Postgraduate research experience: What do graduates find important?

David Carroll, Graduate Careers Australia

Corresponding Author: David Carroll, Graduate Careers Australia

Phone: +61 3 9605 3713

Email: david.carroll@graduatecareers.edu.au

Abstract

Information on the experience of graduates from research degrees is important for institutions seeking to enhance the quality of their postgraduate research degree provision though evidence-based decision making. A common source of these data in Australian higher education is the Postgraduate Research Experience Questionnaire (PREQ), administered annually as a component of the Australian Graduate Survey. The PREQ investigates six facets of the postgraduate research experience, and also asks graduates to provide a rating of their overall satisfaction. With these data, institutional planning departments typically generate descriptive statistics for each facet and the overall satisfaction item. One potential issue with this approach for institutions seeking to allocate scarce resources to improving the satisfaction of their research graduates is that it implicitly assumes that students assign equal weight to each of the six facets when evaluating the quality of their overall experience. If this is not the case, focusing on the areas upon which students place little importance may constitute a sub-optimal allocation of resources. In this study, I use multiple regression to investigate the contribution of each facet to students' overall satisfaction with their research experience, including whether the relative importance of each facet varies across contextual groups. I compare my main results with a similar analysis on data from the UK Postgraduate Research Experience Survey, which is based on the PREQ. Implications for practice are also discussed.

Keywords: research student experience, student satisfaction, research supervision, importance weighting.

Information on the experience of research graduates is important for institutions seeking to enhance the quality of their postgraduate research degree provision through evidence-based decision making. A common source of these data in Australian higher education is the Postgraduate Research Experience Questionnaire (PREQ), administered about four months after course completion by Graduate Careers Australia (GCA) as a component of the Australian Graduate Survey (AGS). The PREQ measures the quality of six key facets of the postgraduate research experience, and also asks graduates to provide a rating of their overall satisfaction with their recently completed degree. The facets of the postgraduate research experience measured by the PREQ are summarised in Table 1. The item wordings are presented in Appendix A.

Table 1
Facets of the postgraduate research experience measured by the PREQ

Title	Focus
Supervision	the accessibility and quality of research degree supervision
Intellectual climate	the learning community and conditions provided by the institution
Skill development	the extent of generic analytical and communication skill development
Infrastructure	the quality of learning infrastructures such as space, equipment and finance
Thesis examination	whether the examination process was timely, fair and satisfactory
Goals and expectations	the clarity of learning structures, requirements and standards
Overall satisfaction	overall satisfaction with the recently completed degree

Notes. Adapted from GCA (2014).

With these data, institutional planning departments and other data users typically generate descriptive statistics for each facet and the overall satisfaction item separately. On the face of it, this analytical approach is appropriate, because each of the six facets targets a different aspect of the postgraduate research experience; however, a potential shortcoming of this approach for institutions seeking to allocate scarce resources to improving the satisfaction of their research students is that it implicitly assumes that students assign equal weight to each facet when evaluating the quality of their overall experience. If this is not the case, focusing on the facets upon which students place little importance may constitute a sub-optimal allocation of resources.

Data from the UK Postgraduate Research Experience Survey (PRES), based on the PREQ, provides some evidence against the equal weighting assumption. Hodsdon and Buckley (2011) use

multiple regression analysis to examine the relationship of each facet with overall experience in the 2011 PRES. Bennett and Turner (2013) conduct a similar analysis on the 2013 PRES. Both sets of results are presented in Table 2. The strength of each facet in explaining the variance in students' overall experience evaluations is given by the regression coefficient—the higher the coefficient, the more important the facet. In brief, both studies conclude that the quality of supervision has the largest impact on how research students rate their overall experience, with intellectual climate/research culture and professional development also important factors. It is inadvisable to make direct comparisons at scale level between the 2011 and 2013 PRES collections because of changes to the questionnaire; however the results are broadly consistent across the two studies.

Table 2
Summary of results from previous studies into the influences on overall satisfaction for higher degree research graduates

	Std. Coef.
Hodsdon and Buckley (2011)	
Supervision	0.290
Intellectual climate	0.209
Professional development and career	0.185
Thesis examination	0.110
Skills development	0.096
Infrastructure	n.s.
Goals and standards	n.s.
Variance explained	49.4%
Bennett and Turner (2013)	
Supervision	0.251
Research skills and Professional development	0.231
Responsibilities and Progress and assessment	0.201
Research culture	0.197
Resources	0.046
Variance explained	53.7%

Notes. n.s. = not significant; Std. Coef. = standardised coefficient.

The main limitation of these studies is that, while the authors acknowledge the large effect of field of education on overall experience, they do not stratify their regression analyses on this basis. As a consequence, it remains unknown as to whether the relative importance placed on these facets differs across fields of education.

In this empirical paper, I expand upon the studies of Hodsdon and Buckley (2011) and Bennett and Turner (2013) by using multiple regression to investigate the contribution of each PREQ facet to students' overall ratings of their postgraduate research experience, including separate analyses by broad field of education and qualification level. The rest of this paper is organised as follows. Section 1 describes the data and variables used in this study. Section 2 gives an overview of my empirical methodology. Results are presented and discussed in Section 3. Section 4 concludes.

1. Data and variables

This study is based on data from the 2013 PREQ, which surveyed research doctoral and masters graduates who qualified for their degree at a participating Australian higher education institution in 2012. Forty-two higher education institutions participated in the PREQ, including all Table A and B universities. Students who qualified for their degree in the first half of the year were surveyed as at 31 October, while those who completed their studies in the second half were surveyed as at 30 April the following year. Questionnaires were sent to 7,685 higher degree research graduates and 4,938 valid responses were returned for a response rate of 64.3% (GCA, 2014).

The PREQ comprises six multi-item scales underpinned by 27 Likert-type items, as well as a single-item overall satisfaction indicator. All items are rated on a five-point response format with categories *strongly disagree, disagree, neither agree nor disagree, agree and strongly agree*. The response format also includes a *does not apply* category, which graduates can mark if they feel that a particular item is not relevant to their experience. Responses in this category are excluded from the calculation of scale and item statistics. Scale scores are computed as the mean of the constituent item scores after recoding the five-point response format to -100, -50, 0, 50 and 100 respectively. The resulting scale scores are approximately normally distributed, which justifies my use of parametric statistical methods in this paper. Carifio and Perla (2007) provide a further rationale for using Likert scale data in parametric statistical procedures.

Starting with the national PREQ file, I excluded 119 graduates who did not respond to the overall satisfaction item and a further 475 with missing scale scores across one or more facets. This yielded an analysis sample of 4,344 graduates.

Table 3 presents descriptive statistics for the six PREQ facets and the overall satisfaction indicator. There is considerable variation in mean scale scores, ranging from 74.5 and 71.7 for skill development and goals and expectations, respectively, to 39.3 for intellectual climate. Intellectual climate also has the largest dispersion of scores around the mean (as shown by the coefficient of variation), suggesting that it is the most variable facet of the postgraduate research experience. Skill development and goals and expectations appear to be the most consistent.

Table 3
PREQ scale descriptive statistics

	Mean	CV
Supervision	57.6	76.2
Intellectual climate	39.3	115.5
Skill development	74.5	41.8
Infrastructure	53.0	74.8
Thesis examination	56.2	82.6
Goals and expectations	71.7	46.8
Overall satisfaction	61.0	75.9
n		4,344

Notes. Computations based on data from the 2013 PREQ. CV = coefficient of variation, which is the ratio of the standard deviation to the mean, expressed as a percentage.

Table 4
PREQ respondent summary statistics

	n	%
Broad field of education		
Natural and Physical Sciences	1,005	23.1
Information Technology	167	3.8
Engineering and Related Technologies	604	13.9
Architecture and Building	39	0.9
Agriculture, Environmental and Related Studies	121	2.8
Health	643	14.8
Education	232	5.3
Management and Commerce	402	9.3
Society and Culture	875	20.1
Creative Arts	255	5.9
Qualification level		
Research masters	636	14.6
Research doctorate	3,708	85.4
Total	4,344	100.0

Notes. Computations based on data from the 2013 PREQ.

Table 4 presents the distribution of graduates in the analysis sample across broad fields of education and qualification levels. Four broad fields of education account for more than 70% of graduates: natural and physical sciences (23.1%), society and culture (20.1%), health (14.8%), and engineering and related technologies (13.9%). One respondent who graduated from a mixed field programme is not listed in the table but is included in the total. In all, research doctoral graduates comprise 85.4% of the sample.

2. Empirical methodology

Following the approach of Hodsdon and Buckley (2011) and Bennett and Turner (2013), multiple regression is used to investigate to what extent the six PREQ facets combined can explain or predict students' overall experience rating, and estimate the relative "importance" of each facet. The general form of the regression equation is:

$$Y = a + b_1X_1 + b_2X_2 + ... + b_nX_n$$

where Y is the dependent variable, a is the regression intercept, X_1, X_2, ... X_n are the independent variables that account for changes in Y, and b_1, b_2, ... b_n are estimated coefficients (or regression weights), which show the relative contribution of each independent variable in predicting the dependent variable. For this analysis, the dependent variable is the overall satisfaction indicator discussed in the previous section, and the six PREQ scales are the independent variables.

3. Results and discussion

I begin by examining the correlations among the variables used in the analysis. This is important because if two or more variables are very strongly correlated, their individual influence in the regression model cannot be easily distinguished. Bennett and Turner (2013) found very strong correlations between progress and assessment, and responsibilities; and research skills and professional development in their analysis of the 2013 PRES. They addressed this in their study by amalgamating the four scales into two (see Table 2). Hodsdon and Buckley (2011) did not find multicollinearity in their independent variables.

The results of my Pearson correlation analysis are presented in Table 5. All the correlation coefficients are significant at the $p < 0.001$ level. Perhaps most importantly for my analysis, none of the correlations appear to be large enough to warrant concern over multicollinearity (Hair, Anderson, Tatham & Black, 1995). The strongest correlations are between skill development and goals and expectations (0.745) and overall satisfaction and supervision (0.724). The weakest correlations are between examination and all other scales, which suggests that students generally view the thesis examination process as not being closely related to other aspects of their postgraduate research experience.

Table 5
Correlations between PREQ scales and the overall satisfaction item

	Supervision	Intellectual climate	Skill develop-ment	Infra-structure	Thesis examin-ation	Goals and expect-ations
Overall satisfaction	0.724	0.626	0.619	0.619	0.492	0.619
Supervision		0.572	0.587	0.550	0.435	0.631
Intellectual climate			0.511	0.660	0.394	0.520
Skill development				0.561	0.482	0.745
Infrastructure					0.400	0.595
Thesis examination						0.527

Notes. Computations based on data from the 2013 PREQ. Pearson's correlation was used. All correlations are significant at $p < 0.001$. $n = 4,344$.

Next, I run the regression described in Section 2 on the full analysis sample. Results are presented in Table 6. While there are bound to be many factors influencing overall satisfaction, the combination of six PREQ scales explains 64.5% of the variance in the overall satisfaction item (r-squared = 0.645). Hodsdon and Buckley (2011) and Bennett and Turner (2013) reported that their regressions explained 49.4% and 53.7% of the variance in overall satisfaction, respectively.

As shown in Table 6, five of the six scales are significant predictors of graduates' overall experience at the 5% level. Only goals and expectations does not have a significant impact on the overall satisfaction item ($p > 0.05$), and its coefficient is comparatively small. The same result was reported by Hodsdon and Buckley (2011), whose analysis included a similar scale. Notably, the constituent items of this scale all relate to graduates' understanding of what was expected of them,

rather than to their research experience explicitly (see Appendix A), which could explain the limited contribution of this factor.

Table 6
Regression estimates, full sample

	Std. Coef.	p-value
Supervision	0.396	0.000
Intellectual climate	0.171	0.000
Infrastructure	0.148	0.000
Skill development	0.142	0.000
Thesis examination	0.111	0.000
Goals and expectations	0.028	0.072
n		4,344
Prob > F		0.000
R-squared		0.645

Notes. Computations based on data from the 2013 PREQ. The dependent variable is the overall satisfaction item. Std. Coef. = standardised coefficient.

Supervision is the most important influence on overall experience, echoing the findings of Hodsdon and Buckley (2011) and Bennett and Turner (2013). Given that this facet addresses such important aspects as topic selection, literature search, and the provision of feedback and support, this result is hardly unexpected. It is also consistent with a large body of anecdotal evidence that the supervisor is the "make or break" element in a research degree. The intellectual climate was also an important influencer, consistent with both studies on the PRES. This implies that graduates are more likely to evaluate their overall experience highly if they feel as though they are part of a broader community of student researchers and academics. Given that students presumably enrol in research degrees to enhance their research skills, the impact of skill development on overall satisfaction is unsurprising. Thesis examination is also a contributing factor, but to a lesser extent.

The only major inconsistency with the study of Hodsdon and Buckley (2011) is that of infrastructure. My analysis showed this facet to have a significant and moderate impact on overall experience, whereas they found no significant impact. Given that the PREQ and PRES items in relation to this facet are similar, this result is perplexing. Although infrastructure (resources) is a significant influencer for Bennett and Turner (2013), its impact is fairly weak. This could suggest a difference between the Australian and UK higher education sectors in relation to the importance of

infrastructure and learning resources, especially since a similar result was obtained for taught postgraduates in the UK (Leman, Turner & Bennett, 2013).

Having estimated importance weights for each facet, it is interesting to compare these with "performance" in the form of mean scale scores for each facet (see Table 3). Ideally, scores on the important facets should be at least as high as those on the less important ones. To this end, I plot in Figure 1 the importance weights from Table 6 against mean scale scores. Generally speaking, the relationship is the opposite of the "ideal" one—the association between mean scale scores and importance weights is broadly negative. Supervision, the scale with the largest impact on overall experience, has a lower mean score than skill development, and goals and expectations, the latter having no significant impact on overall experience. Likewise, intellectual climate is an important influencer with a relatively low mean scale score.

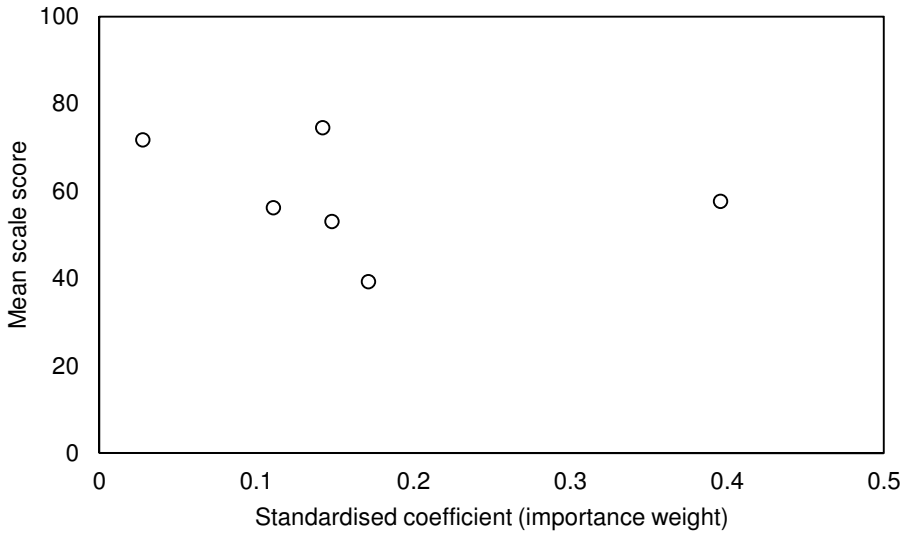

Figure 1. Plot of estimated importance weights vs. mean scale scores.

Next, I investigate whether the relative importance of each facet varies by broad field of education by running a separate regression for each. I do not run a regression for architecture and building due to the small number of observations for this field (n = 39). The facets are ranked by coefficient magnitude in Table 7, with detailed results presented in Appendix B.

Perhaps the most salient finding from Table 7 is that supervision is ranked highest across every broad field except information technology, where it is ranked second. This appears to support

the earlier results concerning the influence of this facet on the overall experience. Goals and expectations is only significant for society and culture graduates and, as shown in Appendix B, is of moderate importance to them. The impacts of the other facets tend to vary by field, validating the decision to stratify the analysis on this basis.

Table 7.
Summary of regression results, by broad field of education

	Sci.	IT	Eng. & Rel.	Ag. & Env.	Health	Edu.	Mgt. & Com.	Soc. & Cult.	Arts
Supervision	1	2	1	1	1	1	1	1	1
Intellectual climate	5	4	3	2	4	n.s.	2	2	2
Infrastructure	2	3	4	n.s.	2	3	n.s.	3	5
Skill development	3	1	2	3	5	n.s.	3	6	3
Thesis examination	4	5	n.s.	n.s.	3	2	n.s.	5	4
Goals and expectations	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	4	n.s.

Notes. Computations based on data from the 2013 PREQ. The table depicts the rankings of the coefficient magnitudes within each broad field of education. n.s. = not significant.

Table 8
Regression estimates, by qualification level

	Masters		Doctorate	
	Std. Coef.	p-value	Std. Coef.	p-value
Supervision	0.430	0.000	0.389	0.000
Intellectual climate	0.221	0.000	0.164	0.000
Infrastructure	0.041	0.234	0.166	0.000
Skill development	0.160	0.000	0.137	0.000
Thesis examination	0.121	0.000	0.110	0.000
Goals and expectations	0.026	0.498	0.028	0.090
n		636		3,708
Prob > F		0.000		0.000
R-squared		0.693		0.635

Notes. Computations based on data from the 2013 PREQ. The dependent variable is the overall satisfaction item. Std. Coef. = standardised coefficient.

Finally for this section, I examine whether the relative importance of each facet varies by qualification level. The results of the two regressions are shown in Table 8. The most notable finding from this analysis relates to the infrastructure scale, which has a significant impact on the overall experience of doctoral graduates but not those from masters degrees. Indeed, testing for equality of regression coefficients (following Paternoster, Brame, Mazerolle & Piquero, 1998) showed this to be

the only coefficient that differed significantly by qualification level ($Z = 2.727$, $p < 0.01$). This result suggests that the availability of suitable learning resources is relatively more important to doctoral students, which may reflect the deeper and more extensive nature of the doctoral research experience.

4. Conclusions

This study investigated the impact of six facets of the postgraduate research experience on graduates' overall satisfaction with their course. Five of the six facets had a statistically significant impact, with goals and expectations being the sole exception. Supervision was the most important influence on overall satisfaction, consistent with similar studies in the UK. Infrastructure had a significant impact on overall satisfaction in my study, in contrast to the findings of Hodsdon and Buckley (2011), which may suggest a difference between the Australian and UK higher education sectors. The top- and bottom-ranked facets were largely similar across broad fields of education. Infrastructure had a statistically significant impact on the overall experience of research doctoral graduates but not those from masters degrees.

The results suggest that institutions would be wise to focus additional efforts on improving the aspects of the research experience underpinning the supervision and intellectual climate scales in particular, as these are important contributors to overall experience that are rated relatively low by respondents, at least when compared with the ratings given to less-important facets (e.g. goals and expectations). This does not mean that institutions can afford to ignore the less-important facets, as students would notice if they were not provided or were very poor. It does mean, however, that improving supervision and integrating students into the department's research culture are likely to have relatively higher pay-offs in terms of overall satisfaction.

The main limitation of my analytical approach is that importance weights obtained by regressing a set of facets on an external criterion, such as overall satisfaction, cannot account for differences in importance across individuals. Indeed, Vavra (1997) argues that the relative importance of facets differs based on whether they are derived explicitly (self-stated importance) or implicitly (estimated by statistical methods). He proposes that explicitly- and implicitly-derived importance weights should be combined to better identify the factors influencing satisfaction. Given this, and

because the current study has provided strong evidence against the equal weighting assumption, I recommend that the Australian higher education sector considers adding self-stated importance measures to the PREQ. This could be accomplished by adding six items to the PREQ, one for each of the six facets (excluding the overall satisfaction item), which ask graduates to rate on a five-point (or n-point) response format the importance of each in terms of their overall experience. To better illustrate this concept, a set of example items are presented in Figure 2.

For the following items, please rate how important, in terms of your overall higher degree research experience, you consider them to be. (1 = Not at all important and 5 = Very important)
Access to quality research degree supervision
The learning community provided by your department
The development of generic analytical and communication skills
Learning infrastructures such as space, equipment and finance
A timely, fair and satisfactory examination process
Provision of guidance on learning structures, requirements and standards

Figure 2. Example importance items for the PREQ.

The responses to these items could then be analysed separately to investigate graduates' conceptions of what is important in terms of their postgraduate research experience, analysed in conjunction with implicitly-derived importance weights in the style of Vavra (1997), and used to construct importance-weighted satisfaction scores that emphasise the facets of the higher education research experience that are considered important by students.

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Appendix A. PREQ item wordings

Supervision
Supervision was available when I needed it
My supervisor/s made a real effort to understand difficulties I faced
My supervisor/s provided additional information relevant to my topic
I was given good guidance in topic selection and refinement
My supervisor/s provided helpful feedback on my progress
I received good guidance in my literature search
Intellectual climate
The department provided opportunities for social contact with other postgraduate students
I was integrated into the department's community
The department provided opportunities for me to become involved in the broader research culture
A good seminar program for postgraduate students was provided
The research ambience in the department or faculty stimulated my work
Skill development
My research further developed my problem-solving skills
I learned to develop my ideas and present them in my written work
My research sharpened my analytic skills
Doing my research helped me to develop my ability to plan my own work
As a result of my research, I feel confident about tackling unfamiliar problems
Infrastructure
I had access to a suitable working space
I had good access to the technical support I needed
I was able to organise good access to necessary equipment
I had good access to computing facilities and services
There was appropriate financial support for research activities
Thesis examination
The thesis examination process was fair
I was satisfied with the thesis examination process
The examination of my thesis was completed in a reasonable time
Goals and Expectations
I developed an understanding of the standard of work expected
I understood the required standard for the thesis
I understood the requirements of thesis examination
Overall satisfaction
Overall, I was satisfied with the quality of my higher degree research experience

Notes. Adapted from GCA (2014).

Appendix B. Regression estimates, by broad field of education

	Sci.		IT		Eng. & Rel.	
	Std. Coef.	p-value	Std. Coef.	p-value	Std. Coef.	p-value
Supervision	0.399	0.000	0.207	0.001	0.435	0.000
Intellectual climate	0.107	0.000	0.180	0.004	0.161	0.000
Infrastructure	0.175	0.000	0.231	0.001	0.191	0.000
Skill development	0.214	0.000	0.184	0.008	0.158	0.000
Thesis examination	0.129	0.000	0.126	0.014	0.039	0.184
Goals and expectations	-0.056	0.090	0.103	0.185	-0.032	0.437
n		1,005		167		604
Prob > F		0.000		0.000		0.000
R-squared		0.613		0.790		0.682
	Ag. & Env.		Health		Edu.	
	Std. Coef.	p-value	Std. Coef.	p-value	Std. Coef.	p-value
Supervision	0.335	0.000	0.454	0.000	0.456	0.000
Intellectual climate	0.330	0.000	0.112	0.001	0.083	0.197
Infrastructure	0.274	0.003	0.101	0.003	0.126	0.067
Skill development	0.001	0.988	0.187	0.000	0.169	0.011
Thesis examination	0.025	0.702	0.127	0.000	0.219	0.000
Goals and expectations	0.010	0.920	0.022	0.554	-0.092	0.228
n		121		643		232
Prob > F		0.000		0.000		0.000
R-squared		0.691		0.667		0.630
	Mgt. & Com.		Soc. & Cult.		Arts	
	Std. Coef.	p-value	Std. Coef.	p-value	Std. Coef.	p-value
Supervision	0.400	0.000	0.378	0.000	0.318	0.000
Intellectual climate	0.282	0.000	0.189	0.000	0.254	0.000
Infrastructure	0.097	0.027	0.089	0.006	0.218	0.000
Skill development	0.076	0.079	0.133	0.000	0.125	0.012
Thesis examination	0.051	0.142	0.112	0.000	0.152	0.001
Goals and expectations	0.088	0.065	0.113	0.001	-0.009	0.882
n		402		875		255
Prob > F		0.000		0.000		0.000
R-squared		0.663		0.620		0.666

Notes. Computations based on data from the 2013 PREQ. The dependent variable is the overall satisfaction item. Std. Coef. = standardised coefficient.