Investigating the difficulties faced by international students undertaking Engineering coursework dissertation projects

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Abstract: A large majority of international postgraduate students in the Faculty of Engineering and Information Technology commence their masters program with limited research experience. In particular, many international students were never encouraged, in their undergraduate studies, to critically evaluate or to plan and manage their own research projects. Moreover, these students were not generally encouraged to construct an argument and validate it. This problem, in conjunction with language difficulties, makes it very difficult for international students to understand the objectives and expectations of a thesis project. In many cases, it is up to the supervisors to provide a high degree of individual consultation on research fundamentals to bridge the gap between the students’ existing research skills and their required proficiency level. The objectives of this paper were to evaluate the research capability and the barriers facing international students when conducting a thesis project. A structured interview approach was proposed for this purpose, addressing questions relating to the difficulties faced when undertaking various elements of the thesis project. Also, respondents were asked to rate provided coping strategies to overcome these difficulties. The primary outcome of the study is the development of an improved supervision approach, which should shift the current one-on-one highly consultative process, between the supervisor and student, to a diversified approach where the student has the opportunity to attempt self-learning. Students who utilise the proposed approach should be better able to visualise the “process map” for their project and deliver improved research outcomes. The proposed hybrid supervision approach incorporates many of the characteristics of “deep learning” where students are given opportunities to be actively involved, enjoy, and reflect upon their experiences during their practical learning exercise.

Introduction

International students attending Australian Universities frequently encounter problems in adjusting to their new social environment. To address this issue, numerous researchers have examined the general difficulties international students face when adjusting to typically “western” higher education institutions (e.g. Chartrand, 1992; Rosenberg et al., 1995; Hurtado et al., 1996). However, few researchers have examined the difficulties faced by international masters students undertaking coursework thesis projects. In addition to “adjustment” problems facing these international students, they must also embrace a deeper level of learning and thought that is usually far removed from their undergraduate experience. In particular, many international students struggle to adjust to a learning environment where students are encouraged to choose a research topic, research approach etc. in mediated consultation with their supervisor. Traversing this “learning culture” abyss can take some students six months before they are ready to tackle the challenges of their projects.

In an attempt to investigate the difficulties faced by international students undertaking engineering thesis projects, this study utilises a structured interview approach with 10 international students undertaking research projects in the field of engineering management. Specifically, the study sought to discover the significant difficulties faced for the different elements and sub-elements of the thesis project and requested students to comment on suggested strategies to overcome these difficulties.
**Difficulties faced by international students**

In recent years, the proportion of international students participating in the Australian higher education sector has increased exponentially. Moreover, this same trend is being experienced in the US, in Europe and in other developed nations, resulting in an opening awareness of the international dimension in higher education (Callan, 2000). However, in many cases, international students studying in Australia typically link socially with similar others, hardly interacting with local students (Knight, 1997). Since the English language has come to play a prominent role in internationalising curriculum and linking the academic profession, it has become essential for international students to have a high level of English proficiency prior to commencing dissertation writing. A number of studies from English-speaking host countries suggested that international students’ overall ability in English is closely related to their academic success and overall adaption (Barrett & Huba, 1994; Lewthwaite, 1996). This is particularly true for thesis writing, where a student may undertake a high quality research project but does not receive a commensurable grade because they failed to articulate their literature review and findings in a professionally structured academic writing style.

Although the mastering of academic writing and verbal presentations in English is one of the fundamental difficulties facing many international students, they also must adapt to different teaching and learning styles to successfully complete their thesis project. In particular, research undertaken by Tompson and Tompson (1996) cites behavioural characteristics such as limited classroom participation, not asking for clarification, and studying only with international students as behaviours that undermine international students’ academic performance. Moreover, before international students can become confident self-learners they must make a significant behavioural adjustment by shifting from an instructional method of learning to a free learning environment in which they have to solve problems rather than memorising facts (Ladd & Ruby, 1999). In particular, students needed to be more independent in their approach instead of relying on thesis supervisors.

In summary, international students must typically overcome a number of difficulties when undertaking each element and sub-element of their research projects. Individual difficulties, such as those mentioned above, were extracted from the literature and were linked to these various elements of the thesis project. For the purpose of this study, the thesis project consisted of eight distinct elements: (1) Formulating the research proposal; (2) Undertaking the literature review; (3) Developing the research method; (4) Conducting the experiment; (5) Data analysis and results; (6) Discussion, conclusions and recommendations; (7) thesis write-up; and (8) Research presentations. These core elements are described in Table 1. Moreover, Table 2 details a summary of each thesis element and its respective sub-elements (activities) where international students may face difficulties.

**Research methods**

The elements and sub-elements of the thesis project where it was envisaged that students would face difficulties were collated, screened, and refined through consultation with students and academics. In order to ascertain the significant difficulties faced by international students and possible strategies to overcome them, a structured questionnaire was developed with the aim of achieving the following research goals:

- Determine the background and industry/research experience of masters coursework students;
• Determine the level of difficulty faced for each element of the thesis project and its respective work demand requirements;
• Determine the level of difficulty faced for each sub-element of the thesis project and the predominant support method used to overcome this problem; and
• Determine the most effective strategies to be implemented that could potentially make the above-mentioned research elements less difficult to tackle for future students undertaking coursework research projects.

In order to achieve the above research goals, the structured interview process contained questions on the background of the survey respondents (Part A), including their research experience, industry experience, supervision profile, credit point progression and type of thesis project. This was followed by Part B which addressed each element and sub-element of the thesis project and asked respondents to rate the level of difficulty faced when undertaking that element on a scale of 1 to 5, where 1 = *Not difficult* and 5 = *Extremely difficult*. Respondents were also required to detail the predominant method used to overcome this problem from a *coded* list e.g. supervisor consultation (SC) etc. The third and final section (Part C) provided respondents with the opportunity to rate the effectiveness of a number of proposed strategies and the option to detail other strategies to overcome difficulties faced during the research process.

**Data analysis and results**

**Respondent profile**

As this paper only reports on the pilot study component of the research project, only 10 structured interviews were conducted to obtain the data for the results presented herein. However, these results provide some indication of the key areas where international coursework engineering students face difficulties when undertaking research projects. Firstly, this study only targeted students undertaking research in the engineering management strand and does not include responses from the structural or civil strands. These students will be targeted in future studies. Students studying the Masters of Engineering in Engineering Management typically come from international universities and have a wide variety of undergraduate engineering backgrounds. Figure 1 details the percentage breakdown of the various field of engineering the masters students completed in their undergraduate studies. Industrial engineering (57%) was the most commonly undertaken undergraduate degree, following by Mechanical (29%) and then civil/structural engineering (14%).
Figure 1: Stream of engineering undertaken in undergraduate degree

Similarly, Figure 2 details the percentage breakdown of the country where the students completed their undergraduate degrees. The most common countries where students who are undertaking the Griffith University Master of Engineering in Engineering Management program undertook their undergraduate degrees is China (29%) and India (29%). The majority of students commencing the Griffith University Masters of Engineering program have some form of industry experience with 86% of students stating they had 0-3 years experience. Also, it should be noted here, that 57% of students had completed some form of thesis project in their undergraduate engineering studies.

Figure 2: Country where undergraduate degree was completed

The next part of the questionnaire sought to determine the supervision frequency of masters thesis students. Figure 3 details the percentage breakdown of the number of meetings that students have with their supervisors. From this figure, it can be seen that students have a wide range of supervision requirements or access to their supervisors with an average frequency of approximately one meeting per week for the students interviewed.
For the purpose of this study, the research thesis project consists of eight distinct elements described in Table 1. For each of these elements, respondents were asked to indicate the percentage (%) breakdown of time, or envisaged time to be spent, on each element of the thesis project. Additionally, respondents were asked to rate the level of difficulty faced when undertaking each element of the thesis project, on a scale of 1 to 5 where 1 = *Not difficult* and 5 = *Extremely difficult*. From Table 1, the data analysis and results (17%) and thesis write-up (19%) stages of the thesis were the most demanding aspects for international students. However, the most difficult elements of the thesis project, for international students, were the formulation of the research proposal (3.29) and the discussion, conclusions and recommendations section (3.29). In general, respondents did not indicate that undertaking the literature review (2.86) and developing the research method (2.86) was difficult. As expected, international students would have some difficulty formulating the research proposal because they are given a tight timeframe of three weeks to do this task only shortly after commencing their studies in Australia.

In addition to detailing the difficulty faced for each element of the thesis project, the respondents were also requested to rate the degree of difficulty faced for each sub-element (activity) of the thesis (Table 2). For example, for element A: “Formulating the research proposal”, the thesis sub-element (activity) is Q1: “Deciding on a research topic to commence”. The highest ten ranked activities where students faced difficulties when undertaking masters coursework thesis projects are detailed below:

1. H-Q39: Answering questions relating to the thesis project (4.17)
2. H-Q35: Presenting fluently and clearly in English (4.00)
3. H-Q40: Applying suggestions made to improve future research approach (4.00)
4. F-Q26: Compiling the results into the key conclusions of the study (3.80)
5. F-Q28: Linking the key conclusions back to similar research studies (3.80)
6. B-Q9: Collating information into a concise summary (3.67)
7. B-Q12: Identifying the research “gaps” where your study can add value (3.67)
8. G-Q29: Concisely writing in English (3.67)
9. E-Q22: Determining what data analysis techniques to use (3.60)
10. F-Q25: Finding and explaining the pertinent findings of the study (3.60)
From the above list, it seems that international students struggle with their research presentations with the top-three ranked difficulties all relating to the thesis presentations element of their thesis project. Also, the students seem to have problems in collating literature into a concise summary, identifying “gaps” where their study may add value, and explaining the pertinent findings of their study concisely in English. These are the key areas where students should be provided additional teaching and learning support.

### Table 1: Demand and difficulty of thesis project elements

<table>
<thead>
<tr>
<th>Thesis element: description</th>
<th>Demand (%)</th>
<th>Mean Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Formulating the Research Proposal</strong>: Concerned with the selection and formulation of the research proposal.</td>
<td>10</td>
<td>3.29</td>
</tr>
<tr>
<td><strong>B. Undertaking the Literature Review</strong>: Concerned with the literature review process, including: finding, reviewing and critically assessing the literature.</td>
<td>12</td>
<td>2.86</td>
</tr>
<tr>
<td><strong>C. Developing the Research Method</strong>: Refers to the development of a solid research process to answer proposed research questions.</td>
<td>10</td>
<td>2.86</td>
</tr>
<tr>
<td><strong>D. Conducting the Experiment</strong>: Focuses on the experiment utilised for answering the research question(s). The experiment utilised can be a questionnaire, interview, laboratory experiment, modelling etc., depending on the strand of engineering thesis undertaken.</td>
<td>11</td>
<td>3.20</td>
</tr>
<tr>
<td><strong>E. Data Analysis and Results</strong>: Covers issues associated with the techniques and tools used to analyse the results of the experiment i.e. statistical techniques, plotting trends, regression analysis, etc.</td>
<td>17</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>F. Discussion, Conclusion and Recommendations</strong>: Concerned with the formulation of a “response” to the obtained results. This element includes the examination of key trends, the in-depth examination of results, developing recommendations, and proposing future research to be undertaken at a later stage.</td>
<td>12</td>
<td>3.29</td>
</tr>
<tr>
<td><strong>G. Thesis Write-up</strong>: Concerned with the structuring and writing of the thesis dissertation.</td>
<td>19</td>
<td>3.14</td>
</tr>
<tr>
<td><strong>H. Research Presentations</strong>: Concerned with the development and delivery of research presentations.</td>
<td>9</td>
<td>3.14</td>
</tr>
<tr>
<td><strong>SUM</strong></td>
<td><strong>100%</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Table 2: Thesis project elements and sub-elements

<table>
<thead>
<tr>
<th>Q. Project element and sub-element</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Formulating the research proposal</strong></td>
<td></td>
</tr>
<tr>
<td>Q1 Deciding on a research topic to commence</td>
<td>2.83</td>
</tr>
<tr>
<td>Q2 Writing the thesis brief</td>
<td>1.67</td>
</tr>
<tr>
<td>Q3 Finding a suitable thesis supervisor</td>
<td>1.83</td>
</tr>
</tbody>
</table>
Q4 Identifying the “gaps” in the literature in your research field 3.17
Q5 Deciding on a project scope which matches the available timeframe 3.00

B. Undertaking the literature review
Q6 Discovering how to search and retrieve research articles 2.33
Q7 Reviewing articles to determine their key research outcomes 2.17
Q8 Understanding how to properly reference different types of articles 3.33
Q9 Collating information into a concise summary 3.67
Q10 Critical analysis of reviewed articles 3.33
Q11 Determining the current state of the research 3.00
Q12 Identifying the research “gaps” where your study can add value 3.67

C. Developing the research method
Q13 Deciding on an appropriate experiment to answer questions 3.00
Q14 Examining the feasibility of the experiment in the given timeframe 2.83
Q15 Ensuring that the experiment will successfully answer the question 3.00
Q16 Determining whether adequate research facilities are available 2.83

D. Conducting the experiment
Q17 Obtaining a suitable amount of data from the experiment 3.00
Q18 Obtaining adequate and timely support from relevant parties 2.80
Q19 Completing the experiment in the scheduled time 2.50
Q20 Designing and conducting the experiment 2.75
Q21 Collecting, sorting and collating data 3.40

E. Data analysis and results
Q21 Learning and using statistical techniques and tools 3.40
Q22 Determining what data analysis techniques to use 3.60
Q23 Utilising data analysis software e.g. SPSS, Excel, design software 3.00
Q24 Compiling data to determine key trends/outcomes/results 3.00

F. Discussion, conclusion and recommendations
Q25 Finding and explaining the pertinent findings of the study 3.60
Q26 Compiling the results into the key conclusions of the study 3.80
Q27 Formulating recommendations for the industry and future research 3.20
Q28 Linking the key conclusions back to similar research studies 3.80

G. Thesis write-up
Q29 Concisely writing in English 3.67
Q30 Formatting and structuring the thesis chapters and sections 2.33
Q31 Presenting the thesis in a professional format 2.83
Q32 Developing professionally presented Figures and Tables 2.80
Q33 Using reporting software (e.g. Word, Excel, PowerPoint etc.) 2.20
Q34 Referencing articles (books, journals, conferences etc.) 2.20

H. Research presentations
Q35 Presenting fluently and clearly in English 4.00
Q36 Developing PowerPoint presentations 2.33
Q37 Determining what information needs to be presented 3.33
Q38 Concisely presenting the overview of project and findings 3.33
Q39 Answering questions relating to the thesis project 4.17
Q40 Applying suggestions made to improve future research approach 4.00

Learning-support mechanisms utilised
In addition to rating the level of difficulty faced when undertaking individual activities, the respondents were also requested to detail the predominant support mechanism used to overcome this problem from the following coded list detailed below:
- **Supervisor consultation (SC):** overcame the problem through individual consultation with the supervisor.
- **Peer consultation (PC):** overcame the problem by consulting peers i.e. speaking to other students, industry professionals, etc.
- **Formal teaching (FT):** the problem was overcome through formal lecturing or tutoring instruction offered in a course or school workshop.
- **University workshop (UW):** overcame the problem by attending a university workshop i.e. training in SPSS, excel etc.
- **Self-learning (SL):** overcame the problem through self-learning with limited assistance from your supervisor or peers.
- **Professional editor (PE):** utilised a professional editing service to overcome the problem.

Figure 4 illustrates the results of this section of the structured interview. This figure details the percentage breakdown of the predominant learning-support mechanism used to overcome difficulties faced for the 40 sub-elements of the thesis project. This figure demonstrates that students mainly utilise only two predominant support mechanisms to overcome their problems throughout the thesis process, specifically, self-learning (42%) and supervisor consultation (33%). Following these two key mechanisms, peer consultation (12%) and formal teaching (8%) are used. As expected, students rarely utilised University workshops (3%) and the provided professional editor (2%) to assist them. As can be seen from the figure, supervisors and their students are carrying the majority of the teaching/learning burden when undertaking coursework dissertation projects.

![Figure 4: Percent breakdown of support method used to overcome problems](image)

**Figure 4: Percent breakdown of support method used to overcome problems**

**Strategies to overcome difficulties faced**

A number of proposed strategies have been developed to overcome the difficulties that may have been faced by international students when undertaking the above-mentioned activities of the thesis project. On a scale of 1 to 5, where 1 = *Not effective* and 5 = *Extremely effective*, respondents were requested to rate the effectiveness of the proposed strategy. Additionally, respondents were requested to detail other strategies that they perceived to be helpful and their associated effectiveness. Table 3 details the seven provided strategies (A-
G) that respondents were asked to rate. In summary, Strategy D (3.86) was rated as the most effective by the respondents. It is interesting to note that the students wanted fixed weekly supervision meetings to guide them, or perhaps push them, through the research process. Interestingly, the students would like a mentoring program with senior students to help them through the research process. This option would be beneficial in the sense that it would reduce the level of dependency on supervisor consultation to overcome problems. Only one other strategy was suggested from the respondents H: The dissertation project should commence in the second semester of the program so that students can discover a field of research which interests them. This recommendation should be adopted to enable international students to settle into Australian university life and explore fields of engineering management that interests them, particularly those students who come from a strictly technical background.

Table 3: Mean effectiveness of proposed strategies

<table>
<thead>
<tr>
<th>Code</th>
<th>Strategy description</th>
<th>Mean effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A web-based step-by-step electronic guidebook detailing an overview of the thesis research process with illustrative examples of each element and sub-element</td>
<td>3.57</td>
</tr>
<tr>
<td>B</td>
<td>A comprehensive course on research methods that must be completed prior to commencing the Dissertation</td>
<td>3.57</td>
</tr>
<tr>
<td>C</td>
<td>On-going school-based workshops detailing various techniques and tools that could be used to assist with the research process</td>
<td>3.14</td>
</tr>
<tr>
<td>D</td>
<td>Fixing hourly meetings with supervisors on a weekly basis (i.e. Monday 10-11 am every week)</td>
<td>3.86</td>
</tr>
<tr>
<td></td>
<td>Develop a mentoring program whereby commencing thesis students are assigned to senior students who are responsible for helping them through the project</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Having a fixed weekly workshop, for a two-hour period, with the supervisor and only his/her thesis students. At these workshops, each student is required to present to the group their progress-to-date and the supervisor will teach relevant research skills to the students. Additionally, students can ask questions specifically relevant to their research project.</td>
<td>3.71</td>
</tr>
<tr>
<td>F</td>
<td>Develop a formal course or conduct school workshops in thesis writing and presentation skills, i.e. a course in academic writing to provide students with the necessary skills to write concisely in English.</td>
<td>3.14</td>
</tr>
<tr>
<td>G</td>
<td></td>
<td>3.00</td>
</tr>
</tbody>
</table>

Summary

International students undertaking the masters programs in the Faculty of Engineering and Information Technology at Griffith University typically have limited research and industry experience. This is particularly true in the engineering management stream where many of the international students did not undertake any management-focused courses in their undergraduate studies. Additionally, these students fight an uphill battle when delivering oral presentations and trying to master academic writing in English. In an attempt to improve the current learning approach, this study sought to determine the key areas where
students faced difficulties when undertaking their thesis project. To achieve this aim, a structured interview approach was adopted to solicit and consolidate knowledge on the difficulties faced by international students undertaking coursework research dissertation projects. This was undertaken in an attempt to formulate a set of strategies to improve the research process. In summary, the most demanding (i.e. time) elements of the thesis project were the data analysis and results and thesis write-up sections. However, students faced the most difficulties in formulating the research proposal and writing conclusions and recommendations. The predominant learning-support mechanisms to overcome the listed problems were self-learning and supervisor consultation with formal teaching and peer consultation as only minor support mechanisms. The respondents indicated that fixed hourly meetings with their respective supervisors and a mentoring program with senior students would be the most effective ways to overcome the difficulties faced during the thesis research process. Future work will target a larger sample of respondents as well as include results from other engineering streams (i.e. civil/structural).

References


