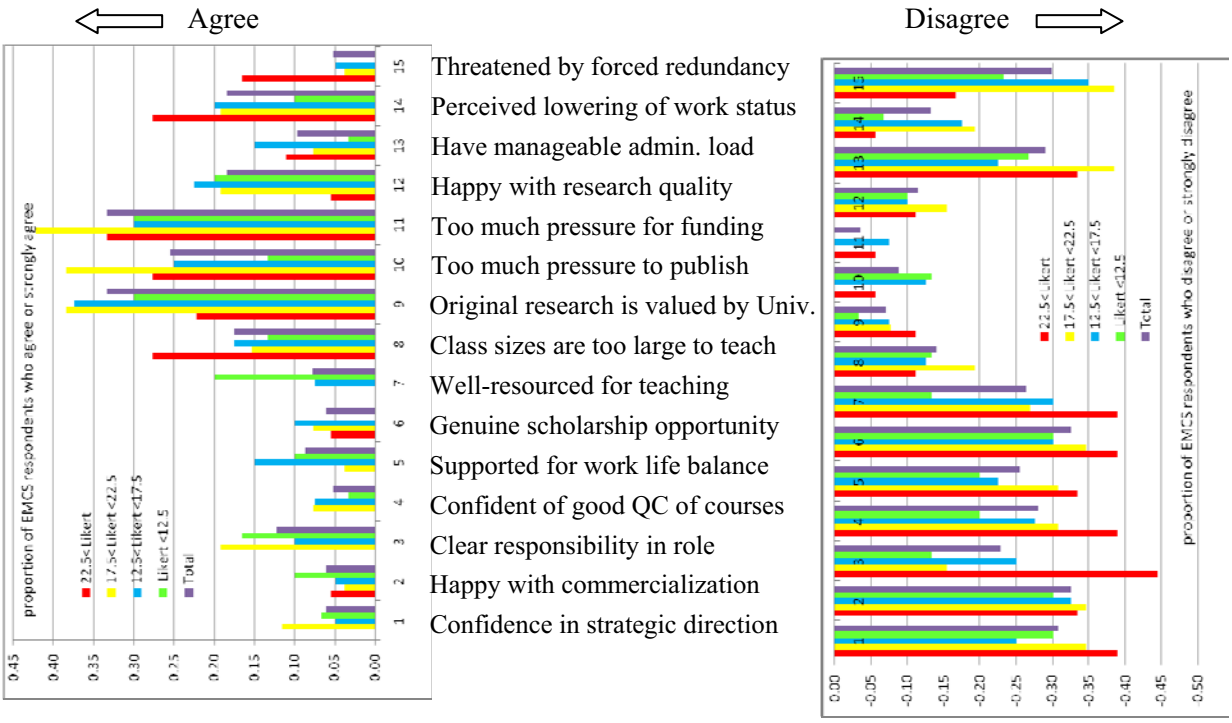


Figure 3: Summary bar-graph of the responses to 15 questions of Part 2 of the Questionnaire

Discussion

Figures 1 and 2 highlight at least four overall and significant trends from responses to Part 1 of the Questionnaire. From Figure 1, the first is that a highly significant number of respondents have a mean stress level, as indicated by the Likert score of the validated instrument of the standard General Health Questionnaire (GHQ), above the health threshold value of 12. Older academics (age >55) however are less stressed and appear "healthy".

The second is that young academics, possibly early career academics, (age <35) have generally greater stress than others (age >40) as borne-out in the best fit to these data (bold line Figure 1). However, the scatter, as indicated by the maximum and minimum bars for the Likert scores in each age category, serves to highlight that there are actually some academics that are significantly stressed in the age category 25 < age < 35 years. These scatter data also serve to underscore that there are some academics that both research and teach in the middle-year categories (35 to 55 years) who have healthy stress levels as indicated by Likert scores of 12 and less.

A third evident trend is that the variance in Likert scores, and therefore stress prevalence, increases with age. This is particularly true for un-tenured academic engineers that research and teach. This may reflect increasing anxiety as un-tenured academic gain age.

The fourth evident trend, seen in Figure 2, is that there were no female respondents in the > 55 age categories, and that the level of stress experienced by female engineers that both research and teach is significantly greater than the males with a greater variance. One explanation is the weighting of just 9 female respondents compared with the 49 males represented in this figure. This means, in effect, that each mean Likert score shown for females is the mean of just 2 responses.

From Figure 3, the summary and comparison of significant stressors (Part 2 of the Questionnaire), careful observation of the "laminate-like" representations of responses highlights that some four tiers of stressors can be identified from greatest (Tier A) to lowest (Tier D), based on the ratio of ECMS academics responses that agreed / disagreed with the 15 questions designed to elicit the key stressors in the research and teaching environment. These data permit a ranking of the stressors in each of the four identified tiers of approximately equal weighting, A to D (Table 2). In Tier A there are two key stressors that were identified. These are, a lack of a clear understanding of the responsibilities in the appointed role as an academic (question 3 of the Questionnaire Part 2), and; that there is felt to be too much pressure to obtain funding (question 11).

In Tier B questions 7, 6, 4, 1, 14, 10 and 8 can be grouped as shown in Table 2. The key stressors identified are that respondents felt that they were not well-resourced by the University for their teaching (question 7) and that there was not ample opportunity for genuine scholarship (question 6). Other stressors in this key group include a lack of confidence in the strategic direction of higher education (question 1) and too much pressure to publish (question 10). It is interesting to note that respondents also felt that class sizes were in fact too large to teach effectively in their courses (question 8). Actually, this is not in itself surprising but this finding is not in agreement with earlier (and limited) data from 10 respondents in the initial trialling of the Questionnaire Part 2 (*unpublished data*).

Tier D of Table 2, together with Figure 4, highlights some "good" news in that respondents do not feel threatened by forced redundancy (question 15) and are happy with the research quality of the University (question 12). Of course, that research quality was not felt to be a stressor might reveal some self-interest by respondents as all were academics that publish and do not want to appear to downgrade its value. More altruistically, it may reveal that academics in ECMS are committed overall to quality in their research efforts.

Table 2: Identification and Ranking in approximately Equal Weightings of Key Stressors from Greatest (Tier A) to Lowest (Tier D)

Tier and Research Question		
A	3	My responsibilities in my appointed role as an academic are clear
	11	There is too much pressure to obtain funding
B	7	I am well-resourced by my institution for my teaching
	6	There is ample opportunity for genuine scholarship
	4	I am confident of good quality control of all courses in my institution
	1	I have confidence in the strategic direction of higher education
	14	I perceive a lowering of status of my academic work generally
	10	There is too much pressure to publish
	8	Class sizes are too large to teach effectively in my courses
C	13	I have a manageable administrative load
	5	I am supported in my aim for a work-family life balance
	2	I am happy with the change in higher education to a commercial orientation
	9	Original research is valued by my institution
D	15	I feel threatened by forced redundancy
	12	I am happy with the research quality of my institution

Tier C underscores some further good news in that respondents did feel that the University valued research (question 9). However, many respondents do not feel supported in their aim for a work-family life balance (question 5). It is seen in Table 2 that in Tier C many respondents felt that their administrative load was a significant stressor (question 13).

The raw overall response rate of 53.3% from eligible academics in ECMS is effectively 1:2 of colleagues and is, surprisingly, high given the general demands on academics, together with the fact that participation was voluntary. The valid response rate of 38.2% is a good response rate (Nulty, 2008) from which reliable conclusions can be drawn for academics in research and teaching in ECMS.

Table 1, for Part 1 of the research Questionnaire, shows clearly that only two respondents, both in the age category 66-70 years, have Likert scores <12; that is, are well within the GHQ healthy threshold. On a raw data basis this is (2/58 x 100 =) 3.4 % of the total number respondents. For a Likert score of = <12 as indicating the health threshold, then stress is highly prevalent at some (52/58 x 100 =) 89.7 % of academics. This figure is in line with the 80% of respondents reported in the literature (Kinman, Jones, and Kinman, 2006, Winefield, Gillespie, Stough, Dua, Hapuarachchi, and Boyd, 2003).

Additional research analyses and reporting of findings are planned. It is believed that these, together with the identification and ranking of key stressors associated with increased likelihood of reported stress amongst academics reported here, will lead to hypotheses for targeted intervention services to alleviate / redirect energies to enhance research and teaching.

Further, it is clear that respondents perceived the University being pro-active in looking at stress and that was received very positively.

Conclusions

The prevalence of stress amongst academic engineers that both research and teach is high in a combined faculty of Engineering, Computer and Mathematical Sciences. All academics with ages less than 60 years have a stress level, as defined by the standard instrument, General Health Questionnaire (GHQ-12), of greater than Likert score = 12.

Levels of stress are greater in early career ages (<35 years) for both tenured and un-tenured academics. For < 50 years, females experience more stress than males. Untenured academics are more stressed than those with tenure, especially as age increases.

The two key stressors associated with increased likelihood of reported stress amongst academics are: A lack of clarity of the role and responsibilities of being an academic, and; Too much pressure being felt to obtain research funding.

These findings are a sound basis for hypotheses for future for potential intervention strategies.

Appendix A

On-line Research Questionnaire Part 1

1. Respondent's data

Age?	
Academic for how many years?	
Total working hours per week?	

2. Tenured?

- Yes
- No

3. Gender

- Male
- Female

4. Question 1.1

	Better Than Usual	Same as Usual	Less Than Usual	Much Less Than Usual
Have you recently been able to concentrate on what you are doing?				

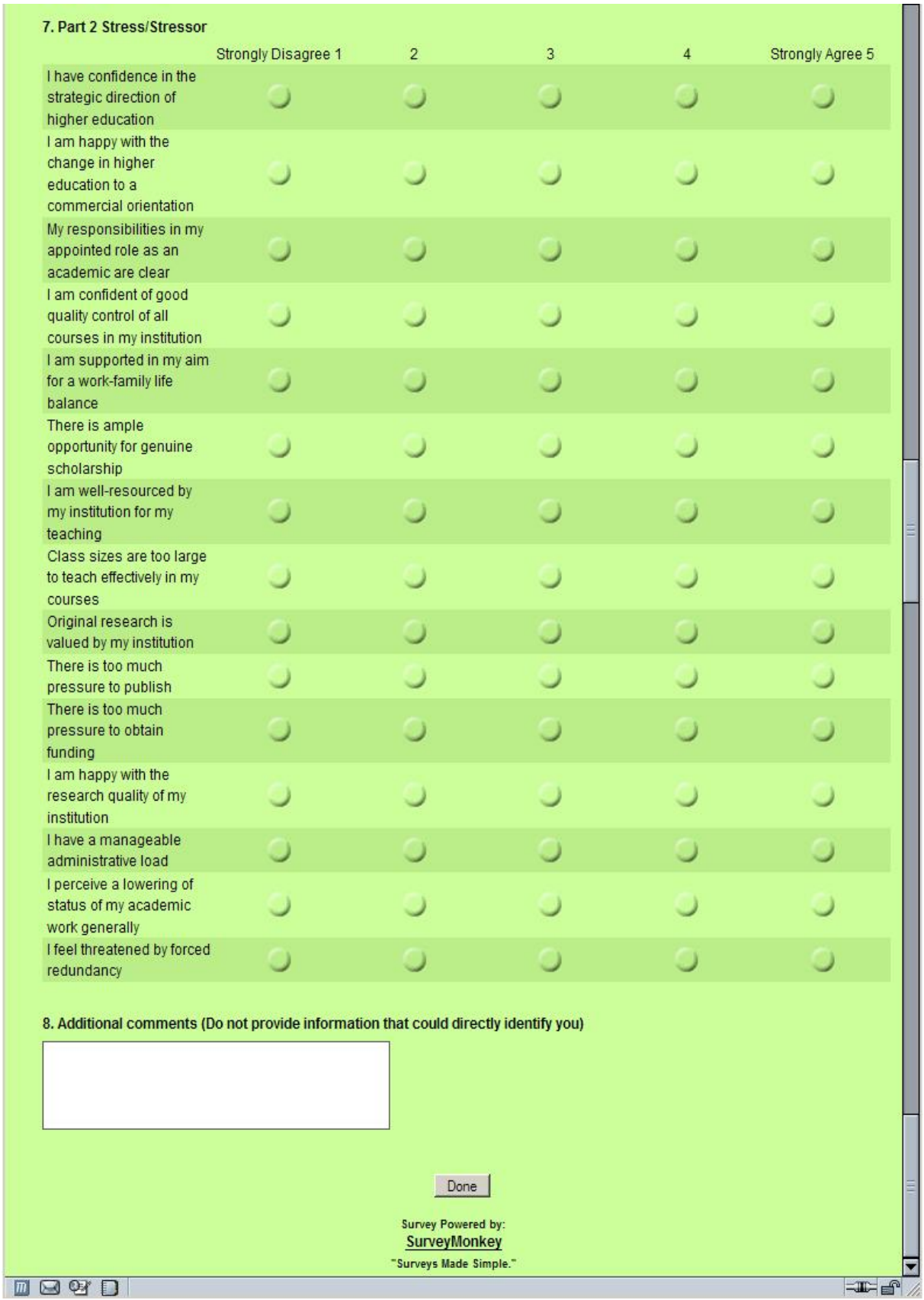
5. Question 1.2 to 1.7

	Not At All	No More Than Usual	Rather More Than Usual	Much More Than Usual
Have you recently lost much sleep over worry?				
Have you recently felt constantly under strains?				
Have you recently felt that you couldn't overcome your difficulties?				
Have you recently been feeling unhappy and depressed?				
Have you recently been losing confidence in yourself?				
Have you recently been thinking yourself as a worthless person?				

6. Question 1.8 to 1.12

	More So Than Usual	Same As Usual	Less Than Usual	Much Less Than Usual
Have you recently felt that you are playing a useful part in things?				
Have you recently felt capable of making decision about things?				
Have you recently been able to enjoy your normal day-to-day normal activities?				
Have you recently been able to face up to your problems?				
Have you recently been feeling reasonably happy, all things considered?				

On-line Research Questionnaire Part 2



7. Part 2 Stress/Stressor

	Strongly Disagree 1	2	3	4	Strongly Agree 5
I have confidence in the strategic direction of higher education					
I am happy with the change in higher education to a commercial orientation					
My responsibilities in my appointed role as an academic are clear					
I am confident of good quality control of all courses in my institution					
I am supported in my aim for a work-family life balance					
There is ample opportunity for genuine scholarship					
I am well-resourced by my institution for my teaching					
Class sizes are too large to teach effectively in my courses					
Original research is valued by my institution					
There is too much pressure to publish					
There is too much pressure to obtain funding					
I am happy with the research quality of my institution					
I have a manageable administrative load					
I perceive a lowering of status of my academic work generally					
I feel threatened by forced redundancy					

8. Additional comments (Do not provide information that could directly identify you)

Done

Survey Powered by:
SurveyMonkey
"Surveys Made Simple."

References

DFAT. 2008. Australia in Brief: Trading with the World. (Australian Government, Canberra). Accessed at http://www.dfat.gov.au/aib/trade_investment.htm on 15 July 2010.

DFAT. 2010. Export Income to Australia from Education Services in 2009 (Australian Government, Canberra), (May 2010).

del Pilar Sanchez-Lopez, M & Dresch, V. 2003. The 12-item general health questionnaire (GHQ-12): Reliability, external validity and factor structure in the Spanish population. *Psicothema* 20(4), 839-843.Nulty, Duncan D. 2008. The adequacy of response rates to online and paper surveys: what can be done? *Assessment & Evaluation in Higher Education* 33(3), 301-314.

Kinman, G., Jones, F & Kinman, R. 2006. The wellbeing of the UK academy 1998-2004. *Quality in Higher Education* 12(1), 15-27.

Winefield, A. H., Gillespie, N., Stough, C., Dua, J., Hapuarachchi, J & Boyd, C. 2003. Occupational stress in Australian university staff. *International Journal of Stress Management* 10, 51-63.

Acknowledgements

The authors which to thank all participants in this research project, and Kogilam Naidoo, Centre for Learning and Professional Development, The University of Adelaide, for help in 2009 with trialling Part 2 of our Research Questionnaire.