Using Student Focus Groups to Support the Validation of Rubrics for Large Scale Undergraduate Independent Research Projects

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Abstract – *Finding methods of validating rubrics for significant "capstone" experiences, including fourth year design projects and the research-oriented thesis, can be challenging, given the large number of individuals typically involved in the assessment of student deliverables. This paper describes a methodology for using student focus groups to support the validation of a rubric for a fourth year thesis course in a large Engineering Program, and the results from these focus groups. Through focus group discussion and activity sheets used in the focus groups, a number of interesting insights were raised about both the rubric, namely: a lack of consultation by the students with the rubric until the final stages of writing the final report; concerns and inconsistencies in the perception of how supervisors will use the rubric; a perceived lack of focus on process and project experience-related criteria and concerns with the level of expectation of the project experience-related criteria that are present, and other concerns related to terminology and distance between rubric descriptors. The focus group provided a useful forum for discussion on course experience and assessment, effectively allowing students to both individually reflect, and build on each other's ideas and suggestions.*

Keywords: Rubric, Assessment, Focus Groups, Multidisciplinary, Capstone, Thesis

1. INTRODUCTION

It is common practice in engineering programs to require at least one major "capstone" experience, such as fourth year team design projects and the research-oriented thesis. These experiences offer students the opportunity to use and gain feedback on engineering skills and knowledge for real-world practice, while providing program staff with the opportunity to capture student assessment data on a number of the key graduate attributes, such as design, investigation and communication. However, to facilitate this, assessment tools are needed, and developing reliable and valid assessment tools is a significant challenge in complex, often multi-disciplinary courses with a large number of students and instructors. In this particular course, the fourth year thesis, students are given the opportunity to work with a faculty member to define and design an original research project, as well as to conduct and communicate engineering-related research. Every year, nearly 200 students in the program work with over 100 supervisors from 20-25 distinct academic departments, and across theoretical, clinical, design and laboratory settings, demonstrating a significant breadth of project scope. Students are provided with assignment guidelines, workshops, reusable learning objects and rubrics to scaffold the documentation and communication of the research.

Although rubrics can be both defined and constructed in different ways, a common definition, as articulated by Andrade [1], is a "document that articulates the expectations for an assignment by listing the criteria, or what counts, and describing levels of quality from excellent to poor". In recent years, we have developed and evolved a series of grading rubrics for the fourth year thesis course, and in the process of doing so we have gathered some feedback from instructors on their validity, and adapted the rubrics to meet the needs of our new accreditation process [2, 3]. However, we have not gathered feedback from students in any kind of particularly rigorous way. A rubric should provide students with a clear understanding of learning outcomes and deliverables, but more broadly provide the students with a tool to support self-regulated learning, in which the student is able to self-identify areas of strength and areas where improvement is needed in working towards the specific learning goals [4]. It is therefore important that their interpretation of the tool is aligned with that of the instructors and the course coordinators/rubric designers.

To facilitate an understanding of how our students are interpreting our rubrics, we decided to develop a procedure for using student focus groups as part of a larger effort to measure the validity and reliability of the rubric, and to some extent, the student's perspective and interpretation of the course deliverables and assessment more generally. Very little was found in the literature on the use of student focus groups (or interviews) for rubric validation. One particularly relevant study by Andrade

and Du [5] used focus groups to examine how students use grading rubrics to support the learning process, and found that rubrics helped the students focus their efforts, produce better work, earn better grades and feel less anxious; however, this work was done in a small, teacher education class on educational psychology; in other words, a significantly different educational context.

2. FOCUS GROUP DESIGN

Focus groups were selected as the methodology of choice as it was expected that students hearing each others' perspectives may elicit more thorough, critical and fruitful responses, a notion that is backed up with some research [6, 7]. The focus group methodology was designed with three key goals: (1) to understand how students use the rubric, (2) to identify aspects of the rubric that seem confusing to the students, and (3) to understand how students describe the learning objectives of the course, and the relevance of the graduate attributes. After a pilot with 5 students, 2 full focus groups with 10 students were facilitated, each for approximately 90 minutes. The focus group included both full-group discussion questions and individual activities, allowing for methods that suited various participant preferences and provided sufficient time for both thinking and discussing. Students were recruited with an email through the course website and a small coffee or bookstore giftcard.

During the focus groups, students were lead through a number of short activities, including a discussion of the course learning objectives and how they were (or were not) reflected in the rubric; a discussion of how they used the rubrics in completing their thesis work; an exercise that required the students to rate the rubric criteria on the basis of relevance, an in-depth discussion of rubric criteria that were deemed to be particularly "fuzzy" by the students, and finally a self-assessment exercise. These activities supported the assessment of both content and construct validity, along with a general interest in gaining an understanding of how students were using the rubrics to support their learning. More specifically, students were provided a handout with the following questions (note that the graduate attribute handouts noted below included the global outcomes and indicators for the investigation and communication attributes):

1. Describe how you used the final thesis document rubric.
2. Did you refer to the rubric guide for clarification regarding the rubric?
3. What would you identify as the learning objectives of the fourth year thesis course? Jot them down, and then rank them from 1-X with 1 being most important (X = total number of learning objectives).

4. Review the two graduate attribute handouts. For each of the indicators, on the handout, rate the relevance of your thesis experience as follows:
0 = my thesis project did not require me to demonstrate this
1 = this was relevant to my thesis project, but my ability level did not advance or change
2 = my ability to do this was enhanced by the thesis project
3 = my ability to do this was significantly enhanced by the thesis project
5. a) Review the thesis rubric. Use the same rating scale as noted above.
5. b) Review your learning objectives under question 3. Is there anything that isn't assessed on the final rubric?
6. Generally speaking, do you find the rubric to be clear?
7. Jot down any criteria from the rubric you find to be particularly difficult to understand.
8. Do you think your supervisor(s) understood and used the rubric? Describe why or why not.
9. Do you understand the scoring categories and the differences (and distance) between them? Why or why not?
10. Is there a specific criteria on this rubric that you feel may be interpreted differently between students and supervisors? If so, how do you think this could be prevented or mitigated?
11. Do you have any suggestions about the rubric: content, format, scales, introduction, use, etc?

Finally, it is important to note that while other rubrics are used in the course to assess a project proposal, presentation and interim report, this particular work focuses on an analysis of the final rubric used in the course (see Appendix A). This rubric attempts to assess both overall project experience, as well as the final project report, which is worth 75% of the final course grade.

3. RESULTS AND DISCUSSION

The focus groups produced two key data types: activity sheets, which included both qualitative and quantitatively oriented questions to be analyzed, and researcher field notes from the discussion. Thematic analysis was used to identify key themes in the qualitative data, where basic descriptive statistics were used to analyze the quantitative data. Quotes directly from the students have been used where possible to encourage authenticity and richness in the presentation of the data. The focus groups elicited a number of interesting findings about the student's perception of the rubric and its various criteria. Results and discussion will be presented using an analytical framework based on some of the questions explored during the focus groups, and will focus primarily on the qualitative data produced.

3.1 How did the students use the rubric?

Students were asked to describe how they used the final document rubric, and it was found that the majority of focus group participants did not use the rubric well in advance of writing their final thesis, but instead used it as either a guide for structuring the thesis, for example, "I used the final thesis rubric for identifying the sections necessary for the final report and to help me form an outline of the report. The requirements were broad but I did refer to them as I was writing my thesis", or to ensure that everything they needed was included, or as a check-list after writing was complete, for example, "I went through the rubric after the rough writing as a checklist, to see what I missed and what I should add".

A number of students suggested that a major barrier to using the rubric more generally was that the ideal format of a thesis varies greatly, depending on the research and disciplinary context. For example, some students held the perception that the rubric supported a particular kind of experimental project, but not projects with a stronger theoretical, design or clinical focus. One student went as far as to state "I did not use (the rubric). The goal was to write a thesis appropriate for my target academic field – astronomy. My thesis was written based on guidelines from astronomy profs." Other students noted more specific concerns, for example, feeling that they couldn't integrate their literature review with the discussion section of their thesis based on the rubric structure, or deal with other unique circumstances, for example "my thesis required two different background literature reviews, and I had to use a different approach in presenting it". One student suggested that "everyone gets something a little different out of the thesis course", with another stating that "more flexibility should be built into the rubric", sentiments that were echoed throughout the focus group discussion.

It was also noted that as an alternative to consulting the rubric, students used past work in their field as a guide, or formulated a plan based on a conversation with their supervisor.

3.2 What is not assessed in the rubric?

Students were asked to identify the learning objectives of the fourth year thesis course, and this elicited very interesting results, in that students cited a very wide variety of objectives; some relating to the documentation and presentation of the thesis, and some relating to the research process, such as conducting a literature review and designing an experimental method. However, many of the learning objectives cited by the students related to the overall experience of completing a significant project; skills like time and project management, working with others in a research environment, learning independently in a new field, learning from failure and self-motivation.

When students were asked to discuss what they felt was missing from the final project rubric, most of the students noted a lack of process-related items, linked to these learning objectives. In addition, some felt that "choosing a scope for the project" or "framing a research problem" was missing from the rubric, likewise "actual understanding of the research and how much the student has learned from doing the thesis" and "developing new research skills related to the methods of your thesis work". One student, who had completed a design-oriented thesis, noted that "My design process was not evaluated. I may have failed and iterated my design multiple times, but that was not captured in the assessment of my work", again reiterating the belief that the rubric did not reflect design-oriented research appropriately.

3.3 What is unclear on the rubric?

Although students indicated that they felt the most important learning objectives associated with the course were related to process or "project experience", the existing "project experience" section of the rubric proved to be the most confusing for the students from an interpretation perspective. For example, students expressed a certain degree of anxiety with "make a measurable impact", noting that it was hard to determine exactly what this meant, and that in 8 months it was difficult to make a significant impact as an undergraduate student. One student asked "how is 'made a measurable impact' measured? What if you tried something and it didn't work? Not fair!", with another adding "When I saw 'work has made a measurable impact, I was freaking out. It's an undergraduate thesis!'. Students also expressed confusion about the idea of significance, for example, "If it's a new field, how do I know that it's significant?", "What does a 'significant challenge' mean to a professor?" and "What if the research yielded no results? How can I defend the significance of the work?!".

Some students noted that their project didn't "Contribute to scholarship, as noted in the rubric, because my project is more industry related", while others stated that they were unsure how to define "superb engineering & scientific knowledge & skills". Finding the difference between "demonstrated initiative, ability to work independently, time management skills and ownership of work throughout the thesis project" and "quality of effort and thesis work indicative of potential for future research success" seemed to be a challenge for some of the students. Finally, students expressed some confusion about "results" and their presentation, for example, "in terms of 'results displayed clearly in an organized manner' – what if my methods didn't really yield results? Where does that leave me?", suggesting that we need to better describe what 'results' mean in the context of fourth year thesis research.

The rubric was designed to serve as a holistic rubric; in other words, there are no specific point values given to each criterion on the rubric. However, this was not clear to some of the students, who assumed that each line of the rubric was given equal weight, as "that is how other rubrics are constructed". Another concern noted by the students, referencing the rubric guide (which included descriptors of each criterion at 4 levels, see Appendix A) was that while some differences between levels were well articulated (such as, under "methods and findings": "describes methods or design in sufficient detail to enable understanding of work done" vs. "detailed description of methods or design helps facilitate a thorough understanding of project"), other level changes were very subtle, and the students couldn't always pinpoint exactly what the difference would be (for example, the difference between "some justification" and "sufficient justification"). Finally, some students provided a general assessment that the rubric was "clear, but vague". One student noted, "I understood every field, but it was very open ended. More detail for each field, and more fields, whether they be optional or not, would be useful."

3.4 What is your supervisor's impression of the rubric?

A few students demonstrated absolute confidence that their supervisor agreed with the structure of the rubric and that they would mark by it. However, most students expressed that their supervisors held a lower commitment to using the rubric to inform their grading. A number of students indicated a sense of uncertainty about whether their supervisor would find a document produced using this rubric to be suitable for their work. Two students noted that the research lab they were working with would find a document that focused only on "methods tried" and "key results" to be more useful. A few other students noted that their supervisor didn't like the structure encouraged by the rubric, and had provided the student with significant modifications, and that "in cases where the supervisor wanted something else, the supervisor had priority since they were doing the marking". Some students felt that their supervisor would already have a grade in mind, based on the overall project experience, and that the rubric wouldn't really influence the specific grade: "Prof will read it and assign a grade, and fit the rubric to the mark he has in mind", or that the supervisor's grade would focus more on process: "their idea is process-based; and rubric is be product based (i.e. how well the doc was written and not OUR capabilities as researchers/designers)". Others noted that their supervisor was simply "too busy" to use rubrics, or that he or she would likely be "confused" when trying to use it. Most troubling, there was a sense that if the supervisor was expecting something different than what was on the rubric, but wasn't fully articulating those expectations,

then the student found it hard to know how to best structure their final project report.

3.5 Rating of relevance and self-assessment

During the focus groups, students were asked to rate the relevance of the various criteria on a scale of 0-3, with 3 indicating "my ability to do this was significantly enhanced by the thesis project" and 0 indicating "my thesis project did not require me to demonstrate this". Interestingly, the three criteria rated as "least relevant" according to the students were three completely unrelated criteria: (1) Provides justification for methods chosen or design decisions made (1.55); (2) Work has contributed to scholarship in field/made a measurable impact (1.45); and (3) Document length, formatting, structure meets stated requirements, and specific demands of thesis topic (1.42). As this analysis was conducted after the focus groups were complete, this is worthy of follow-up to understand why, in particular (1) and (3) were considered largely irrelevant to the thesis experience. Students were also asked to self-assess their own thesis according to the rubric, and while the self-assessment was largely positive, the students rated the following as their weakest areas: (1) Work has contributed to scholarship in field/made a measurable impact; (2) Identifies, summarizes, and synthesizes relevant research in constructing an understanding of current state of field; and (3) Enables deeper understanding of research question/design problem through analysis of research in the field, indicating a path for moving research forward. Given the discussion in the focus group, (1) is not surprising, but it is unclear why the students feel their literature review skills are weak.

4. CONCLUSIONS

The focus groups proved to be a very interesting source of discussion and analysis on both how students use (and don't use) the final course rubric, and the experience in the course overall. Students clearly feel that we are not acknowledging enough of the project experience-related requirements, but at the same time had significant challenges with the way "project experience" is currently framed and described in the rubric, which was designed to encourage and measure excellence in research effort. There is some concern about the applicability of the rubric to all project types and disciplines, opening up the possibility for a more customizable rubric to highlight the role of different contexts in the thesis course. The feedback from the students supports the need for a review of vocabulary used in the rubric, and the differences between descriptor levels. Interestingly, some concerns about the requirements for results were expressed, suggesting a need to better define "results" in the context of the thesis (sometimes, getting no results is a result!).

Finally, there are clearly concerns about how supervisors (instructors) use the rubric, and a need to strike a balance between the learning objectives we, as an undergraduate program, have for the students in the thesis course, and the objectives that come from the research environment. The results of these focus groups will support some changes to the rubric and rubric guide, along with further exploration of the rubric with both students and instructors.

Acknowledgements

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APPENDIX A: RUBRIC AND RUBRIC GUIDE

FINAL THESIS REPORT RUBRIC – I – ESC499

Student Name: _____   Supervisor: _____   Grade: _____ /100

Component	1	2	3	4	Requirement	Comments (Use back if necessary)
Introduction	☐	☐	☐	☐	Establishes context necessary to facilitate thorough understanding of thesis work in a concise manner	
	☐	☐	☐	☐	Establishes a clear research gap/design problem, makes a convincing case for the significance of proposed research work	
	☐	☐	☐	☐	Identifies goal for thesis work that explicitly addresses this gap/problem; provides clear purpose statement	
Literature Review / Background	☐	☐	☐	☐	Explains theoretical concepts important to understanding of thesis work	
	☐	☐	☐	☐	Identifies, summarizes, and synthesizes relevant research in constructing an understanding of current state of field	
	☐	☐	☐	☐	Enables deeper understanding of research question/design problem through analysis of research in the field, indicating a path for moving research forward	
Methods and Findings	☐	☐	☐	☐	Describes methods or design in sufficient detail to enable understanding of work done	
	☐	☐	☐	☐	Provides justification for methods chosen or design decisions made	
	☐	☐	☐	☐	Results displayed clearly in organized manner, using appropriate figures or graphics; key results highlighted	
Discussion and Conclusions	☐	☐	☐	☐	Engages with and explains results intelligently	
	☐	☐	☐	☐	Identifies key claims to be drawn from results of research or design evaluation, qualifies them appropriately	
	☐	☐	☐	☐	Outlines significance of research done, identifies potential future work that arises from thesis work	
Overall Document Design	☐	☐	☐	☐	Abstract concisely summarizes purpose, methods, key results of research, and presents conclusions clearly	
	☐	☐	☐	☐	Document length, formatting, structure meets stated requirements, and specific demands of thesis topic	
	☐	☐	☐	☐	Organized well, with content in discrete and appropriate positions in paper, structure clearly laid out, transitions that create flow in document	
	☐	☐	☐	☐	Demonstrates grammatically correct, coherent prose that concisely and clearly communicates complex topics in well designed paragraphs and sentences	
	☐	☐	☐	☐	Uses and integrates well-designed visuals effectively to communicate key concepts / results	
	☐	☐	☐	☐	Provides clear attribution of ideas throughout paper using a known referencing standard; uses references effectively to help establish context, back claims, or justify decisions	
Project Experience	☐	☐	☐	☐	Work has contributed to scholarship in field / made a measurable impact	
	☐	☐	☐	☐	Demonstrated initiative, ability to work independently, time management skills and ownership of work throughout thesis project	
	☐	☐	☐	☐	Thesis work posed a significant challenge, requiring superb engineering & scientific knowledge and skills	
	☐	☐	☐	☐	Quality of effort and thesis work indicative of potential for future research success	
	☐	☐	☐	☐	Has incorporated feedback and additional research on initial deliverables to improve final thesis document and work	

*1 - Fails (0-60%); 2 - Adequate (60-70%); 3 - Good (70-80%); 4 - Exceeds expectations (80-100%). These numerical equivalents are only approximate; final grade and value of each component is up to the supervisor.

A ROUGH GUIDE TO THE FINAL THESIS REPORT RUBRIC GUIDE – I – ESC499

Component	Fails	Adequate	Good	Exceeds Expectations
Introduction	Missing key elements of context necessary to understand thesis work	Establishes just sufficient context necessary to facilitate a basic understanding of thesis work	Establishes context necessary to facilitate understanding of thesis work	Develops context appropriately and concisely in facilitating thorough understanding of thesis work
	Research gap or design problem remains unarticulated or unclear	Research gap or design problem is identified, but too broad or general to define project clearly	Identifies a clear research gap/design problem	Establishes a clear research gap or design problem, makes a convincing case for the significance of proposed research work
	Goal of thesis work is difficult to identify, or unrelated to gap or problem statement	Stated goal for thesis work is vague, imprecise, or not clearly related to gap/problem statement	Identifies goal for thesis work that addresses this gap/problem	Explicitly identifies goal for thesis work in a clear purpose statement for the project that addresses gap/problem
Literature Review / Background	Missing key explanations of theoretical concepts important to thesis work	Most theoretical concepts important to work are identified and briefly explained	Identifies and explains theoretical concepts important to understanding of thesis work	Explains theoretical concepts clearly, concisely, in context of thesis work
	Fails to acknowledge or reference key research/prior work in the field	Identifies some important research/prior work in the field, but misses a few essential developments	Identifies and summarizes most of the key research/prior work in developing an understanding of the field	Identifies, summarizes, and synthesizes relevant research in constructing a nearly complete understanding of current state of field
	Analysis of field is incomplete and fails to further develop the research gap/design problem	Analysis of field provides limited help to further develop the research gap/design problem	Enables understanding of research question/design problem through analysis of research in the field	Enables deep understanding of research question/design prob. via thorough analysis of research in the field, indicating path for moving forward
Methods and Findings	Fails to explain key elements of methods or design	Most elements of methods or design are explained in sufficient detail; missing elements may hamper understanding of work done	Describes methods or design in sufficient detail to enable understanding of work done	Detailed description of methods or design helps facilitate a thorough understanding of project
	Fails to justify key elements of method or design decisions	Provides some justification for most methods chosen/design decisions made	Provides sufficient justification for methods chosen / design decisions made	Justification for methods chosen/design decisions clearly and convincingly articulated, warranting validity of project
	Results not displayed in organized or appropriate manner	Most results are displayed in an organized manner, using some appropriate figures or graphics	Results displayed clearly in organized manner, using appropriate figures or graphics	Results displayed clearly in organized manner, using appropriate visuals that help highlight key results and findings
Discussion and Conclusions	Engages with results only superficially, without explanation of significance	Engages with and provides explanation for most results	Engages with and explains key results intelligently	Employs and explain results clearly in the context of research / design claims made
	Fails to make key claims from results of research or design evaluation	Makes appropriate claims from results of research or design evaluation, though claims may not be fully warranted	Identifies and explains key claims to be drawn from results of research or design evaluation	Identifies and warrants key claims to be drawn from results of research or design evaluation, qualifies them appropriately
	Fails to identify significance of research or design work done	Summarizes research / design work done, but fails to place it in context of prior or future work	Clearly identifies significance of research/ design work done in context of past work	Outlines significance of research/design work done, identifies potential future work that arises from thesis work
Overall Document Design:	Abstract fails to adequately describe nature and conclusions of project	Abstract provides a vague description of nature and conclusions of project	Abstract summarizes key elements of thesis sufficiently	Abstract concisely and completely summarizes purpose, methods, key results of research, presenting conclusions clearly
	Document length or formatting fails to meet many of the stated requirements	Some inconsistencies in formatting, but mostly meets the stated requirements	Document length, formatting, structure meets stated requirements	Document length, formatting, structure meets stated requirements, and specific demands of thesis topic

#1 – Fails (0-60%); 2 – Adequate (60-70%); 3 – Good (70-80%); 4 – Exceeds expectations (80-100%). These numerical equivalents are only approximate; final grade and value of each component is up to the supervisor.

A ROUGH GUIDE TO THE FINAL THESIS REPORT RUBRIC GUIDE – I – ESC499

Component	Fails	Adequate	Good	Exceeds Expectations
	Poorly organized throughout, lacking clear structure and flow throughout document	A few organizational problems detract from an otherwise well structured thesis	Organized well, with content in discrete and appropriate positions in paper, and structure clearly laid out	Organized well, with logical and explicit structure, and transitions that create flow throughout document
	Grammatical problems hamper understanding of key elements of the document	Some grammatical problems hamper readability of prose, but not understanding of document	Demonstrates grammatically correct, coherent prose throughout	Demonstrates grammatically correct, coherent prose that concisely and clearly communicates complex topics in well designed paragraphs and sentences
	Visuals not used appropriately or well integrated into document	Visuals employed appropriately, but may not be well integrated into document	Uses and integrates visuals effectively to communicate key concepts / results	Uses and integrates well-designed visuals effectively to communicate key concepts / results
	Poor attribution of ideas throughout, missing key references and failing to use an appropriate referencing standard	Provides clear attribution of ideas throughout paper using a known referencing standard, with only a few gaps or errors	Provides clear and thorough attribution of ideas throughout paper using a known referencing standard	Provides clear attribution of ideas throughout paper using a known referencing standard; references used effectively to help establish context, back claims, or justify decisions
Project Experience	Work makes no contribution to the field, and is only marginally relevant to current good scholarship	While no significant impact is made, work is relevant to good scholarship in the field	Work advances the possibility for future advancements in the field	Work has contributed to scholarship in field / made a measurable impact
	Student lacks the ability to take initiative, work independently, manage their time and/or take ownership over the project, negatively impacting the thesis experience	Student sometimes shows the ability to take initiative, work independently, manage their time and take ownership over the project	Student takes initiative and works independently, demonstrating good time management skills and project ownership	Demonstrated excellence in taking initiative, ability to work independently, time management skills and ownership of work throughout thesis project
	Thesis work completed did not meet expectations, nor showcase the knowledge and skills expected from an undergraduate engineering student	Thesis work required the knowledge and skills expected of an undergraduate engineering student	Thesis work posed a reasonable challenge, requiring engineering & scientific knowledge typical of a senior undergraduate or junior graduate student	Thesis work posed a significant challenge, requiring superb engineering & scientific knowledge and skills
	Student does not demonstrate potential for future research work	Quality of effort and thesis work indicative of some potential for future research work, with more study and experience	Quality of effort and thesis work indicative of some potential for future research success	Quality of effort and thesis work indicative of strong potential for future research success
	Student does not incorporate feedback or additional research from initial deliverables in the final thesis document or project work	Student incorporates some feedback and/or additional research from initial deliverables in the final thesis document or project work	Student incorporates most feedback and/or additional research from initial deliverables in the final thesis document or project work	Student has incorporated all relevant feedback from initial deliverables, and has actively incorporated new research or analysis to improve final thesis document and project work

*1 - Fails (0-60%); 2 - Adequate (60-70%); 3 - Good (70-80%); 4 - Exceeds expectations (80-100%). These numerical equivalents are only approximate; final grade and value of each component is up to the supervisor.