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The examination of research theses has only relatively recently attracted research interest that has focused on what examiners do and how consistent they are. The research questions in this study address firstly whether PhD and research masters theses were treated by examiners as qualitatively different on 12 indicators of importance across the areas: contribution of the thesis, the literature review, approach and methodology, analyses and results and presentation. Secondly what was the examiner assessment of quality of a recently examined thesis on the same indicators and, finally, how well the indicators were reflected in a holistic assessment of thesis quality. The work reported here draws on the responses of 353 PhD and 74 research masters thesis examiners. Findings showed the examiners generally rated the relative importance of the indicators very similarly at both degree levels. Further the order of importance across indicators was essentially the same for the two levels of thesis. Anticipated differences did emerge with the examiners giving higher quality gradings for all contribution indicators for PhD as compared with research masters theses. The 12 specific quality indicators, individually and collectively were strongly related to the holistic assessment of thesis quality, particularly at the PhD level.

Keywords: thesis assessment; PhD examination; research masters examination; thesis quality; quality criteria

Introduction and background

Within academia, doctoral assessment is distinctive, reflecting the elite status and elevated expectations of the degree including the requirement that the candidate produce an original contribution to research. Sustained investigation into doctoral degrees is still very recent, and among the pressing issues that commentators have identified is the need to obtain more clarity about the processes and practices involved during the final thesis or dissertation examination, which in some programmes includes an oral component. Those who research thesis examination face a number of challenges. The high stakes, highly complex nature of the examination, together with variations in degree specifications, assessment procedures and in the nature of record-keeping between institutions make it difficult to obtain robust and comparable information about examination that does not blatantly or inadvertently influence the outcome. Another complicating dimension is that the execution and judgement of this type of work take place at a level of intellectual operation – of learning and knowledge transfer – that is still little understood and so generates its own mysteries. Considerable effort is being expended by quality assurance agencies to ensure that it is possible to distinguish between degrees, including research

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degrees, and so ensure validity in assessment, but so far there has not been research that addresses fundamental questions about the distinctions made by examiners between levels of research degree including the two most traditional ones – the research masters and the PhD.

In Australia, research theses normally are examined by two or three examiners who are external to the university. Slightly more than half the examiners included in this study were based overseas. When discipline mix is taken into consideration, this is about the norm for Australian PhD examination. Examiners are chosen and approved on the basis of their expertise in the subject area of the thesis. Each examiner writes an independent report on the thesis, normally of two to three pages, and makes a recommendation as to the fate of the thesis. For most universities the recommendation is a choice of one of the following options: accept the thesis as submitted; accept the thesis with required or invited minor corrections; accept subject to required, more major corrections; require that the thesis be revised and resubmitted for further examination; and fail. A university committee then makes a decision on the thesis, based on the examiner reports. When examiner recommendations differ, the decision is normally a compromise between positions, although more frequently leaning towards greater rather than lesser corrections. The thesis examination is the sole assessment measure taken for research candidatures in Australia, there being no oral examination or viva.

Brief literature review

Concern about the PhD examination process has long been an issue, but it is less than 20 years since some of the first studies of the process appeared (see, e.g. Pitkethly and Prosser 1995; Johnston 1997). One focus has been on the criteria examiners use (Noble 1994; Johnston 1997; Shaw and Green 2002; Lawson, Marsh, and Tansley 2003; Powell and Green 2003). Mullins and Kiley (2002) noted that examiners appeared to use their own criteria, and were confident in the decisions they made (Winter, Griffiths, and Green 2000; Holbrook et al. 2004). Tinkler and Jackson (2004, 119) concluded that 'the broad range of standards embraced by the award of a PhD' make it necessary to increase our understandings of examiner expectations and decisions.

Whereas interest in and studies of PhD examination are now much more common, masters degree examination remains largely neglected as an area for study.

An early Australian study of 125 masters degree theses in Education is instructive with respect to differences in criteria set for PhD and masters levels (Hansford and Maxwell 1993). The theses examined ranged from being one-third of the masters degree (89 candidates), through two-thirds of the degree (27) to the whole degree (9). The first two groups would now be considered to have completed a 'minor' thesis as part of a coursework masters degree, while the third group would now be considered to have undertaken a 'research' masters degree. The 255 examiner reports for these theses were content coded and 20 areas of criticism were recorded. Major areas commented on included the literature review, theoretical and conceptual framework, methodology and data analysis. What is notable is that there was no comment related to the contribution of the thesis to the field. Clearly an original contribution was not considered a requirement of masters degrees in Education at that time.

It seems that this lack of an expectation of originality in masters theses has been maintained institutionally. A recent, small UK study involving examination of

masters degree theses in four disciplines did not include originality as a criterion. The examiners involved in the study considered the omission of originality from the marking guidelines' criteria they were asked to follow was inappropriate. While the examiners 'acknowledged that originality was not part of … the marking criteria, they felt that this was an important aspect of theses, and marks should reflect this' (Bettany-Saltikov, Kilinc, and Stow 2009, 634).

Emphasising that, in the area of expectations of masters degree theses, the waters are muddy, two other small UK studies involving research student supervisors gave weight to both similarities and differences between PhD and masters theses (Anderson, Day, and McLaughlin 2006; Pilcher 2011). The view was expressed that, while masters' theses might contribute to knowledge in the discipline, there were limitations in that these new researchers needed to align themselves with the research community and achieve a level of 'research-mindedness'. However, the view was also put that the best masters dissertations would be original but that originality was not essential at the masters level.

Aims

This paper, which arises from two recent large-scale studies of thesis examination, has two major aims. First, we report information collected from thesis examiners with the focus on their responses to two questions. What are the relative levels of importance on a range of criteria in judging thesis quality, and what is the quality on each of those criteria of a thesis they recently examined? Secondly, we report the extent to which examiners of PhD and research masters' theses see the importance of the criteria differently, and whether theses at the two levels differ in meeting their expectations. Finally, we consider how closely these criteria relate to an overall assessment of quality made by the same examiners. Thus this paper addresses the questions:

> Are research masters and PhD theses treated by examiners as qualitatively different in 'level' on recognised criteria?

> What is the quality of theses they examined on those same criteria?

> How well are the criteria reflected in assessments of overall thesis quality at the two levels of PhD and research masters examinations?

Method

From a study involving detailed coding and analysis of 2121 examiner reports on 804 PhD theses presented for examination at eight Australian universities of varying research intensiveness (Holbrook et al. 2004) 12 indicators of thesis quality were developed. The indicators were distributed across the following criteria for importance of various thesis quality criteria: Contribution (three indicators), Literature review (three indicators), Approach and method (two), Analysis and results (two), Presentation (two). Details of the indicators within each of these general criteria are shown in Table 1.

In a subsequent study, new groups of PhD and research masters examiners were asked to do three things. First, at the time of examination, they were asked to rate the overall quality of the thesis on a five-point normative scale as follows:

(1) in the top 10% of all theses at that level, (2) in the next 20%, (3) in the mid 40%, (4) in the next 20% and (5) in the bottom 10% of theses.

After the examination was complete and examiners had returned their reports, the 12 indicators described above were presented to these examiners. The examiners were asked to do two additional tasks of relevance to this paper:

(1) Rate the quality of the thesis they had just examined on each of the 12 indicators using a six-point scale ranging from fundamentally flawed (coded 1) to exceptional quality (coded 6).
(2) Rate the importance of each indicator for thesis quality generally at that level using a six-point scale ranging from not at all important (coded 1) to extremely important (coded 6). As part of this exercise, the examiners at both levels were also invited to add other indicators of quality they considered should have been included.

The thesis component of the research masters degrees included in this study is required to be at least two-thirds of the total, but the norm is that the final assessment is based 100% on the thesis submitted. There could be concurrent coursework undertaken by the student, designed to assist the research study, but it would not constitute part of the ultimate assessment for the award of the degree.

The samples

The second set of examiner samples were obtained from five Australian universities, again ranging in research intensiveness. Each university was asked to invite

Table 1. Mean scores comparing levels of importance of the 12 indicators for the quality of PhD and research masters theses.

Importance in rank order for the PhD level ($\rho = 0.958$)	PhD level ($N_{min} = 351$)				Research masters level ($N_{min} = 73$)		
	Group	Mean	SD	Rank	Mean	SD	Rank
Analysis/Findings: effective interpretation	1	5.28	.721	1	5.14	.875	2
Approach/Methodology: appropriate		5.23	.731	2	5.16	.855	1
Analysis/Findings: appropriateness	2	5.16	.737	3	5.08	.963	3
Literature review: accuracy		5.15	.745	4	4.99	.937	5
Approach/Methodology: effective application		5.11	.703	5	5.00	.833	4
Contribution: originality	3	5.07	.802	6	4.79	.990	7
Presentation: communicative competence		5.03	.748	7	4.86	.919	6
Contribution: substantive		4.99	.807	8	4.73	1.107	8
Contribution: advance knowledge	4	4.85	.846	9	4.59	1.122	11
Literature review: use/application		4.83	.845	10	4.70	.980	9
Literature review: coverage		4.77	.880	11	4.66	.987	10
Presentation: correct expression	5	4.62	.902	12	4.59	1.035	11

Notes: Scale points were: 1 = not at all important, 2 = not very important, 3 = of some importance, 4 = important, 5 = very important, 6 = exceptionally important.

all examiners of theses submitted over a fixed period to participate in the study. Samples of 353 PhD examiners (of a total of 275 theses) and 74 research masters examiners (64 theses) were obtained. As the study was demanding of examiner time, the PhD sample was considered very satisfactory (we had set ourselves the minimum target of 200 PhD examiners, and 400 examiners would have been considered ideal). The achieved sample of research masters examiners was relatively smaller. One reason for this is that, compared with PhDs, there are significantly fewer research masters theses submitted across Australia. In 2009, there were almost 5800 PhD completions and almost 1300 research masters' degree completions nationally (the research masters submissions thus being 22% of the number of PhDs). In this study, the number of research masters theses involved was 23% of PhD theses. A second reason for the smaller numbers was that, despite extending the data collection time frame, there were indications that the lesser importance of the research masters qualification meant that these examiners were less willing to put in the time necessary for participation in this study. In consequence of the much smaller sample, we have to accept larger standard errors for all measures made of the research masters' examiner reports.

Results

Levels of indicator importance for PhD and research masters theses

The means for each importance indicator have been grouped for both degrees according to their rank order of importance for PhD theses (see Table 1). The indicator mean scores at both degree levels were all above 3.5 (the neutral point) indicating examiners considered that all the criteria were important to some degree. The range of indicator importance scores for the PhD was from a mean of 5.3 for Analysis/Findings: Effective interpretation to the lowest mean of 4.6 for Presentation: correct expression. For research masters the range was from 5.2 for Approach/Methodology: appropriate to 4.6 for both Contribution: advancement of knowledge and Presentation: correct expression. Although the range was similar at both levels, there were minor differences in the order of importance between the two degrees.

The 12 indicators for the PhD formed five reasonably distinct groups on level of Importance. Clearly, Analysis/Findings and Approach/Methodology were the dominant criteria of importance for examiners when judging thesis quality, comprising almost all of the first two groups of Importance in Table 1. Literature review accuracy was also in the second group for Importance.

Given the generally perceived stress on the PhD as making a contribution to new knowledge, it is perhaps surprising that the three indicators of Contribution were all in the lower half for relative Importance (Groups 3 and 4), compared with other indicators. Apart from accuracy, the other two Literature review indicators were also in Group 4.

Less surprisingly, the two indicators of Presentation were split between communicative competence being in Group 3 and correctness of English expression in Group 5. Although still important, the relative isolation of the use of correct expression at the bottom of the importance hierarchy for PhD theses perhaps reflects that expression is a necessary but not sufficient condition for a high-quality thesis.

Levels of indicator importance between degrees

There was a very high level of consistency between the examiners on the relative level of importance of the 12 indicators for the PhD and research masters theses, as measured by Spearman's rank order correlation coefficient ($\rho = 0.958$). In absolute terms, the mean importance scores from the research masters examiners, although high, were consistently lower than those from the PhD examiners. The differences were not statistically significant with the exception of Contribution: originality where the PhD examiners rated it as more important. In the advice given to examiners, originality is less often normally stated as a criterion for research masters' degrees.

Quality of PhD and research masters theses on the 12 indicators

The mean scores for all quality indicators at both degree levels ranged between Moderate/High quality and High quality. The highest quality was recorded for Presentation: correct expression with a mean of 4.87, and the lowest for Contribution: advancement of knowledge with a mean of 4.34. The locations of all indicators between these two extremes are shown in Table 2.

There was a high level of consistency between the examiners on the relative quality of indicators for the PhD and research masters' theses ($\rho = 0.909$). In absolute terms, the mean quality scores from the research masters' examiners were consistently slightly lower than those from the PhD examiners. Quality of research masters' theses ranged from 4.6 for Presentation: correct expression to 4.1 for Contribution: advancement of knowledge.

PhD and research masters mean differences were significant for 5 of the 12 indicators, namely all three Contribution indicators, Literature review: accuracy, and Presentation: correct expression. In all cases, PhD quality assessments were higher than the masters. A combination of these two results (the relative and absolute

Table 2.   Mean scores comparing the quality of PhD and research masters theses on the 12 indicators.

Quality in rank order for the PhD level ($\rho = 0.909$)	PhD level ($N_{min} = 357$)				Research masters level ($N_{min} = 78$)		
	Group	Mean	SD	Rank	Mean	SD	Rank
Presentation: correct expression	1	4.87	1.047	1	4.61	1.091	1
Presentation: communicative competence	2	4.76	1.117	2	4.60	1.098	2
Literature review: accuracy		4.72	1.023	3	4.46	.976	5
Approach/Methodology: appropriate	3	4.68	.963	4	4.47	1.031	4
Literature review: coverage		4.65	1.134	5	4.41	1.015	7
Approach/Methodology: effective application		4.64	1.060	6	4.44	.953	6
Literature review: Use/Application		4.62	1.141	7	4.52	.998	3
Analysis/Findings: appropriateness		4.61	1.031	8	4.37	1.100	8
Contribution: originality		4.59	.955	9	4.32	.899	10
Analysis/Findings: effectiveness	4	4.54	1.044	10	4.35	1.076	9
Contribution: substantive		4.49	.986	11	4.15	1.051	11
Contribution: advance knowledge	5	4.34	1.009	12	4.08	1.083	12

Notes: Scale points were: 1 = fundamentally flawed, 2 = low quality, 3 = moderate/low quality, 4 = moderate/high quality, 5 = high quality, 6 = exceptional quality.

levels across the 12 indicators) seems to suggest that similar standards were being applied to theses at PhD and research masters level, and that the PhD theses were judged of higher quality on Contribution, and some aspects of the Literature review and Presentation.

The first two groups, showing highest examiner satisfaction, are made up of the two Presentation indicators and Literature review: accuracy. It could be said that these are basic indicators of thesis quality being adequate. The third, large group is made up of a mix of approach, analysis, other aspects of the literature review and Contribution: originality. When a PhD thesis is sent out for examination, originality is normally mentioned specifically as a requirement in advice given to examiners. The remaining two groups include an assessment of the effectiveness of the analyses and two elements of Contribution, over and above originality – the more demanding requirements that the thesis contribution is substantial and includes a clear advancement of knowledge in the discipline.

Developing and testing a composite measure of thesis quality

The 12 indicators of quality were subjected to a Principal Components factor analysis at the PhD and research masters degree level in the attempt to confirm a single-factor solution. As shown in Table 3, all 12 indicators at both levels loaded strongly on a single factor, accounting for approximately two-thirds of the variance. The four highest loadings were for indicators of effective analyses, substantive contribution of the thesis, use of the literature and effective methodology. Although still having high loadings, the four lowest were for both indicators of presentation, and for literature coverage and appropriate methodology. The Cronbach alpha scale reliability was high at both degree levels.

A composite scale score was created by weighting each indicator with its factor loading. The validity of the composite score was checked by correlating it with the overall normative rating of thesis quality, obtained separately from examiners. The

Table 3. Factor loadings of 12 indicators of thesis quality, variance explained and scale reliabilities.

	Factor loadings	
Indicator	PhD	Research masters
Analysis/Findings: effectiveness	.860	.904
Contribution: substantive	.858	.802
Literature review: use/application	.857	.839
Approach/Methodology: effective application	.854	.801
Literature review: accuracy	.851	.783
Analysis/Findings: appropriateness	.841	.860
Contribution: advance knowledge	.838	.830
Contribution: originality	.824	.837
Approach/Methodology: appropriate	.799	.825
Literature review: coverage	.799	.718
Presentation: communicative competence	.795	.703
Presentation: correct expression	.679	.631
Variance explained	67.7%	63.7%
Alpha reliability	0.956	0.946

Note: Indicators are listed in descending order for PhD examination.

correlations were 0.823 for PhD theses and 0.771 for research masters theses, suggesting the composite scale score was a valid measure of thesis quality at both levels.

With respect to possible discipline differences in thesis quality, the relatively small number of examiner reports, particularly at the masters level, restricted analyses by discipline that could be undertaken across the two degree levels. However, at the PhD level, there were two small, but significant discipline differences on the quality indicators. For substantial contribution, the theses examined in Health and in Science were rated as of higher quality than theses in Business. For accuracy of the literature review the theses examined in Engineering were rated as of higher quality than theses in Education. Further work into what examiners understood by a substantial contribution in their discipline and what constituted inaccuracy in the literature review would be required to investigate the discipline differences found at the PhD level. There were no differences for importance between the discipline groupings on any of the 12 indicators at either degree level.

Discussion and conclusions

With respect to the importance of the 12 quality indicators, it is clear that examiners generally adopted the same criteria for PhD and research masters theses, in that all indicators were considered to be important at both levels. Further, the order of importance across the indicators was essentially the same for the two levels of thesis. One might have expected greater differences for indicators between the two levels, particularly with respect to Contribution of the theses related to originality and advancing knowledge, often spoken of as identifying characteristics of the PhD Such an expectation is reinforced by the (UK) Department for Business, Innovation and Skills (2010) summary that contribution of masters degree candidates should 'show originality in tackling and solving problems' without reference to originality in contributing to the discipline or advancing knowledge. However, the PhD examiners in this study also ranked the three indicators of Contribution in the lower half of all 12 indicators, and specifically lower than indicators of Approach/Methodology, Analysis/Findings and accuracy of the Literature review.

Some of the anticipated differences did emerge when the quality of the PhD and research masters' theses was compared. Examiners gave significantly higher quality gradings for all Contribution indicators for PhD compared with research masters theses. The differences between levels were from one-third to one half a standard deviation, indicating that the differences were not trivial. Such a result strongly suggests that, although examiners were generally looking for the same indicators of quality at both levels, they were more likely to be satisfied with the Contribution of PhD compared to research masters theses.

The relationships of overall thesis quality with the 12 specific quality indicators, individually and collectively, were strong as shown by the high factor loadings of individual indicators and the high correlation with a composite scale comprising the indicators. This was true at both levels, but more notably for the doctoral theses examined.

The strong relationships for importance of quality indicators and the actual assessed differences between the two levels of degree may be considered as expected and appropriate, if one thinks of the research masters' qualification as a smaller version of a PhD but not different in kind. Perhaps this is now more the common view amongst academics and candidates. However, if one sees a research

masters qualification more as a preparation for PhD studies, in terms of developing the knowledge and skills required for the more in-depth and ground-breaking research of the PhD, it is less appropriate to judge the masters thesis by the same criteria that are used for the PhD. A research masters degree as preparation for PhD studies perhaps represents an earlier view of the development of researchers and of the relationship between the two degree levels.

Unfortunately, because comparative research studies were not done, it is difficult for us to know whether different criteria were used in examining research masters theses in the past. However, the two studies cited above do suggest a difference over time. It seems that Contribution was not expected of a masters degree thesis in the early 1990s, but by the mid-2000s examiners thought it should be (Hansford and Maxwell 1993; Bettany-Saltikov, Kilinc, and Stow 2009). Also suggesting that there was a difference in kind between theses at the two levels in the past, in the example of a senior, eminent examiner who wrote in 1980 in a personal communication to the first author that a masters thesis he was examining was 'workmanlike, exhibiting that appropriate levels of research skills and knowledge had been reached … the candidate now being ready to commence doctoral degree studies', and presumably then make a contribution to the discipline. At that time a research masters degree was normally required for entry to PhD candidature in Education, the particular discipline concerned. Since that time, there has been an increase in research degree programmes, including those in the creative and visual arts where an exhibition or other component is examined in addition to the written work. In Australia, examiners are asked to treat both components as one 'thesis' when writing their reports. There were too few creative arts theses to examine the possible effects of the additional component on the examination process in this study.

From about the time that the data collection for this study was being undertaken, increasing numbers of Australian universities were asking more from thesis examiners. It is now much more common to request examiners to rate the thesis on a number of criteria, of varying specificity, sometimes not unlike some of the 12 indicators used in this study. On the assumption that obtaining more information from examiners, who effectively set thesis standards of what is accepted and what is not, this practice can only assist the assessment process, and should be seen as positive for assessment reliability and for providing greater guidance to supervisors and future candidates.

This paper was not based on the premise that thesis examination was a poorly executed process, but that there was room for improvement. A question the researchers are left to consider at this point is whether we now have sufficient information to develop sound guidelines and practices to increase the validity and reliability of thesis assessment. We believe we have reached this point as far as thesis examination itself goes in identifying appropriate quality indicators to guide thesis assessment. However, whether thesis examiners can reasonably be asked to provide responses to specific pre-specified criteria, in addition to their written reports, is not a question for researchers, but one for academic administrators of research degree programmes.

A related but separate question is whether the addition of an altogether different type of measure to the Australian assessment system of candidature at the peak academic level of the PhD would further assist our assessment of the candidate in addition to assessment of the thesis. For example, we currently have no information on how the existence of a viva examination might affect PhD assessment, if at all.

To this end, the authors are currently working with other researchers in the area undertaking research into the impact of oral examination (or viva) on PhD candidate assessment.

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