

# Research Higher Degree (RHD) Experiences and Outcomes

## 2007 STUDENT SURVEY FEEDBACK REPORT

Dr Gillian Yeo

Ms Elisha Frederiks

Ms Angela Parsons

Ms Leah Zajdlewicz

Dr Suzanne Morris

Dr Catherine Manathunga

Dr Rachael Pitt

JULY 2007

# TABLE OF CONTENTS

<b>1 EXECUTIVE SUMMARY</b> .....	<b>3</b>
1.1 OVERVIEW.....	3
1.2 RESEARCH DESIGN AND METHODOLOGY .....	4
1.3 RESULTS.....	5
1.3.1 <i>Assessment of RHD Experiences and Outcomes</i> .....	5
1.3.2 <i>Key Factors Associated with RHD Experiences and Outcomes</i> .....	5
1.3.2.1 <i>Key Student Factors Associated with RHD Experiences and Outcomes</i> .....	5
1.3.2.2 <i>Key Supervisory Factors Associated with RHD Experiences and Outcomes</i> .....	6
1.3.2.3 <i>Key Institutional Factors Associated with RHD Experiences and Outcomes</i> .....	7
1.3.3 <i>Differences between RHD Candidates with University- versus Industry-Based Advisors</i> .....	8
1.4 CONCLUSIONS .....	9
1.5 ACKNOWLEDGEMENTS .....	10
<b>2 RESEARCH OVERVIEW</b> .....	<b>11</b>
2.1 BACKGROUND .....	11
2.2 PROJECT TEAM.....	12
<b>3 THE 2007 RHD STUDENT SURVEY</b> .....	<b>13</b>
3.1 ASSESSMENT DIMENSIONS .....	13
3.2 ASSESSMENT MEASURES.....	14
3.2.1 <i>Student Factors</i> .....	14
3.2.2 <i>Supervisory Factors</i> .....	15
3.2.3 <i>Institutional Factors</i> .....	16
3.2.4 <i>RHD Internal Experiences</i> .....	18
3.2.5 <i>RHD External Outcomes</i> .....	18
3.3 RESEARCH DESIGN AND METHODOLOGY .....	19
3.4 SAMPLE .....	19
<b>4 FINDINGS</b> .....	<b>22</b>
4.1 ASSESSMENT OF RHD EXPERIENCES AND OUTCOMES .....	22
4.1.1 <i>Student Factors</i> .....	22
4.1.2 <i>Supervisory Factors</i> .....	24
4.1.3 <i>Institutional Factors</i> .....	26
4.1.4 <i>RHD Internal Experiences</i> .....	28
4.1.5 <i>RHD External Outcomes</i> .....	29
4.2 KEY FACTORS ASSOCIATED WITH RHD EXPERIENCES AND OUTCOMES.....	30
4.2.1 <i>Key Student Factors</i> .....	30
4.2.2 <i>Key Supervisory Factors</i> .....	32
4.2.3 <i>Key Institutional Factors</i> .....	34
4.3 COMPARING RHD CANDIDATES WITH UNIVERSITY- VERSUS INDUSTRY-BASED ADVISORS .....	35
4.3.1 <i>Key Differences between RHD Candidates with University- versus Industry-Based Advisors</i> .....	35
4.3.1.1 <i>Key Differences in Supervisory Factors</i> .....	36
4.3.1.2 <i>Key Differences in Institutional Factors</i> .....	37
<b>5 CONCLUSIONS</b> .....	<b>38</b>
5.1 WHAT DO RHD CANDIDATES HAVE TO SAY ABOUT THEIR RHD EXPERIENCES AND OUTCOMES? .....	38
5.2 WHAT ARE THE KEY FACTORS THAT ARE ASSOCIATED WITH RHD EXPERIENCES AND OUTCOMES?.....	38
5.2.1 <i>Student Factors</i> .....	38
5.2.2 <i>Supervisory Factors</i> .....	40
5.2.3 <i>Institutional Factors</i> .....	41
5.3 DO PERCEPTIONS OF STUDENT, SUPERVISORY AND INSTITUTIONAL FACTORS DIFFER FOR RHD CANDIDATES WITH UNIVERSITY- VS. INDUSTRY-BASED ADVISORS? .....	42
5.4 CONCLUSION .....	43

# 1 EXECUTIVE SUMMARY

## 1.1 OVERVIEW

The *Research Higher Degree (RHD) Experiences and Outcomes* research project was designed to collect quantitative data on the key student, supervisory and institutional factors that are associated with RHD candidates' experiences and outcomes during the completion of postgraduate research. This interdisciplinary investigation was conducted with a sample of confirmed RHD candidates enrolled at The University of Queensland (UQ), Australia. The specific aims of this study are to assess four primary research questions:

1. What are the key *student* factors associated with RHD candidates' experiences and outcomes?
2. What are the key *supervisory* factors associated with RHD candidates' experiences and outcomes?
3. What are the key *institutional* factors associated with RHD candidates' experiences and outcomes?



4. Do the student, supervisory and institutional factors differ for RHD candidates who have *university-* versus *industry-based* advisors?

The primary focus of the present research is to gather quantitative information to examine these four questions in the *short-term*. It also constitutes the first phase of data collection for an analysis of the *long-term* effects of key student, supervisory and institutional factors as RHD candidates progress through the various stages of postgraduate research.

This report presents the findings obtained from the first phase of the *RHD Experiences and Outcomes* research project. Analyses were conducted at the aggregate level, such that results are reported for the entire sample of participating RHD candidates across all university schools and institutes at UQ.

## 1.2 RESEARCH DESIGN AND METHODOLOGY

In March 2007, 2176 confirmed RHD candidates enrolled at UQ were contacted via email and invited to participate in an online survey investigating the experiences and outcomes of RHD candidates during the completion of postgraduate study. The survey was designed to collect self-report data on the following five assessment dimensions:

- *Student Factors* related to the personal characteristics and qualities of individual RHD candidates, including self-confidence, achievement goals, achievement emotions, and motivational strategies.
- *Supervisory Factors* related to the nature of candidates' working relationship with their 'principal advisor' – that is, the advisor with whom candidates have the most contact and receive the most guidance from for their postgraduate research. These factors included advisory arrangements, advisor support, interpersonal contact, advisor feedback, establishment of supervisory expectations, and candidate/advisor adherence to supervisory expectations.

This assessment dimension also collected data on 'advisor affiliation', which refers to whether candidates have a principal advisor who is university-based (e.g., a UQ academic staff member) or industry-based (e.g., an employee in a private company, external organisation, the CSIRO, a government agency, etc.).

- *Institutional Factors* related to the contextual environment of the 'research unit' where candidates conduct their research – that is, the university school, institute or research centre (on-campus research unit) or the external facility or organisation (off-campus research unit) where candidates perform most research activities. These factors included institutional support, research culture, learning climate, institutional resources, and achievement goal structures.
- *RHD Internal Experiences* including satisfaction, research involvement, research commitment, and intentions to withdraw from postgraduate research.
- *RHD External Outcomes* including the total number of published/submitted journal articles, conference papers/abstracts, books, seminars, reports to business/industry, new research tools/techniques, commercial outcomes, patents, and research grants.

The response rate was 23%, with the final sample consisting of 500 confirmed RHD candidates (42% male, 58% female) enrolled across seven faculties and four research institutes at UQ. The average age of respondents was 32.8 years, and ranged from 21 to 73 years. Candidates had been enrolled in postgraduate research for an average duration of 2.8 years, with approximately 12 months remaining until PhD submission. 91% of candidates had a principal advisor who was university-based, whereas 8% had an industry-based advisor (1% of candidates did not specify).

## 1.3 RESULTS

### 1.3.1 Assessment of RHD Experiences and Outcomes

Overall, RHD candidates were very positive regarding their personal characteristics, the supervisory arrangements with their principal advisors, and the institutional features of their working environment. They also reported very positive experiences of undertaking postgraduate research (e.g., research commitment and involvement) and appeared to be quite productive in terms of generating external outcomes (e.g., journal article publications and submissions, seminar presentations, grants).

### 1.3.2 Key Factors Associated with RHD Experiences and Outcomes

Almost all of the assessment dimensions were significantly related to RHD experiences and outcomes, with the exception of research culture and institutional resources. Table 1 presents the key student, supervisory and institutional factors associated with RHD candidates' internal research experiences and external research outcomes.

*Table 1.* Key assessment dimensions associated with RHD experiences and outcomes.

<b>STUDENT FACTORS</b>	<b>SUPERVISORY FACTORS</b>	<b>INSTITUTIONAL FACTORS</b>
<b>Self-Confidence</b>	<b>Advisor Support</b>	<b>Institutional Support</b>
<b>Achievement Goals</b>	<b>Interpersonal Contact</b>	<b>Learning Climate</b>
<b>Achievement Emotions</b>	<b>Advisor Feedback</b>	<b>Achievement Goal Structures</b>
<b>Motivational Strategies</b>	<b>Establishment of Supervisory Expectations</b>	
	<b>Candidate/Advisor Adherence to Supervisory Expectations</b>	

These key student, supervisory and institutional factors were strongly related to *all* of the internal research experiences and *most* of the external research outcomes assessed in the *2007 RHD Student Survey*, with the exception of journal article publications, refereed conference papers, book chapters and research grants. More specific detail on how each factor was associated with RHD candidates' experiences and outcomes is provided below.

#### 1.3.2.1 Key Student Factors Associated with RHD Experiences and Outcomes

Each of the student factors assessed in the *2007 RHD Student Survey* was related to at least one dimension of RHD candidates' internal research experiences and/or external research outcomes. Table 2 presents the key student factors associated with RHD internal experiences and external outcomes.

Table 2. Key student factors associated with RHD experiences and outcomes.

INTERNAL EXPERIENCES	EXTERNAL OUTCOMES
<p><b>Self-Confidence</b></p> <p><b>Achievement Emotions</b> (<i>Enjoyment</i>)</p>	<p><b>Self-Confidence</b></p> <p><b>Achievement Emotions</b> (<i>Pride, Anxiety</i>)</p> <p><b>Achievement Goals</b> (<i>Mastery &amp; Performance-Approach</i>)</p> <p><b>Motivational Strategies</b> (<i>Affective Regulation</i>)</p>

Key findings included:

- RHD candidates with higher self-confidence tended to report greater satisfaction with and commitment to their research, alongside submitting a greater number of journal articles for publication, than candidates with lower self-confidence.
- Unexpectedly, candidates who experienced *greater* anxiety and/or *less* pride while working on research tasks and activities tended to present more seminars than candidates who experienced less anxiety and/or greater pride.
- Candidates with a stronger desire to master new knowledge, skills and situations tended to generate more industry/business reports than those with a weaker desire. Candidates with a stronger desire to prove their competence by outperforming others tended to publish more books than candidates with a weaker desire.

#### 1.3.2.2 Key Supervisory Factors Associated with RHD Experiences and Outcomes

Each of the supervisory factors assessed in the 2007 RHD Student Survey was related to at least one dimension of RHD candidates' internal research experiences and/or external research outcomes. Table 3 presents the key supervisory factors associated with RHD internal experiences and external outcomes.

Table 3. Key supervisory factors associated with RHD experiences and outcomes.

INTERNAL EXPERIENCES	EXTERNAL OUTCOMES
<p><b>Advisor Feedback</b></p> <p><b>Candidate Adherence to Supervisory Expectations</b></p> <p><b>Advisor Adherence to Supervisory Expectations</b></p>	<p><b>Advisor Support</b></p> <p><b>Interpersonal Contact</b> (<i>Face-to-Face, Internet</i>)</p> <p><b>Establishment of Supervisory Expectations</b></p> <p><b>Candidate Adherence to Supervisory Expectations</b></p>

Key findings included:

- Unexpectedly, RHD candidates who perceived that they received *more*, rather than less, constructive, comprehensive and timely feedback from their primary advisor tended to demonstrate stronger intentions to withdraw from postgraduate research.
- Candidates who perceived that their primary advisor had violated, rather than adhered to, the supervisory expectations that were established for working together indicated stronger intentions to quit postgraduate research.
- RHD candidates who established clear supervisory expectations for working with their advisor tended to submit more journal articles and produce more conference abstracts than candidates who had not established clear supervisory expectations.
- Candidates who reported frequent, as opposed to occasional, face-to-face contact with their advisor tended to produce more conference abstracts, whereas candidates who had frequent, rather than occasional, internet-based contact tended to generate more industry/business reports.

#### 1.3.2.3 Key Institutional Factors Associated with RHD Experiences and Outcomes

With the exception of research culture and institutional resources, all of the institutional factors assessed in the 2007 RHD Student Survey were associated with at least one dimension of RHD candidates' external research outcomes. Table 4 presents these key supervisory factors. In contrast, no institutional factors were significantly related to the RHD candidates' internal experiences of satisfaction, commitment, involvement, or turnover intentions during postgraduate research.

Table 4. Key institutional factors associated with RHD outcomes.

<b>EXTERNAL OUTCOMES</b>
<b>Institutional Support</b>
<b>Learning Climate</b>
<b>Achievement Goal Structures</b> <i>(Performance Goals)</i>

Key findings included:

- RHD candidates who perceived that their research unit provided higher, rather than lower, levels of institutional support for postgraduate research tended to generate more new research tools/techniques, more reports to industry/business, and more commercial outcomes.
- RHD candidates who perceived that their research unit encouraged a climate of continuous learning tended to generate more commercial outcomes and more new research tools/techniques compared to candidates who did not perceive that their research unit encouraged continuous learning during postgraduate research.

### 1.3.3 Differences between RHD Candidates with University- versus Industry-Based Advisors

Overall, there were significant differences between RHD candidates with university-based versus industry-based advisors on one supervisory factor and three institutional factors assessed in the *2007 RHD Student Survey*. There were no substantial differences between the two groups, however, on any of the student factors included in the assessment model. Table 5 presents the four factors on which candidates with university- versus industry-based advisors demonstrated significant differences.

*Table 5.* Key factors on which RHD candidates with university- versus industry-based advisors differed.

SUPERVISORY FACTORS	INSTITUTIONAL FACTORS
<p><b>1. Interpersonal Contact</b>  <i>(Face-to-Face Interaction &amp; Phone Conversation)</i></p>	<p><b>1. Institutional Support</b>  <b>2. Learning Climate</b>  <b>3. Institutional Resources</b></p>

In general, RHD candidates with industry-based primary advisors reported more positive perceptions of interpersonal contact, institutional support, learning climate, and institutional resources than those with university-based advisors. Key findings included:

- On average, candidates with industry-based advisors engaged in more frequent face-to-face interaction and phone-based communication with their principal advisors than candidates with university-based advisors.
- Candidates with industry-based advisors reported that their research unit expressed higher levels of institutional support for postgraduate research than candidates with university-based advisors.
- Candidates with industry-based advisors perceived that their research unit offered more support, encouragement, and praise for students' continuous learning during postgraduate research than candidates with university-based advisors.
- Candidates with industry-based advisors were more likely to report that their research unit provided adequate resources, infrastructure, equipment and facilities for conducting research than candidates with university-based advisors.

## 1.4 CONCLUSIONS

The aim of this research project was to conduct a large-scale assessment of the factors that influence RHD internal experiences and external outcomes. In general, RHD candidates were overwhelmingly positive about all aspects of their postgraduate research experiences and outcomes at UQ. Moreover, a trichotomy of factors – student, supervisory *and* institutional – were significantly associated with these internal experiences and external outcomes. Key findings are as follows:

- Self-confidence and achievement emotions were key drivers of both internal research experiences (e.g., satisfaction) and external research outcomes (e.g., submission of journal articles and seminar presentations, respectively).
- The establishment of supervisory expectations was a key driver of external research outcomes (e.g., submission of journal articles); whereas the adherence to supervisory expectations was a key driver of internal research experiences (e.g., satisfaction).
- Institutional factors, the key drivers being institutional support and learning climate, were only associated with external research outcomes (e.g., commercial outcomes).
- RHD candidates with industry- versus university-based advisors appeared to have similar personal characteristics and supervisory relationships; however, those with industry-based advisors reported more frequent face-to-face interaction and were more positive regarding the working environment of their research unit (e.g., institutional support and learning climate).

These results can be used to make informed decisions regarding strategic RHD initiatives. In particular, it is recommended that a comprehensive suite of professional development initiatives for both RHD candidates *and* advisors that targets all three levels – the student, the supervisory relationship and the institutional environment – be developed. This suite of initiatives could include:

- Workshops for RHD candidates on self-esteem, self-confidence, achievement goals, achievement emotions, and reflecting on personal strengths and weaknesses.
- Workshops for RHD candidates and advisors on establishing and adhering to mutual expectations. This may even include combined workshops, if appropriate.
- Advisor professional development sessions on optimising RHD candidates' self-confidence, achievement emotions and goals, and self-awareness during learning.
- Advisor and postgraduate coordinator workshops on developing a supportive and inclusive research culture for the postgraduate community.
- Advisor and postgraduate coordinator workshops on encouraging an institutional climate of continuous learning and development.
- Informative briefing sessions for RHD candidates, advisors and postgraduate coordinators on the key findings of this study.

It would be important for these professional development activities to be made available to both university and industry-based advisors, and for these advisors to have the opportunity to network and learn from each others' practice. Implementing this comprehensive suite of professional development initiatives would provide a best practice example to other universities, alongside promising to make the internal experiences and external outcomes of RHD candidates at UQ even more positive, fruitful and rewarding in the future.

## 1.5 ACKNOWLEDGEMENTS

We would like to firstly acknowledge our industry partner, the Cooperative Research Centre for Sugar Industry Innovation through Biotechnology (CRC SIIB), for providing the funding that made this research project possible.

We would also like to thank all of the personnel, faculties and institutes at The University of Queensland that provided the research team with invaluable assistance and support services with regards to survey design and administration, including:

- Professor Alan Lawson, Dean of the UQ Graduate School, The University of Queensland.
- Professor Christa Critchley, Deputy Dean of the UQ Graduate School, The University of Queensland.
- Mr Gary Johnson, Coordinator, Postgraduate Research Studies Unit, The University of Queensland.
- Mr Paul Jackson, Experimental Programmer (IT Support), The School of Psychology, The University of Queensland.

Finally, we would also like to thank all of the 2007 Research Higher Degree candidates at The University of Queensland who took the time and effort to participate in the research. Without this active participation, the research project would not have been possible.

Dr Gillian Yeo  
Ms Elisha Frederiks  
Ms Angela Parsons  
Ms Leah Zajdlewicz  
Dr Suzanne Morris  
Dr Catherine Manathunga  
Dr Rachael Pitt

## 2 RESEARCH OVERVIEW

### 2.1 BACKGROUND

The *Research Higher Degree (RHD) Experiences and Outcomes* research project was designed to collect quantitative data on a range of student, supervisory and institutional factors that shape the experiences and outcomes of RHD candidates during the completion of postgraduate research. Guided by an interdisciplinary framework, the project involves a collaboration of academics across various faculties, schools and research centres at The University of Queensland (UQ), including the School of Psychology, the School of Integrative Biology, the Cooperative Research Centre for Sugar Industry Innovation through Biotechnology (CRC SIIB), the UQ Graduate School, and the Teaching and Education Development Institute (TEDI).

The overarching aim of the research was to determine the important student, supervisory and institutional factors that are related to RHD candidates' internal experiences and external outcomes *in the short-term*. It concurrently serves to gather preliminary data for examining the *long-term* effects of these factors over time as RHD candidates progress through the various stages of postgraduate research.

The specific aims of the project are to present quantitative findings to address four main research questions:

1. What are the key *student* factors associated with RHD candidates' experiences and outcomes?
2. What are the key *supervisory* factors associated with RHD candidates' experiences and outcomes?
3. What are the key *institutional* factors associated with RHD candidates' experiences and outcomes?



4. Do the student, supervisory and institutional factors differ for RHD candidates with *university-based* versus *industry-based* advisors?

## **2.2 PROJECT TEAM**

The project team members were as follows:

**Dr Gillian Yeo**

Lecturer in Organisational Psychology, School of Psychology, The University of Queensland.

**Ms Elisha Frederiks**

PhD in Organisational Psychology (Candidate), School of Psychology, The University of Queensland.

**Dr Suzanne Morris**

Education Officer, the Cooperative Research Centre for Sugar Industry Innovation through Biotechnology (CRC SIIB) and School of Integrative Biology, The University of Queensland.

**Dr Catherine Manathunga**

Senior Lecturer, Teaching and Education Development Institute (TEDI) and UQ Graduate School, The University of Queensland.

**Ms Angela Parsons**

Master of Organisational Psychology (Candidate), School of Psychology, The University of Queensland.

**Ms Leah Zajdlewicz**

Master of Organisational Psychology (Candidate), School of Psychology, The University of Queensland.

**Dr Rachael Pitt**

Postdoctoral Research Fellow, The University of Queensland Social Research Centre (UQSRC), The University of Queensland.

### 3 THE 2007 RHD STUDENT SURVEY

#### 3.1 ASSESSMENT DIMENSIONS

The following diagram illustrates the basic research model and underlying measurement dimensions of the 2007 RHD Student Experiences and Outcomes Survey:

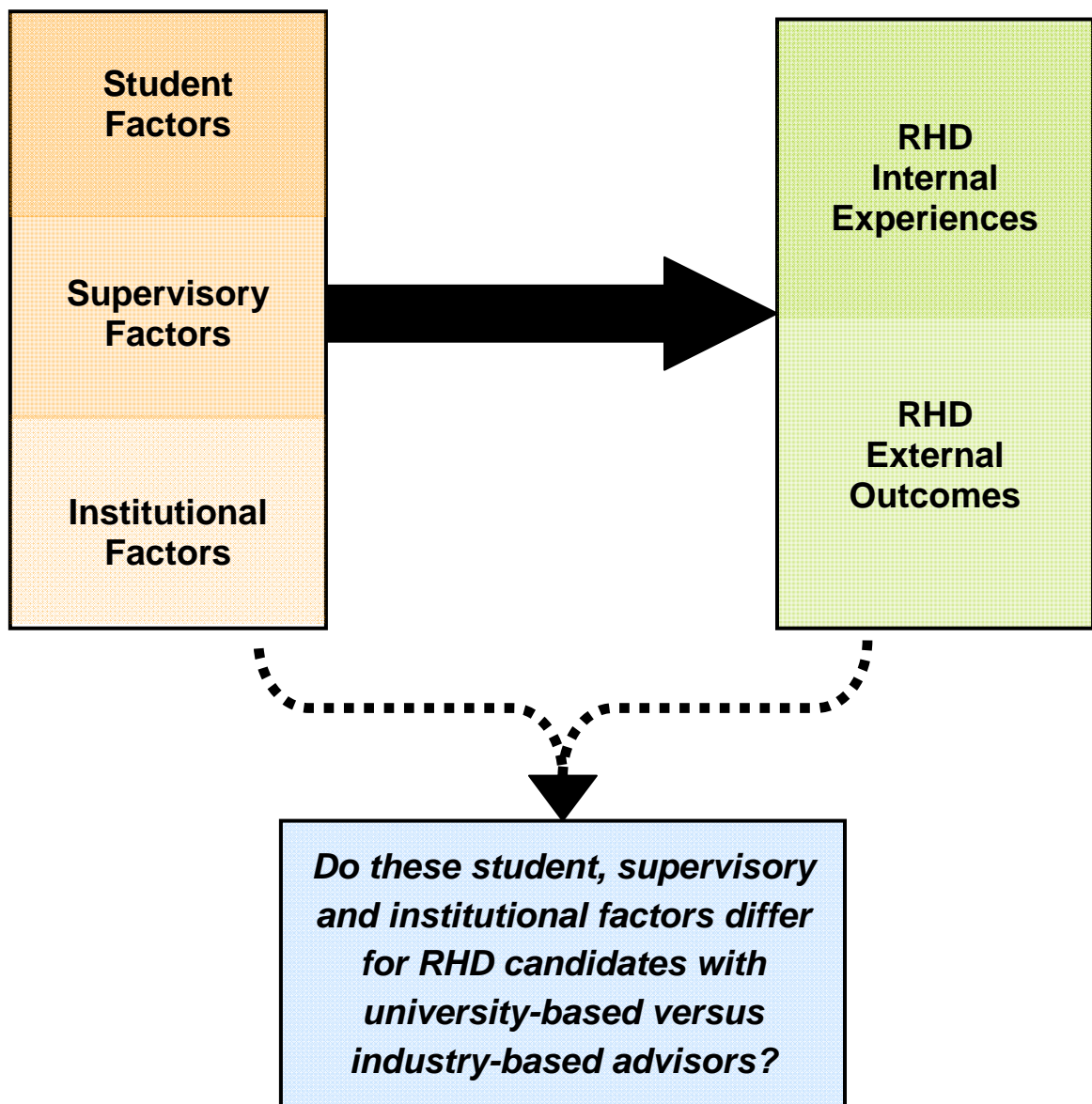


Figure 1. 2007 RHD Student Experiences and Outcomes Survey assessment dimensions.

## 3.2 ASSESSMENT MEASURES

To evaluate the underlying measurement dimensions of the assessment model, the 2007 *RHD Student Experiences and Outcomes Survey* was designed to collect quantitative, self-report data from RHD candidates on each of the following factors:

### 3.2.1 Student Factors

Student factors refer to the affective (e.g., moods, emotions), cognitive (e.g., thoughts, mental processes), and behavioural (e.g., response tendencies) qualities and personal characteristics of individual RHD candidates. The student factors assessed in the current research project include:

**Self-Confidence.** This measure assesses the extent to which candidates perceive themselves as capable of successfully achieving desired goals and outcomes across a range of different research tasks and activities. Example items include:

- “I will be able to achieve most of the goals that I have set myself for my RHD.”
- “I believe I can succeed at any endeavour related to my research to which I set my mind.”

**Achievement Goals.** This measure assesses the general tendency of candidates toward developing and demonstrating their knowledge, skills and abilities in academic achievement situations. In particular, it examines the extent to which candidates pursue three different types of goals, including:

*Mastery Goals.* A desire to develop the self by acquiring new skills, mastering new situations, and improving one’s competence. An example item is:

- “It is important for me to understand the content of my research area as thoroughly as possible.”

*Performance-Approach Goals.* A desire to prove the adequacy of one’s competence by gaining favourable judgments and positive evaluations in comparison with others. An example item is:

- “It is important for me to do well compared to other RHD candidates in my research area.”

*Performance-Avoidance Goals.* A desire to avoid disproving one’s competence by avoiding unfavourable judgments and negative evaluations in comparison with others. An example item is:

- “I just want to avoid performing poorly in my research compared to other RHD candidates.”

**Achievement Emotions.** This measure assesses the tendency of candidates toward feeling a number of discrete emotional states in academic achievement situations. In particular, it examines the extent to which candidates experience each of the following emotions during research tasks or activities:

- *Enjoyment*
- *Anger*
- *Helplessness*
- *Pride*
- *Anxiety*
- *Boredom*

**Motivational Strategies.** This measure assesses the extent to which candidates use self-regulation to sustain or strengthen the level of effort devoted toward complex tasks or difficult research activities. In particular, it assesses candidates' tendency to use two regulatory strategies in academic achievement situations:

*Affective Regulation.* Emotional control processes that serve to reduce the occurrence of distracting moods, feelings or emotions that may arise while performing complex or difficult activities (e.g., anxiety, anger, frustration). An example item is:

- “*I try to keep my feelings from interfering too much.*”

*Cognitive Regulation.* Self-monitoring and goal-setting processes that serve to increase task-focused attention while performing complex or difficult research activities, despite boredom, disinterest or task-irrelevant thoughts. An example item is:

- “*I pay close attention to the kinds of difficulties or problems I am facing.*”

### 3.2.2 Supervisory Factors

Supervisory factors refer to the administrative features of RHD candidates' supervisory arrangements, as well as the qualitative nature of candidates' working relationship with their 'principal advisor' – that is, the advisor with whom candidates have the most contact and receive the most guidance from for their postgraduate research. The supervisory factors assessed in the current research include:

**Advisory Arrangements.** This measure collects information on the general supervisory arrangements that exist between candidates and their advisory team, such as total number of advisors (principal and associates), gender of principal advisor, and previous changes in advisors during RHD candidature.

**Principal Advisor Affiliation.** This measure assesses whether candidates have a principal advisor who is university-based (e.g., a member of UQ's academic staff) or industry-based (e.g., an employee in a private company, the CSIRO, a government agency, etc.).

**Advisor Support.** This measure assesses candidates' perceptions of the extent to which their primary advisor expresses genuine support for their academic growth and personal wellbeing – for instance, by displaying sensitivity and interpersonal responsiveness; by providing encouragement and praise for personal efforts; and by fostering confidence and motivating expectations. Example items include:

- “*My advisor shows genuine concern for my research progress.*”
- “*My advisor gives me recognition and praise for doing a good job.*”
- “*My advisor motivates me to do my best work.*”

**Interpersonal Contact.** This measure assesses the frequency of advisor-candidate contact (e.g., never, less than once a month, once a month, once a fortnight, once a week, more than once a week) using each of the following modes of communication:

- *Face-to-Face Interaction*
- *Phone Conversation*
- *Email Correspondence*
- *Internet-based Contact*

**Advisor Feedback.** This measure assesses candidates' perceptions of the extent to which their principal advisor provides comprehensive, constructive and timely feedback on important issues relating to research progress. Example items include:

- *“My advisor is available for discussions and consultations when needed.”*
- *“My advisor engages in constructive discussions with me about my progress.”*

**Establishment of Supervisory Expectations.** This measure assesses the extent to which candidates and their principal advisor have openly discussed and established clear roles, responsibilities and expectations for working together. Example items include:

- *“My advisor and I have discussed our shared expectations of each other.”*
- *“I am clear about what my advisor expects of me.”*

**Adherence to Supervisory Expectations.** This measure assesses candidates' perceptions of the extent to which both *he/she* and *his/her principal advisor* have successfully fulfilled the designated roles, responsibilities, and commitments made to each other at the beginning of the RHD candidature. Example items include:

- *“So far, my advisor has done an excellent job of fulfilling his/her commitments to me.”*
- *“I feel that I have come through in fulfilling the commitments I made to my advisor when I started my RHD.”*

### 3.2.3 Institutional Factors

Institutional factors refer to contextual features and physical characteristics in the working environment of the 'research unit' where RHD candidates conduct their research – that is, the university school, institute or research centre (i.e., on-campus research unit) or the external facility or organisation (i.e., off-campus research unit) where candidates perform most research activities. The institutional factors assessed in the current research include:

**Institutional Support.** This measure assesses candidates' perceptions of the extent to which their research unit expresses genuine care and concern for their individual wellbeing; appreciates their personal opinions, values and goals; and provides necessary assistance and support when problems arise. Example items include:

- *“My research unit strongly considers my goals and values.”*
- *“My research unit is willing to help me if I need a special favour.”*

**Research Culture.** This measure assesses candidates' perceptions of the extent to which their research unit creates an environmental ambience that stimulates intellectual growth – for example, by making an effort to integrate candidates into the academic community; by encouraging staff and students to develop intellectual relationships; and by providing opportunities to share ideas and engage in scholarly discussion. Example items include:

- *“My research unit provides opportunities for RHD candidates to become involved in the broader research culture.”*

- *“My research unit organises additional, informal learning activities for RHD candidates to join (e.g., reading/journal groups, workshops, peer mentoring programs, etc.).”*

**Learning Climate.** This measure assesses candidates’ perceptions of the extent to which their research unit expresses support for students’ continuous learning and encourages the application of new knowledge and skills during research. Example items include:

- *“My research unit encourages RHD candidates to acquire new knowledge and skills during their research.”*
- *“My research unit gives recognition and credit to candidates who apply new knowledge and skills to their work.”*

**Institutional Resources.** This measure assesses candidates’ perceptions of the extent to which their research unit provides adequate resources, equipment, facilities, and infrastructure for conducting research and disseminating findings. Example items include:

- *“My research unit provides RHD candidates with a suitable workspace or office.”*
- *“My research unit provides RHD candidates with access to computer facilities, IT services, specialist hardware/software, etc.”*

**Achievement Goal Structures.** This measure assesses candidates’ perceptions of the goals, values and attitudes toward academic achievement that are advocated by their research unit. In particular, it measures the tendency of the institutional environment to embrace task, authority and reward structures that encourage two different types of achievement goals for candidates:

*Mastery Goal Structures.* A learning environment that encourages candidates to develop and challenge themselves by acquiring new skills, mastering new situations, and optimising research competence. An example item is:

- *“My research unit defines success in terms of individual improvement and progress.”*

*Performance Goal Structures.* A learning environment that encourages candidates to prove their competence (or to avoid disproving competence) by gaining positive evaluations, performing better than others, and avoiding errors or mistakes during learning. An example item is:

- *“My research unit encourages candidates to put in effort in order to perform better than others.”*

### 3.2.4 RHD Internal Experiences

RHD internal experiences refer to the inner subjective thoughts, personal attitudes, and qualitative feelings that candidates have toward their postgraduate research. Four facets of RHD candidates' internal experience were assessed in the current study, including:

**Satisfaction.** This measure assesses the overall level of pleasure, contentment and gratification that candidates derive from their research. An example item is:

- *“I find real enjoyment in my research.”*

**Research Involvement.** This measure assesses the extent to which candidates psychologically identify with their postgraduate research and perceive it to be an integral part of their daily life due to the opportunities it affords in satisfying important needs, fulfilling goals, and defining their self-concept. An example item is:

- *“I am very much personally involved with my research.”*

**Research Commitment.** This measure assesses the extent to which candidates feel emotionally and intellectually dedicated, devoted and attached to undertaking the necessary course of action for completing their research. An example item is:

- *“I like my research too much to give it up.”*

**Turnover Intentions.** This measure assesses the extent to which candidates experience thoughts of quitting and genuinely intend to withdraw from postgraduate research in the foreseeable future. An example item is:

- *“I intend to search for something else to do instead of my RHD (e.g., undertaking full-time work, traveling overseas, entering a new progression, etc.).”*

### 3.2.5 RHD External Outcomes

RHD external outcomes refer to the measurable outputs and quantifiable achievements attained by candidates during the completion of postgraduate research. Two aspects of RHD candidates' external outcomes were assessed in the current study, including:

**Research Outcomes.** This measure assesses the total number of research outputs that RHD candidates have generated or produced during their candidature, including submitted and published journal articles, refereed conference papers and abstracts, books, book chapters, seminar presentations, reports to industry or business, commercial outcomes, patents, and new research tools or techniques.

**Grant Success.** This measure assesses the total number and total dollar value (\$AU) of research grants that RHD candidates have attained since commencing postgraduate study.

### 3.3 RESEARCH DESIGN AND METHODOLOGY

After receiving approval from the Dean of the UQ Graduate School and ethical clearance within the guidelines of the National Health and Medical Research Council, the research team obtained access to the student email addresses of 2257 confirmed RHD candidates enrolled at UQ. Approximately 3.5% of these email accounts were deactivated, invalid, and/or expired at the time of data collection during semester one, 2007. In turn, the final sample consisted of 2176 confirmed RHD candidates.

To assess the key research questions, self-report data were collected from candidates by way of an electronic survey instrument. The survey was divided into six sections: (1) demographic and background information; (2) institutional factors in the academic environment; (3) supervisory arrangements and relationships; (4) student characteristics; (5) internal research experiences; and (6) external research outcomes.

In March 2007, RHD candidates were contacted via email and invited to participate in an online study assessing “*the experiences and outcomes of postgraduate research students at UQ*”. Candidates were assured that all data would remain anonymous and that no identifying information would be attached to their survey answers. It was outlined that the research project formed the first part of a longitudinal study and would therefore involve the annual distribution of a self-report survey to all confirmed RHD candidates at UQ. Candidates were assured, however, that participation in the first survey would not place them under any obligation to complete follow-up surveys in the future. This email included a URL to enable candidates to access the survey instrument via the internet using a web-browser. Paper-pencil versions of the survey were also made available for any candidate who requested to complete the instrument off-line<sup>1</sup>.

To allow the UQ research team to collect data on an annual basis, respondents were asked to create an anonymous identification code that would enable their individual data to be linked over time. As reimbursement for participation, candidates were invited to enter a prize draw to win one of forty \$30.00 Movie Gift Cards to spend at any Birch Carroll and Coyle Cinema throughout Australia. To further maximise the response rate, two reminder emails were sent at weekly intervals following the initial email.

After survey completion, participants’ data was electronically transferred to a secure server at UQ’s School of Psychology in a password-protected file. Participants were provided with a URL link enabling them to access a separate web-page where they could provide relevant contact details to enter the prize draw. This two-part process ensured that when online data was exported from the web-survey program to the relevant computer files for data analysis, participants’ survey responses remained detached from their personal information for the prize draw. Further, only selected members from the UQ research team were granted access to the raw data and data analysis files.

### 3.4 SAMPLE

Survey data was obtained from a total of 500 confirmed RHD candidates (42% male, 58% female) enrolled in postgraduate research across seven faculties and four institutes at UQ. The demographic characteristics of the final sample are presented in Table 6.

---

<sup>1</sup> No RHD candidates who were contacted in the current study requested a paper-pencil version of survey.

Table 6. Demographic characteristics of sample (N = 500) for the 2007 RHD Student Survey.

Age		Gender	
Minimum Age	21 years	Male	42.2%
Maximum Age	73 years	Female	56.8%
Mean Age	32.8 years	Not specified	1.0%
University Faculty/Institute		Highest Entry Qualification	
Arts	11.2%	Honours 1	40.8%
Biological & Chemical Sciences	15.8%	Honours 2A	12.0%
Business, Economics & Law	5.6%	Honours 2B	2.0%
Engineering, Physical Sciences & Architecture	16.0%	Masters by Research	13.4%
Health Sciences	19.8%	Masters by Coursework	17.2%
Natural Resources, Agriculture & Veterinary Science	9.0%	Incomplete Masters	2.6%
Social & Behavioural Sciences	17.2%	Graduate 2yrs plus experience	4.6%
University Institutes	4.2%	Other Qualification	6.2%
Not Specified	1.2%	Not Specified	1.2%
Prior Industry/Professional Experience			
Experience Related to RHD		Experience Unrelated to RHD	
0 years	44.6%	0 years	46.4%
1-2 years	19.8%	1-2 years	16.4%
3-5 years	16.0%	3-5 years	12.6%
6-10 years	7.8%	6-10 years	9.6%
11-15 years	4.8%	11-15 years	4.8%
15+ years	5.6%	15+ years	8.8%
Not Specified	1.4%	Not Specified	1.4%
RHD Candidature Arrangements			
Candidature Duration		Current RHD Project Affiliation	
Average Current Duration	2.8 years	University School	67.6%
Average Time until PhD Submission	11.7 months	University Institute	7.2%
Enrolment Status		Cooperative Research Centre	8.4%
Domestic Student	83.0%	Other Research Centre	15.8%
International Student	15.8%	Not Specified	1.0%
Not Specified	1.2%	Preferred RHD Project Affiliation	
Enrolment Basis		University School	67.6%
Full-time on-campus	67.8%	University Institute	10.6%
Full-time off-campus	10.4%	Cooperative Research Centre	6.2%
Part-time on-campus	10.0%	Other Research Centre	12.6%
Part-time off-campus	9.0%	Not Specified	3.0%
Other	1.8%	RHD Project Location	
Not Specified	1.0%	University	87.4%
		Industry	11.0%
		Not Specified	1.6%

<b>RHD Supervisory Arrangements</b>			
<b>Total Number of Advisors</b>		<b>Changes in Principal Advisor</b>	
One	2.0%	None	75.8%
Two	62.0%	One	18.0%
Three	27.8%	Two	2.4%
Four +	7.2%	Three +	2.8%
Not Specified	1.0%	Not Specified	1.0%
<b>Closest Advisor</b>		<b>Principal Advisor Affiliation</b>	
Principal Advisor	80.0%	University-based	90.8%
Associate Advisor	18.8%	Industry-based	8.0%
Not Specified	1.2%	Not Specified	1.2%
<b>Gender of Principal Advisor</b>		<b>Preferred Principal Advisor Affiliation</b>	
Male	64.2%	University-based	90.8%
Female	34.6%	Industry-based	7.6%
Not Specified	1.2%	Not Specified	1.6%
<b>Sources of RHD Funding</b>		<b>Current Paid Employment</b>	
<b>Funding for RHD Stipend Scholarship</b>		<b>Employment Status</b>	
APA/UQ(I)PRS Scholarship	41.4%	Full-time employment	16.6%
APAI	4.0%	Part-time employment	48.0%
AusAid	1.4%	Not employed	34.4%
Rural Development Corporation	0.4%	Not Specified	1.0%
Industry Partner	3.2%	<b>Employment Relevance</b>	
Other Scholarship	25.6%	Related to RHD research	47.4%
Other funding	3.2%	Not Related to RHD research	16.8%
Self-Funded	19.0%	Not Specified	35.8%
Not Specified	1.8%	<b>Average Hours (per week)</b>	
<b>Funding for RHD Project</b>		18 hours	
Industry/Business Funding	17.0%	<b>Caretaking Commitments</b>	
No Funding	81.2%	<b>Current Caretaking Commitments</b>	
Not Specified	1.8%	Yes	78.7%
<b>Top-up Additional Funding</b>		No	21.3%
Stipend Scholarship Funding	19.6%	<b>Average Hours (per week)</b>	
RHD Project Funding	14.0%	30 hours	
No Top-up Funding	54.0%		
Not Specified	1.6%		

## 4 FINDINGS

### 4.1 ASSESSMENT OF RHD EXPERIENCES AND OUTCOMES

This section reports the average levels of each factor for the student, supervisory, institutional and outcome dimensions described in the assessment model, thereby providing an evaluation of RHD candidates' experiences and outcomes.

#### 4.1.1 Student Factors

The *2007 RHD Student Survey* asked candidates to provide information on four personal characteristics that may be related to internal research experiences and external research outcomes, including: (1) self-confidence, which reflects candidates' beliefs in their ability to successfully achieve desired goals across various research activities; (2) achievement goals, which reflect candidates' general tendencies toward developing and demonstrating ability in academic situations; (3) achievement emotions, which reflect candidates' general tendencies toward experiencing various emotions in academic situations; and (4) motivational strategies, which reflect candidates' use of cognitive and affective regulation to maintain high levels of effort during complex tasks and difficult research activities.

Figure 2 presents the average levels reported by RHD candidates across each of the assessment dimensions. Scores greater than 50% indicate that, on average, candidates perceived themselves as possessing that particular personal characteristic.

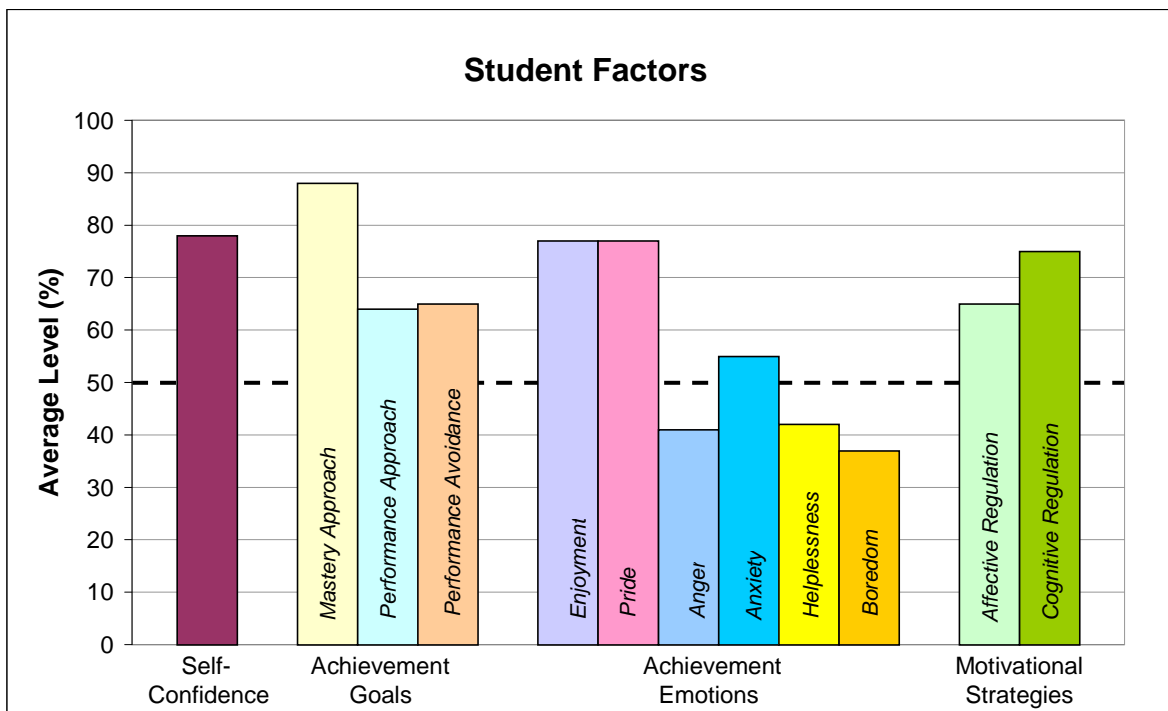


Figure 2. Average levels of the student factors.

Overall, RHD candidates rated themselves positively across the majority of student factors. Key findings are as follows:

- On average, RHD candidates reported high levels of self-confidence in their ability to successfully achieve desired goals and outcomes across a range of different research tasks and activities.
- On average, candidates reported a desire to prove their competence by gaining positive evaluations (performance-approach goals), as well as a desire to avoid disproving their competence by preventing negative evaluations (performance-avoid goals). To an even greater extent, however, candidates reported a desire to develop academic competence by mastering new knowledge, skills and situations during postgraduate research (mastery goals).
- Candidates generally experienced the positive emotions of enjoyment and pride, but not the negative emotions of boredom, anger or hopelessness, while conducting research tasks and activities. They did, however, report a tendency to experience anxiety in some research-related situations.
- RHD candidates tended to use the motivational strategies of cognitive and affective regulation to sustain effort during complex or difficult research activities.

### 4.1.2 Supervisory Factors

RHD candidates were also asked to provide information on the nature of the supervisory relationship that they had established with their principal advisor. As the vast majority (97%) of candidates had more than one advisor, the *2007 RHD Student Survey* used the term ‘*principal advisor*’ to refer to the advisor with whom candidates had the most contact and received the most guidance from for their research. Candidates were asked about five aspects of the working relationship with their principal advisor: (1) advisor support, which reflects advisors’ expression of genuine care toward candidates’ needs; (2) interpersonal contact, including the frequency of face-to-face, email, phone and internet-based communication; (3) advisor feedback, which reflects advisors’ provision of constructive, comprehensive, and timely feedback to candidates; (4) establishment of supervisory expectations, which reflects candidate-advisor negotiations of shared roles, responsibilities and commitments for working together; and (5) candidate/advisor adherence to supervisory expectations.

Figure 3 presents the average levels reported by candidates on the supervisory factors of advisor support, advisor feedback, establishment of supervisory expectations, and candidate/advisor adherence to supervisory expectations. Scores exceeding 50% indicate that, on average, candidates perceived that dimension positively in terms of the working relationship with their principal advisor.

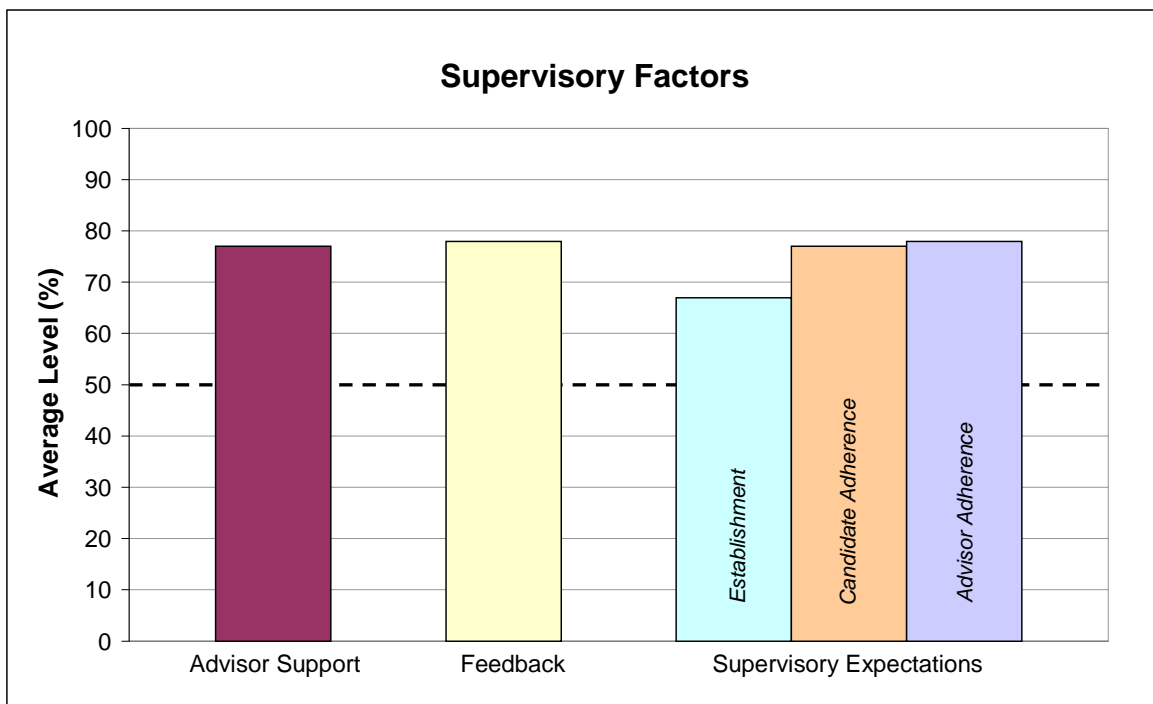


Figure 3. Average levels of the supervisory factors.

In general, RHD candidates perceived all facets of the supervisory relationship with their principal advisor to be positive. Key findings are as follows:

- On average, candidates indicated that their principal advisor was supportive of their research by expressing genuine sensitivity and responsiveness, providing encouragement and praise, and offering opportunities for academic development.
- Candidates reported receiving comprehensive, constructive, and timely feedback from their principal advisor on issues relating to research progress.

- In general, most candidates had negotiated, established and clarified basic ‘ground-rules’, informal protocols and shared expectations for working with their principal advisor. A slightly higher proportion of candidates perceived that these mutual expectations and commitments had been successfully fulfilled by both themselves and their principal advisor since commencing postgraduate research.

Figure 4 displays percentages for the average frequency of interpersonal contact between candidates and their principal advisors. These percentage scores are displayed for four different modes of candidate-advisor communication: (1) fact-to-face interaction; (2) email correspondence; (3) phone conversation; and (4) internet-based contact.

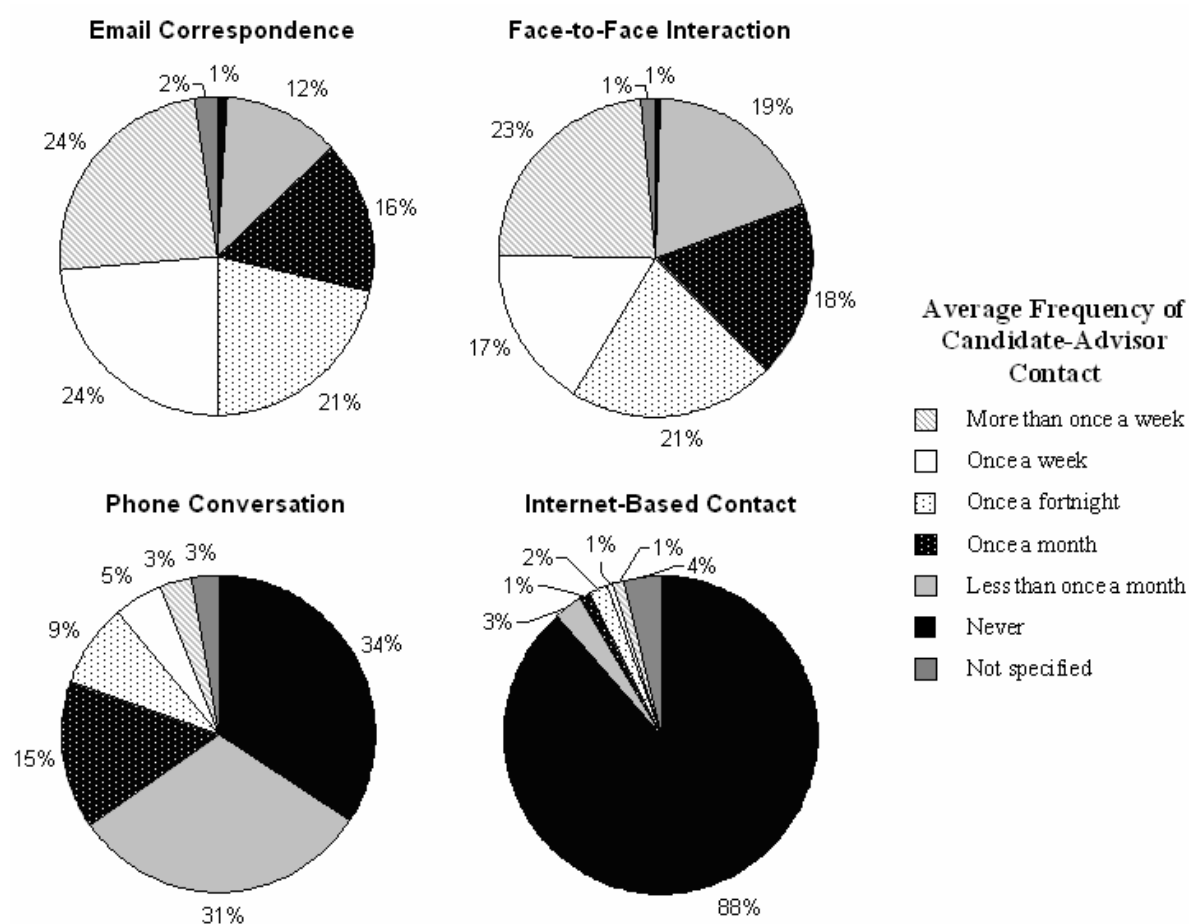


Figure 4. Percentages of the average frequency of candidate-principal advisor contact across different modes of communication.

Overall, the frequency of contact between candidates and their principal advisors varied substantially across the four modes of communication. Key findings are as follows:

- On average, RHD candidates engaged in email correspondence with their advisor very frequently, with 48% of candidates using this method at least once per week.
- Candidates also frequently engaged in face-to-face contact with their advisor, with most candidates using this method on a weekly (40%) or fortnightly (21%) basis.

- In general, candidates had phone contact with their advisor less than once a month, with approximately one-third of candidates reporting no prior use of this method.
- On average, candidates reported very infrequent use of internet-based methods (e.g., MSN messenger, web-cam) to communicate with their advisor, with fewer than 8% of candidates reporting any prior use of this method.

### 4.1.3 Institutional Factors

The *2007 RHD Student Survey* also asked candidates for information on the institutional environment in which they conducted their postgraduate research. More than 87% of candidates indicated that they conducted their research in a university school, institute or research centre located on-campus, while 11% conducted their research in an external research facility located off-campus. For simplicity, the *2007 RHD Student Survey* used the term ‘research unit’ to refer to the working environment where candidates perform most research tasks/activities. Candidates were asked about five different aspects of the working environment of their research unit, including: (1) institutional support, which reflects the research unit’s expression of genuine care and concern for candidates’ needs; (2) research culture, which reflects the provision of an integrative academic community for staff and students; (3) learning climate, which reflects the research unit’s tendency to encourage the continuous acquisition of knowledge/skills during research; (4) institutional resources, which reflects the provision of adequate equipment, facilities and infrastructure to assist candidates with conducting research; and (5) achievement goal structures, which reflects the overall goals and values for achievement that are advocated by the research unit.

Figure 5 presents the average levels reported by RHD candidates across each of the assessment dimensions. Scores greater than 50% indicate that, on average, candidates perceived their research unit to be high on that particular dimension.

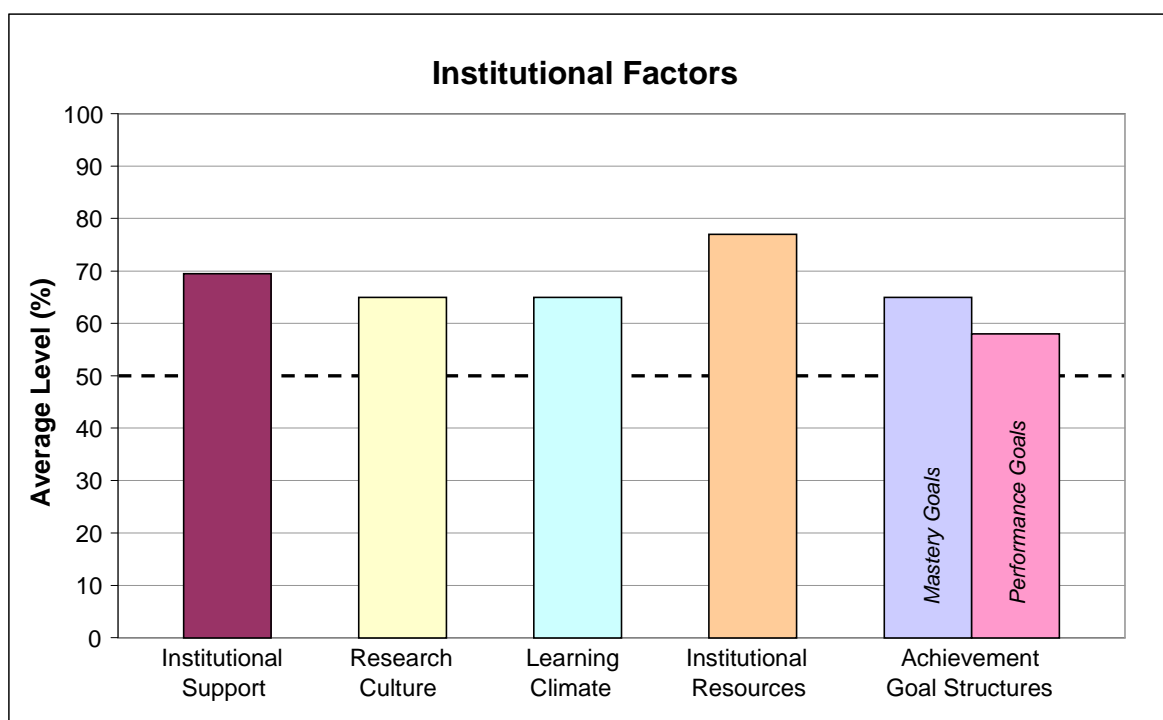


Figure 5. Average levels of the institutional factors.

Overall, RHD candidates perceived the institutional environment of their research unit to be very positive. Key findings are as follows:

- In general, candidates reported that their research unit expresses genuine care, concern and support for students' personal wellbeing and academic progress.
- On average, candidates indicated that their research unit creates an environmental ambience that stimulates intellectual growth and extends academic development.
- Most candidates perceived their research unit to encourage a climate of continuous learning by encouraging students to acquire new knowledge/skills during research.
- In general, candidates reported that their research unit provides adequate resources, infrastructure, equipment and facilities for conducting research.
- On average, candidates perceived that their research unit defines success in terms of individual improvement and encourages students to exert effort to learn new things, improve competence, and challenge themselves (i.e., mastery goals).
- Candidates also generally perceived that their research unit defines success in terms of high individual performance relative to others and encourages candidates to outperform their peers and avoid making errors/mistakes during research (i.e., performance goals).

#### 4.1.4 RHD Internal Experiences

To assess experiential outcomes during postgraduate research, the *2007 RHD Student Survey* also collected information on candidates' internal thoughts, subjective attitudes and qualitative feelings toward their research. Candidates were asked about four different facets of the RHD experience, including: (1) satisfaction, which reflects overall feelings of contentment with undertaking one's research; (2) involvement, which reflects a sense of personal identification with one's research; (3) commitment, which reflects dedication, attachment and devotion towards one's research; and (4) turnover intentions, which reflects thoughts of withdrawing from or quitting one's research in the foreseeable future.

Figure 6 displays the average levels reported by RHD candidates across each of the four assessment dimensions. Scores greater than 50% indicate that, on average, candidates reported high levels on that particular dimension. In the case of turnover intentions, scores *less than 50%* indicate that candidates did not report strong intentions to withdraw from or quit postgraduate research.

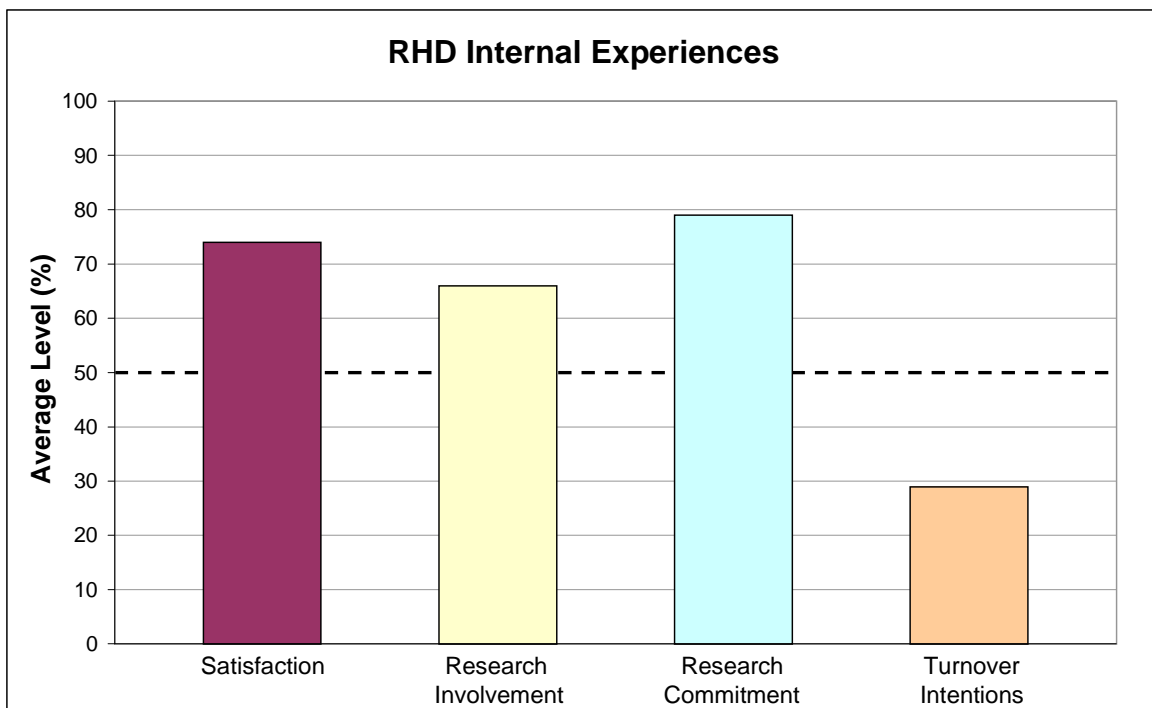


Figure 6. Average levels of RHD candidates' internal research experiences.

Overall, RHD candidates rated the postgraduate research experience at UQ positively. Key findings are as follows:

- On average, the majority of RHD candidates felt very satisfied with, involved in, and committed to their postgraduate research program.
- In general, candidates indicated that they did not think about or intend to quit postgraduate research in the foreseeable future.

#### 4.1.5 RHD External Outcomes

Finally, the 2007 RHD Student Survey also collected information on the quantifiable achievements and measurable outputs attained by candidates during postgraduate research. Candidates were asked to provide details on two different types of external achievements: (1) research outcomes, such as the total number of submitted/published journal articles, refereed conference papers/abstracts, seminars, industry/business reports, etc; and (2) grant successes, including the total number and total dollar value (\$AU) of research grants awarded during postgraduate research.

Figure 7 shows the percentage scores of candidates who obtained *one or more* of the external research outcomes since commencing their RHD candidature. These percentages are presented separately for each type of research outcome.

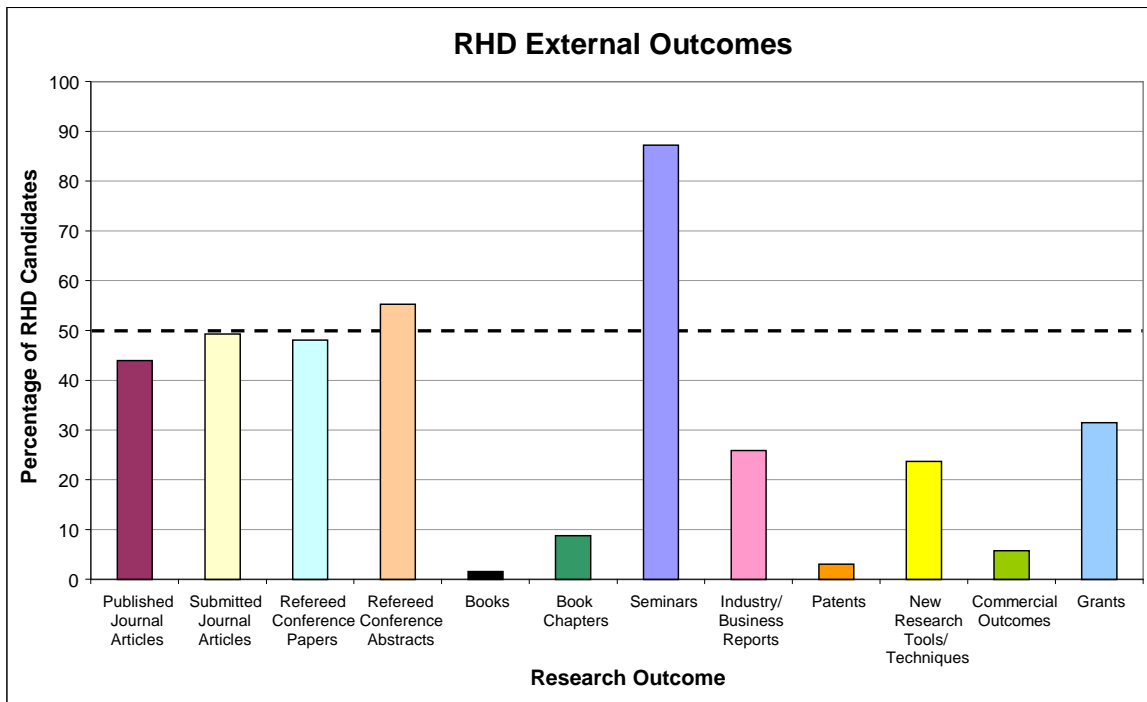


Figure 7. Percentage of RHD candidates who obtained one or more of the external outcomes.

Overall, the percentage of candidates who attained one or more of the research outcomes varied substantially for the different types of outcomes. Key findings are as follows:

- Approximately 88% of candidates presented at least one seminar during their RHD.
- On average, almost half (49%) of all candidates had submitted at least one journal article during their candidature, with a slightly lower proportion of candidates (44%) publishing a journal article.
- A moderate proportion of candidates (48%) had produced a refereed conference paper during their candidature, with a slightly higher proportion (55%) producing a refereed conference abstract.
- Fewer than 10% of candidates had produced a book, a book chapter, a patent, or a commercial outcome since commencing postgraduate research.
- Approximately one-third of all RHD candidates were awarded a research grant during their candidature. Of those candidates, the average total value of research grants attained was AU\$29,259, and ranged from AU\$800 to \$AU385,000.

## 4.2 KEY FACTORS ASSOCIATED WITH RHD EXPERIENCES AND OUTCOMES

This section reports the results of statistical analyses (standard multiple regression) to assess the key student, supervisory and institutional factors that are associated with RHD candidates' internal experiences and external outcomes during postgraduate research.

To enhance the validity of any significant relationships that emerged between factors, all analyses controlled for the effects of individual differences between candidates on each of the demographic characteristics detailed in Table 6 (e.g., candidates' age, gender, entry qualification, faculty/school, enrolment status/basis, current paid employment, etc.).

The statistically significant results from data analyses of the student, supervisory and institutional factors are detailed below in a sequential order. For each group, key findings are presented separately for RHD candidates' internal experiences and external outcomes.

### 4.2.1 Key Student Factors

First, analyses were conducted to assess whether the student characteristics of self-confidence, achievement goals, achievement emotions and motivational strategies were significantly related to RHD candidates' internal experiences and external outcomes during postgraduate research. The results of these analyses are presented in Tables 7 and 8 below.

*Table 7. Student Factors Associated with RHD Internal Experiences.*

<b>RHD INTERNAL EXPERIENCES</b>
<b>Satisfaction was associated with...</b>
<b>1. Self-Confidence</b> <b>2. Enjoyment</b>
<b>Research Involvement was associated with...</b>
<b>1. Enjoyment</b>
<b>Research Commitment was associated with...</b>
<b>1. Self-Confidence</b>

These analyses suggest that:

- RHD candidates with high self-confidence in their ability to successfully perform various research tasks/activities tended to report higher levels of satisfaction and commitment to their research than those with low self-confidence.
- Candidates who experienced higher levels of enjoyment while conducting their research were more likely to feel satisfied with and involved in their research than those who experienced lower levels of enjoyment.

Table 8. Student Factors Associated with RHD External Outcomes.

<b>RHD EXTERNAL OUTCOMES</b>
<b>Number of Submitted Journal Articles was associated with...</b>
<b>1. Self-Confidence</b>
<b>Number of Books was associated with...</b>
<b>1. Performance-Approach Goals</b>
<b>Number of Seminar Presentations was associated with...</b>
<b>1. Pride</b> <b>2. Anxiety</b> <b>3. Affective Regulation</b>
<b>Number of Industry/Business Reports was associated with...</b>
<b>1. Mastery Goals</b>

These analyses suggest that:

- RHD candidates with higher self-confidence in their ability to successfully perform research tasks/activities were more likely to submit journal articles for publication than candidates with lower self-confidence.
- Candidates with a strong desire to prove their competence by gaining favourable evaluations and by outperforming others tended to publish more books than those candidates with less of a concern to prove their competence.
- Those candidates who experienced lower levels of pride or higher levels of anxiety while conducting research activities tended to present more seminars than those with higher pride or lower anxiety.

These findings may be the result of individuals with high anxiety and/or low pride engaging in ‘approach’ behaviours in an effort to reduce feelings of tension and/or increase feelings of pride, respectively. As seminar presentations often provide a relaxed and informal learning environment for students, candidates may actively seek out such situations in order to quell anxiety and develop a sense of self-pride.

- Candidates who reported using affective regulation during complex or difficult research tasks presented more seminars than those candidates who reported using fewer affective regulation strategies.
- Candidates who indicated a strong desire to develop themselves by mastering new situations and by improving competence were more likely to generate reports to industry/business than those with less of a concern to pursue mastery goals.

#### 4.2.2 Key Supervisory Factors

A second set of analyses were conducted to examine whether the supervisory factors of advisor support, interpersonal contact, advisor feedback, establishment of supervisory expectations, and adherence to supervisory expectations were associated with candidates' internal experiences and external outcomes during postgraduate research. The results of these analyses are presented in the tables below.

*Table 9. Supervisory Factors Associated with RHD Internal Experiences.*

<b>RHD INTERNAL EXPERIENCES</b>
<b>Satisfaction was associated with...</b>
<b>1. Candidate Adherence to Supervisory Expectations</b>
<b>Turnover Intentions were associated with...</b>
<b>1. Advisor Adherence to Supervisory Expectations</b> <b>2. Feedback</b>

These analyses suggest that:

- Candidates who perceived that they had successfully adhered to, rather than violated, the supervisory expectations that were established for working with their primary advisor tended to feel more satisfied with postgraduate research.
- Candidates who perceived that their primary advisor had violated, rather than adhered to, the supervisory expectations that were established for working together tended to report stronger intentions to quit their RHD in the foreseeable future.
- Candidates also tended to report stronger intentions to quit postgraduate research if they perceived that their advisor provided more, rather than less, comprehensive, constructive and timely feedback on their work and research progress.

This finding may be the result of advisors delivering more feedback to those candidates who are underperforming or making poor progress. It is also possible that receiving more feedback may produce extra work for candidates (e.g., to fix errors and correct mistakes), thereby giving candidates the perception of a 'never-ending' workload.

Table 10. Supervisory Factors Associated with RHD External Outcomes.

<b>RHD EXTERNAL OUTCOMES</b>
<b>Number of Submitted Journal Articles was associated with...</b>
<b>1. Establishment of Supervisory Expectations</b>
<b>Number of Refereed Conference Abstracts was associated with...</b>
<b>1. Establishment of Supervisory Expectations 2. Face-to-Face Interaction</b>
<b>Number of Reports to Industry/Business was associated with...</b>
<b>1. Internet-Based Contact</b>
<b>Number of Patents was associated with...</b>
<b>1. Candidate Adherence to Supervisory Expectations</b>
<b>Number of Commercial Outcomes was associated with...</b>
<b>1. Advisor Support</b>

These analyses suggest that:

- RHD candidates who had established clear supervisory expectations for working with their primary advisor tended to submit more journal articles and generate more conference abstracts than those candidates who had not established clear supervisory expectations.
- Candidates who reported more frequent face-to-face interaction with their advisor tended to generate more refereed conference abstracts than candidates who reported less frequent face-to-face interaction.
- Candidates who reported more frequent internet-based contact with their advisor tended to generate more industry/business reports than those candidates with less frequent internet-based contact.
- Candidates who perceived that they had adhered to, rather than violated, the supervisory expectations that they had established with their primary advisor tended to produce more patents during their RHD candidature.
- Candidates who reported receiving higher levels of support from their principal advisor tended to generate more commercial outcomes than those who reported receiving lower levels of support.

### 4.2.3 Key Institutional Factors

Finally, data analyses were also conducted to test whether the factors of institutional support, research culture, learning climate, institutional resources and achievement goal structures were related to RHD candidates' internal experiences and external outcomes.

Results revealed that none of the aforementioned institutional factors were significantly associated with RHD candidates' internal experiences during postgraduate research. That is, candidates' perceptions of the institutional environmental of their research unit were not related to their satisfaction with, involvement in, or commitment to postgraduate research, nor to their intentions to withdraw from research in the foreseeable future.

In contrast, a number of institutional factors were significantly related to the external outcomes attained by RHD candidates during their candidature. The results of these analyses are presented below.

*Table 11.* Institutional Factors Associated with RHD External Outcomes.

<b>RHD EXTERNAL OUTCOMES</b>
<b>Number of Reports to Industry/Business was associated with...</b>
<b>1. Institutional Support</b>
<b>Number of New Research Techniques/Tools was associated with...</b>
<b>1. Institutional Support</b>
<b>2. Learning Climate</b>
<b>Number of Commercial Outcomes was associated with...</b>
<b>1. Institutional Support</b>
<b>2. Performance Goal Structures</b>
<b>3. Learning Climate</b>

These analyses suggest that:

- Candidates who perceived that their research unit provided high, rather than low, levels of institutional support for postgraduate research tended to produce more industry/business reports, more new research tools/techniques, and/or more commercial outcomes.
- Candidates who reported that their research unit encouraged students' continuous learning tended to produce more research tools/techniques and more commercial outcomes than candidates who did not report that their research unit encouraged a climate of continuous learning.
- Candidates who reported that their research unit encouraged students to outperform others and avoid making errors/mistakes during research tended to generate fewer commercial outcomes than candidates who did not report that their research unit encouraged performance-oriented goals.

### 4.3 COMPARING RHD CANDIDATES WITH UNIVERSITY-BASED VERSUS INDUSTRY-BASED ADVISORS

The *2007 RHD Student Survey* revealed that the vast majority of RHD candidates (91%) had a principal advisor who was university-based (e.g., a UQ academic staff member), whereas only 9% of candidates had an industry-based advisor (e.g., an employee in an external organisation, private company, government agency, etc.).

A set of statistical analyses (independent t-tests) were conducted to assess whether RHD candidates with university- versus industry-based advisors differed on each of the student, supervisory and institutional factors assessed in the *2007 RHD Student Survey*. These factors are outlined below in Table 8.

Table 12. Assessment dimensions of the *2007 RHD Student Survey*.

STUDENT FACTORS	SUPERVISORY FACTORS	INSTITUTIONAL FACTORS
Self-Confidence	Advisor Support	Institutional Support
Achievement Goals	Interpersonal Contact	Research Culture
Achievement Emotions	Advisor Feedback	Learning Climate
Motivational Strategies	Establishment of Supervisory Expectations	Institutional Resources
	Candidate/Advisor Adherence to Supervisory Expectations	Achievement Goal Structures

#### 4.3.1 Key Differences between RHD Candidates with University- versus Industry-Based Advisors

Overall, RHD candidates with university- versus industry-based advisors demonstrated significant differences on one supervisory factor and three institutional factors assessed in the *2007 RHD Student Survey*. There were no substantial differences between the groups, however, on any of the student factors included in the assessment model. Table 9 presents the four factors on which RHD candidates with university-based advisors and industry-based advisors differed from one another.

Table 13. Key factors on which RHD candidates with industry- versus university-based advisors differed.

SUPERVISORY FACTORS	INSTITUTIONAL FACTORS
<b>1. Interpersonal Contact</b> <i>Face-to-Face Interaction</i> <i>Phone Conversation</i>	<b>1. Institutional Support</b> <b>2. Learning Climate</b> <b>3. Institutional Resources</b>

#### 4.3.1.1 Key Differences in Supervisory Factors

RHD candidates with university-based and industry-based advisors showed clear differences in terms of the frequency of using face-to-face interaction and phone conversation as a method of candidate-advisor contact. Figure 8 presents percentage scores for the average frequency of candidate-advisor contact for candidates with university-based and industry-based advisors. The percentages are displayed for the communication modes of face-to-face interaction and phone conversation separately.

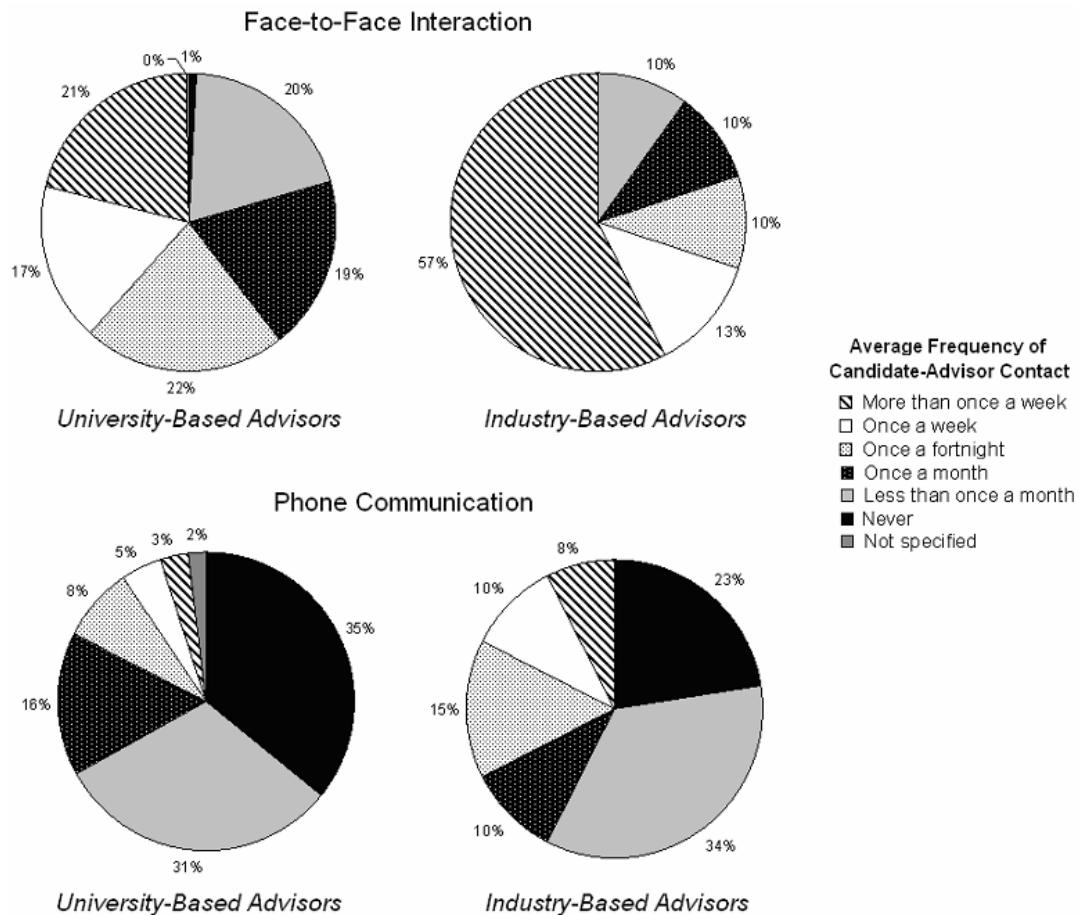


Figure 8. Average frequency of face-to-face and phone contact for candidates with university- versus industry-based principal advisors.

Overall, candidates with industry-based advisors reported more frequent face-to-face interaction and phone-based contact with their principal advisors than candidates with university-based advisors. Key findings are as follows:

- 70% of candidates with industry-based advisors engaged in face-to-face contact at least once a week. In contrast, less than 40% of candidates with university-based advisors used face-to-face contact on a weekly basis.

One possible explanation for this difference is that candidates with industry-based advisors may conduct research at a location, or in a research facility, that is closer in proximity to their advisor than candidates with university-based advisors.

- 18% of candidates with industry-based advisors engaged in phone-based conversation on a weekly basis. In contrast, less than 8% of candidates with university-based advisors engaged in phone conversation on a weekly basis.

#### 4.3.1.2 Key Differences in Institutional Factors

Figure 9 presents the average levels reported by candidates with university-based versus industry-based advisors on the three institutional factors that differentiated the two groups.

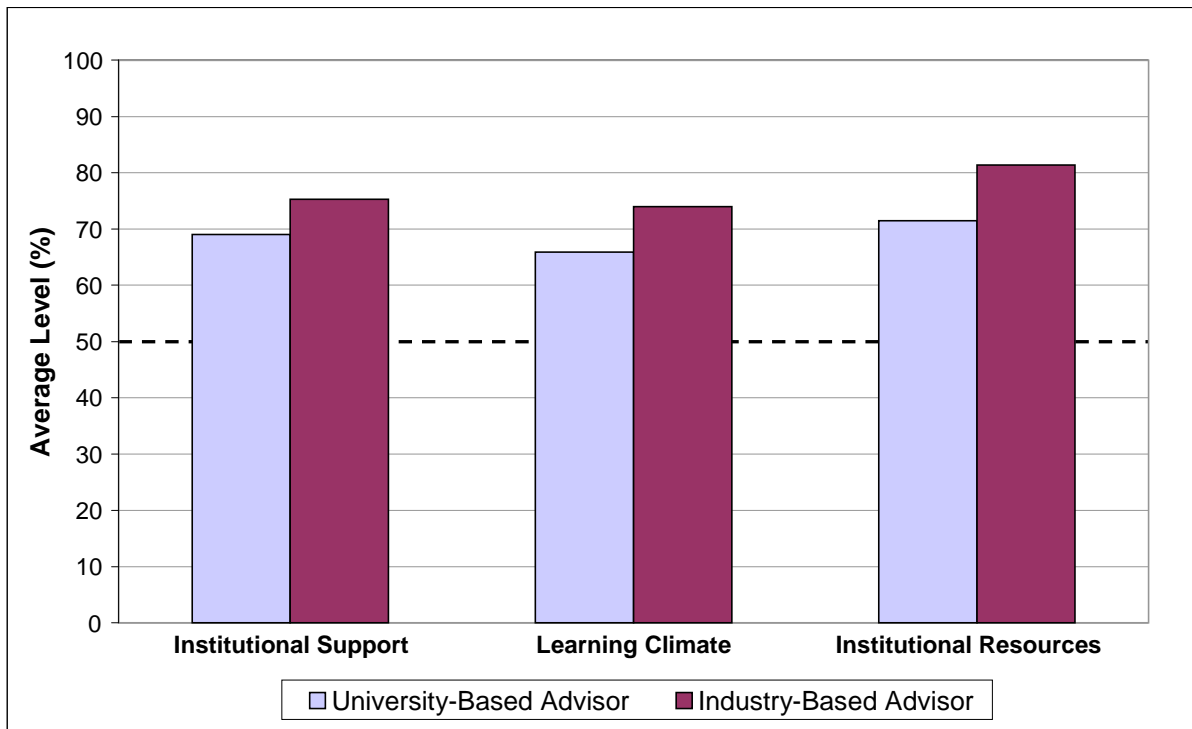


Figure 9. Differences in institutional factors for RHD candidates with university- versus industry-based advisors.

Overall, candidates with industry-based advisors perceived these three facets of the institutional environment of their research unit to be more positive than candidates with university-based advisors. Key findings are as follows:

- On average, candidates with industry-based advisors perceived that their research unit provided higher levels of institutional support for postgraduate research than candidates with university-based advisors.
- RHD candidates with industry-based advisors were more likely to report that their research unit supported continuous learning and encouraged the application of new knowledge/skills during research than candidates with university-based advisors.
- RHD candidates with industry-based advisors were more likely to report that their research unit provided adequate resources, infrastructure, equipment and facilities for conducting research than candidates with university-based advisors.

## 5 CONCLUSIONS

### 5.1 WHAT DO RHD CANDIDATES HAVE TO SAY ABOUT THEIR RHD EXPERIENCES AND OUTCOMES?

In general, the results of the *2007 RHD Student Survey* were overwhelmingly positive. RHD candidates at UQ reported favourable perceptions regarding their own personal characteristics (e.g., self-confidence), their experience with supervision (e.g., advisor support) and their working environment (e.g., institutional support) (see Figures 2-5). Not surprisingly then, candidates also tended to report high levels of satisfaction, research involvement and research commitment, as well as weak intentions to withdraw from postgraduate research in the foreseeable future (see Figure 6).

What is particularly encouraging is that candidates also appear to be generating tangible outcomes from their research (see Figure 7). Most candidates had presented their work at a seminar, and approximately half had submitted or produced at least one journal article, refereed conference abstract and/or conference paper. Some candidates also generated external outcomes such as business/industry reports, new research tools/techniques, patents, commercial outcomes, books, and book chapters. More than one-third of candidates received a grant during their candidature, with the average total value of grants attained by those candidates reaching almost AU\$30,000. These results are very encouraging for UQ, particularly given that the information has been gleaned from individual students themselves. The RHD experience at UQ appears to be both positive and fruitful. The remainder of this conclusion focuses on avenues for further optimising RHD candidates' internal experiences and external outcomes, both now and in the future.

### 5.2 WHAT ARE THE KEY FACTORS THAT ARE ASSOCIATED WITH RHD EXPERIENCES AND OUTCOMES?

#### 5.2.1 Student Factors

Each student factor assessed in the project was significantly related to at least one aspect of RHD candidates' internal experiences and/or external outcomes during postgraduate research. Table 14 presents the key student factors that emerged from the data analyses (these results have been integrated from Tables 7-8).

*Table 14.* Key student factors associated with RHD experiences and outcomes.

INTERNAL EXPERIENCES	EXTERNAL OUTCOMES
<p><b>Self-Confidence</b></p> <p><b>Achievement Emotions</b> <i>(Enjoyment)</i></p>	<p><b>Self-Confidence</b></p> <p><b>Achievement Emotions</b> <i>(Anxiety, Pride)</i></p> <p><b>Achievement Goals</b> <i>(Mastery, Performance-Approach)</i></p> <p><b>Motivational Strategies</b> <i>(Affective Regulation)</i></p>

Clearly, these results highlight that the personal qualities of candidates appear to play an important role in shaping postgraduate research experiences and outcomes. The two key drivers that emerged were self-confidence and achievement emotions, as these were important for both internal experiences and external outcomes.

Self-confidence refers to the extent to which candidates perceive themselves as capable of successfully achieving research-related goals and outcomes. Candidates with higher self-confidence tended to report greater satisfaction and research commitment, and reported submitting more journal articles for publication, than candidates with lower self-confidence. These findings highlight the potential influence of candidates' subjective beliefs of personal competence in affecting not only their *experiences* of postgraduate research, but also the *outcomes* they produce during their candidature.

Fortunately, most RHD students tended to report high confidence in their research abilities (see Figure 2). Nevertheless, these results suggest that interventions designed to enhance candidates' self-confidence promise to have a beneficial impact on RHD experiences and outcomes, particularly for those who lack confidence in their research abilities. Potential interventions include 'personal development' workshops or 'motivational' seminars that encourage candidates to focus on their individual strengths, adopt positive self-talk, actively seek affirmation from others, watch and learn from a respected role-model/mentor, and pursue opportunities to develop and demonstrate their research expertise.

In relation to achievement emotions, this project supports the common belief that the process of completing a RHD can be an emotional experience, with ups and downs throughout the candidature. Results suggested that the most intense emotions experienced by candidates are enjoyment, pride and anxiety (see Figure 2). What is particularly noteworthy is that each of these emotions emerged as key drivers of the candidates' broader experiences and outcomes. Candidates who gained *enjoyment* from their research activities reported greater satisfaction and research involvement compared to those who experienced less enjoyment.

Surprisingly, however, results also revealed that RHD candidates who felt *greater* anxiety and/or *less* pride in research situations tended to deliver *more* seminar presentations. This suggests that such candidates were reacting adaptively to their unpleasant emotions. For example, it is possible that candidates with high anxiety were using seminar presentations as a relatively safe, yet challenging vehicle for quelling unwarranted fears. Together, these results highlight the potential benefits of helping candidates to enhance positive emotions, and assisting them to develop proactive ways of dealing with the negative emotions that will inevitably be experienced at various times throughout their RHD candidature.

## 5.2.2 Supervisory Factors

Each supervisory factor assessed in the project was related to at least one aspect of RHD candidates' internal experiences and/or external outcomes during postgraduate research. Table 15 presents the key supervisory factors that emerged from the data analyses (these results have been integrated from Tables 9-10).

Table 15. Key Supervisory factors associated with RHD experiences and outcomes.

INTERNAL EXPERIENCES	EXTERNAL OUTCOMES
<p style="text-align: center;"><b>Advisor Feedback</b></p> <p style="text-align: center;"><b>Candidate Adherence to Supervisory Expectations</b></p> <p style="text-align: center;"><b>Advisor Adherence to Supervisory Expectations</b></p>	<p style="text-align: center;"><b>Advisor Support</b></p> <p style="text-align: center;"><b>Interpersonal Contact</b> <i>(Face-to-Face, Internet)</i></p> <p style="text-align: center;"><b>Establishment of Supervisory Expectations</b></p> <p style="text-align: center;"><b>Candidate Adherence to Supervisory Expectations</b></p>

These results demonstrate that both qualitative *and* quantitative aspects of the supervisory relationship appear to be important for shaping RHD candidates' research experiences and outcomes during postgraduate research. The most striking finding relates to *supervisory expectations*. The extent to which candidates and advisors established clear expectations regarding their relationship, and the extent to which these expectations were *adhered to by both* candidate and advisor, consistently emerged as drivers of both RHD experiences and outcomes. Interestingly, the initial process of establishing expectations was most strongly related to the external outcomes that candidates produced, whereas the subsequent process of fulfilling expectations was most strongly related to the candidates' internal experiences.

RHD candidates who had established clear supervisory expectations for working with their advisor tended to submit more journal articles for publication and produce more conference abstracts than those who had not established clear supervisory expectations. Candidates who perceived that these expectations had been successfully adhered to by themselves and their advisor tended to report greater satisfaction and weaker intentions to quit their research. The potential significance of supervisory expectations is underscored by the fact that publications and completion time are arguably two of the most important indicators of RHD candidates' success. Together, these findings suggest that efforts to maintain and enhance a formalised process of establishing supervisory expectations – alongside a process for revisiting those expectations at regular intervals – promises to be well worth the investment of resources.

### 5.2.3 Institutional Factors

Three institutional factors assessed in the project were related to RHD candidates' external outcomes during postgraduate research. Table 16 presents these key institutional factors (these results have been summarised from Table 11).

Table 16. Key institutional factors associated with RHD external outcomes.

EXTERNAL OUTCOMES
<b>Institutional Support</b>
<b>Learning Climate</b>
<b>Achievement Goal Structures</b> ( <i>Performance Goals</i> )

These results indicate that the working environment in which candidates complete their RHD may have a direct impact on the external outcomes they produce. The two key drivers were candidates' perceptions of *institutional support* and *learning climate* because these were related to multiple external outcomes. Institutional support refers to the extent to which research units express genuine care for the wellbeing of candidates; appreciate candidates' goals, values, and opinions; and offer assistance and support when problems arise. Learning climate refers to the extent to which research units express support for continuous learning and encourage the application of new knowledge and skills during research. Interestingly, these factors were both related to quantifiable, external outcomes.

RHD candidates who perceived that their research unit provided high, rather than low, levels of institutional support or learning climate tended to generate more research tools/techniques and more commercial outcomes. Those candidates who perceived high, rather than low institutional support were also likely to produce more industry/business reports. In combination, these results suggest that strategies aimed at developing a positive organisational climate may have a beneficial impact on candidates' attainment of external outcomes that have a commercial and/or business-focus. Potential strategies include: a) induction sessions that aim to integrate new RHD candidates into the broader research culture and academic community; b) informal learning opportunities that promote scholarly discussion (e.g., reading groups and peer mentoring programs); c) regular seminar programs that encourage candidates and academic staff to interact and develop intellectual relationships; and d) financial assistance to support research activities such as conference attendance and academic development programs.

Interestingly, institutional factors were not related to candidates' internal experiences of satisfaction, commitment, involvement, or intentions to quit postgraduate research (see page 34). On the other hand, student and supervisory factors did emerge as key drivers of candidates' internal experiences. This suggests that it is the more immediate, day-to-day experiences associated with the supervisory relationship and the student's personal characteristics that influence subjective attitudes towards research, as opposed to the more abstract features of the working environment. In contrast, an institution's contextual features appear to drive more tangible, quantifiable outcomes. A possible explanation for this is that the working environment where candidates undertake their research has an influence on the resources required to produce these types of outcomes.

### 5.3 DO PERCEPTIONS OF STUDENT, SUPERVISORY AND INSTITUTIONAL FACTORS DIFFER FOR RHD CANDIDATES WITH UNIVERSITY- VS INDUSTRY-BASED ADVISORS?

A key contribution of this project is that it has identified key differences between RHD candidates with university- versus industry-based advisors. In particular, significant group differences were identified on one supervisory factor and three institutional factors in the assessment model. Table 17 presents the key factors on which the groups differed (these results have been integrated from Figures 8-9).

Table 17. Differences between RHD candidates with university- and industry-based advisors.

SUPERVISORY FACTORS	INSTITUTIONAL FACTORS
<p><b>1. Interpersonal Contact</b>  <i>Face-to-Face Interaction</i>  <i>Phone Conversation</i></p>	<p><b>1. Institutional Support</b>  <b>2. Learning Climate</b>  <b>3. Institutional Resources</b></p>

These results indicate that candidates with industry- and university-based advisors appear to work in different research environments and use different modes of communication. In each case, candidates with industry-based advisors reported more positive experiences than those with university-based advisors.

Candidates with industry-based advisors engaged in more frequent face-to-face interaction and more phone conversation with their advisors than candidates with university-based advisors. Candidates with industry-based advisors also reported that their research unit provided higher levels of institutional support, greater encouragement for students' continuous learning, and better access to resources such as equipment, facilities and infrastructure, in comparison to candidates with university-based advisors. Potential explanations for these differences include: a) industry-based advisors may have fewer candidates to supervise than university-based advisors; b) industry-based advisors may work in closer proximity to candidates than university-based advisors; and c) industry-based advisors may be located in institutional environments that offer greater access to research-supportive resources than university-based advisors.

Recently, there has been a marked increase in the amount of industry-funded research being conducted by universities. It is therefore encouraging that the generally positive experiences reported by RHD candidates at UQ appear to be maintained or enhanced for those working in these newer, industry-based advisor relationships. The results indicate that these two groups of RHD candidates were similar types of students – that is, they did not differ in personal characteristics (e.g. self-confidence, achievement emotions) (see page 35). This is important because it suggests that a representative sample of RHD candidates are participating in industry-funded projects. Similarly, the two groups reported similar experiences in terms of establishing and adhering to shared expectations with their primary advisors. This is important because it suggests that RHD candidates at UQ are experiencing similar supervisory relationships, regardless of whether their advisor is a member of UQ's academic staff or an employee of an external organisation. The factors that differentiated the two groups were the frequency of interpersonal contact and the

institutional environment. This makes sense, because an advisor's affiliation with the university or industry may influence the nature of advisor-candidate communication and/or the physical location or institutional environment in which candidates conduct their research. This clear pattern of expected results is also of methodological importance because it supports the validity of our survey measures.

The fact that RHD candidates with industry-based advisors reported more frequent face-to-face interaction and more positive perceptions of their institutional environment compared to those with university-based advisors is particularly important because these factors were key drivers of candidates' external outcomes (see Tables 10-11). More frequent face-to-face interaction was associated with producing more refereed conference abstracts, which is often conceived as an "academically-focused" type of external outcome. In contrast, institutional support and learning climate were related to more "business-oriented" or "profit-focused" external outcomes such as industry/business reports, new research tools/techniques, and commercial outcomes.

These results suggest that RHD candidates with industry-based advisors are more likely to work in an environment which is conducive to attaining commercial- or business-focused outcomes, which may be particularly welcomed by candidates with an interest in these types of external outcomes. More broadly, it may be useful to examine the contextual features of these candidates' working environments to make informed decisions regarding strategic organisational change initiatives. These efforts are likely to be cost effective, because resulting interventions should be particularly beneficial for candidates with university-based advisors, who represent the vast majority of RHD candidates enrolled at UQ.

## **5.4 CONCLUSION**

The aim of this research project was to conduct a large-scale assessment of the factors that are associated with RHD candidates' internal experiences and external outcomes. In general, candidates were overwhelmingly positive about all aspects of their postgraduate research experience at UQ. Moreover, a trichotomy of factors – student, supervisory and institutional – were significantly related to candidates' internal experiences and external outcomes. Key findings are as follows:

- Self-confidence and achievement emotions were key drivers of both internal experiences (e.g., satisfaction) and external outcomes (e.g., journal article submissions and seminar presentations).
- The establishment of supervisory expectations was a key driver of external outcomes (e.g., journal article submissions), whereas the adherence to supervisory expectations was a key driver of internal experiences (e.g., satisfaction).
- Institutional factors, particularly those of institutional support and learning climate, were related to external outcomes (e.g., commercial outcomes), but not to internal experiences.
- RHD candidates with industry- versus university-based advisors appeared to have similar personal characteristics and supervisory relationships; however, those with industry-based advisors reported more frequent face-to-face interaction and were more positive regarding the working environment of their research unit (e.g., institutional support and learning climate).

These results can be used to make informed decisions regarding strategic RHD initiatives. In particular, it is recommended that a comprehensive suite of professional development activities for both RHD candidates *and* advisors that targets all three levels – the student, the supervisory relationship and the institutional environment – be designed. This suite of initiatives could include:

- Workshops for RHD candidates on self-confidence, achievement emotions, achievement goals, and reflecting on personal strengths and weaknesses.
- Workshops for RHD candidates and advisors on negotiating and adhering to shared expectations. This may even include joint workshops, where appropriate.
- Advisor professional development sessions on enhancing the self-confidence, achievement emotions, achievement goals, and self-awareness of RHD candidates.
- Advisor and postgraduate coordinator workshops on creating a supportive and collaborative research culture for postgraduate students.
- Advisor and postgraduate coordinator workshops on encouraging an institutional climate of continuous learning and development.
- Briefing sessions for RHD candidates, advisors and postgraduate coordinators on the key findings of this study.

If implemented, it would be important for these professional development initiatives to be made available to both university and industry-based advisors, and for advisors to have an opportunity to interact, network and learn from each others' practices.

Developing and implementing this comprehensive suite of professional development initiatives would offer a best practice example for other universities throughout Australia and beyond. Additionally, and perhaps most importantly, it would contribute toward ensuring that the postgraduate research experience at UQ is made even *more* positive, fruitful and rewarding for RHD candidates in the future.

Copyright materials contained herein have been reproduced under the provisions of the Copyright Act 1968, as amended, or with the permission of the copyright owner. This material may not be reproduced in any manner whatsoever except for the purposes of individual study.

(c) Gillian Yeo, Elisha Frederiks, Angela Parsons, Leah Zajdlewicz, Suzanne Morris, Catherine Manathunga and Rachael Pitt, 2007 The University of Queensland, Brisbane, Australia.