

Introduction

This is my report to Assignment 2 in LH216V. It starts with providing the background to and new Intended Learning Outcomes (ILOs) for MF2071 - the course I have chosen to focus on. It then presents a matrix linking the ILOs to grading criteria for the different assessments in the course. The motivation and relationships between the ILOs, assessments and grading criteria are described, leading up to a decision on how to combine the different assessments into a final grade.

Background

MF2071 is the Research Methodology course for the Mechatronics division at the ITM School. As such it is intended to ensure that our students have a common understanding of research in Mechatronics, research methodology and research ethics before they start on their Master Thesis. Therefore, it also fills the role of a preparatory course for our Master Thesis course.

The course is lecture-based, with the main assessment being a written report handed in at the end of the course. The report outlines the planning, context and methodological choices for a (fictional or nonfictional) master thesis. However, the course also includes a literature search part as a separate "course-in-the-course", which is assessed through a literature search report. This overall course does not assess literature search per se, but allows students to leverage on the literature search report in the written report to fulfil the MF2017 ILOs.

Rewriting and breaking down the Intended Learning Outcomes

I started with updating the ILOs for the MF2071 course. This involved removing parts of the ILOs that were actually not covered by the course, clarifying the emphasis of the ILOs, and defining three of the ILOs as subparts of another ILO.

At the end of the course the students should be able to:

- Write a master thesis proposal ~~scientific article~~ in ~~within a specific field,~~ related to the mechatronics ~~and~~ or embedded control systems, and:
 - ~~Summarise and at a general level~~ Discuss important challenges ~~and trends to a master thesis project.~~
 - ~~Discuss and~~ Evaluate different scientific research methods ~~for use in a master thesis project.~~
 - ~~Evaluate, Discuss and argue around~~ Reason about research ethics ~~in relation to a master thesis project.~~
 - ~~Carry out a scientific study.~~

... in regard to the proposed master thesis project.
- Review and give constructive criticism on another student's master thesis proposal ~~scientific article.~~

ILO, Assessment and Grading Criteria Matrix

Learning Outcome		E	D	C	B	A	
1	Write a master thesis proposal in a field related to mechatronics or embedded control systems	<ul style="list-style-type: none"> - Includes Research Question (RQ) related to mechatronics or embedded control systems. - Includes a believable time plan. 			Not assessed at higher levels		
		Assessed by: The written report					
2	Discuss important challenges	<ul style="list-style-type: none"> Framed as to motivate the RQ: - An acceptable amount of references to motivate importance of the general research area of RQ. - An acceptable amount of references to motivate research methodology choice with respect to the research area. - An acceptable amount of references to describe ethical issues associated with the research area. 	Not ...	<ul style="list-style-type: none"> - Describes several important research questions discussed in the general research area of RQ. - Describes the application of several research methodologies in the research area. - Describes several ethical issues associated with the research area. 	<ul style="list-style-type: none"> - Motivates the academic utility of the RQ. - Motivates the choice of research methodology based on the research area. - Describes how ethical issues likely to be encountered due to RQ are usually addressed in the research area. 	<ul style="list-style-type: none"> - Motivates the RQ from an industrial perspective, weighing the academic and industrial perspectives against each other. 	
		Assessed by: Literature search report (E), with the written report enabling higher grades.					
3	Evaluate different scientific research methods	<ul style="list-style-type: none"> - Describes several relevant research methodologies and chooses one. 	Not ...	<ul style="list-style-type: none"> - Makes a believable argument for choosing several relevant research methodologies and chooses one. 	<ul style="list-style-type: none"> - Makes a believable argument for the choice of a certain research methodology. 	<ul style="list-style-type: none"> - Based on methodology/method choice, weighs the validity of probable research results against their industrial utility. 	
		Assessed by: The written report					
4	Reasons about research ethics	<ul style="list-style-type: none"> - Describes likely ethical issues associated with RQ/methodology/methods. 	Not ...	<ul style="list-style-type: none"> - Makes a believable argument for why certain ethical issues are the most likely to be encountered by the study. 	<ul style="list-style-type: none"> - Makes a believable argument for how ethical issues most likely to be encountered in the study should be addressed. 	<ul style="list-style-type: none"> - Using an academic and industrial perspective, weighs methodology/method choices against each other to address/avoid different ethical issues. 	
		Assessed by: The written report					
5	Review and give constructive criticism on another student's master thesis proposal	<ul style="list-style-type: none"> - Reasons about possible improvements to the contents of the report. 	Not ...	<ul style="list-style-type: none"> - Provides relevant references and suggestions on improvements to academic aspects, e.g. methodologies and ethical issues, using material not mentioned in the report. 	Not assessed	<ul style="list-style-type: none"> - Provides relevant references and suggestions on improvements to industrial aspects, e.g. utility and codes of conduct, using material not mentioned in the report. 	
		Assessed by: Online peer assessment of reports by two other, randomly chosen, students					

The Foundation for the Grading Criteria

The MF2071 course was given as a Pass/Fail course and - as made apparent by the required changes to the ILOs - is plagued by a lot of legacy. This e.g. meant that some of the ILOs were not linked to any assessment. Text in red in the previous matrix thus signals assessments that were added to enable A-F grading to be introduced against **all** ILOs.

As a base for the different levels of criteria I used Entwistle's model of the teaching-learning process (1). This is based on its strong construct validity (2) and that it has been developed for the context of higher education (3).

Entwistle's model is based on the two dimensions of *deep vs surface approaches to learning*, and *strategic vs apathetic approaches to studying* (1). Deep learning is trying to understand the underlying ideas of the learning material, while surface learning is to focus on the learning material and what it explicitly conveys (4). A strategic approach is to optimize time spent in deep vs surface learning to get the highest possible grade for the least effort. Deep learning can be approached in a *holist, serialist* or *versatile* way (1). The holist style is broad and personally structured, while the serialist style is critical, cautious and step-by-step structured. The versatile style is to alternate between the holist and serialist styles to avoid the negative effects of taking either to the extreme. To this Entwistle adds the goal of taking students through different stages of thinking: the belief in a single truth (*dualism*), the acceptance of all positions (*multiplicity*), the narrowing to justifiable conclusions (*relativism*), and achieving a coherent individual perspective on a discipline (*commitment*) (1).

I related this to the grading criteria as:

E	D	C	B	A
Dualism		Multiplicity	Relativism	Commitment
References to arguments and finding by others	Going beyond references in logical arguments, by merging knowledge from several sources, etc.			

Assessment using Criteria

A master thesis proposal is actually a quite straight-forward thing. The student has to provide a relevant research question, show an understanding of what addressing this research question implies in a scientific context, and produce a plan that tie these together.

The *written report* thus *requires*:

- A relevant research question, assessed based on the description of the mechatronics and embedded control systems research areas.
- A time plan, assessed based on it matching 20 weeks of effort.
- Enough references, assessed to match the research question to a research area and its specific challenges in regard to the utility of the research question, research methodology and ethical issues.
- A motivation at least for the type of research methodology to use (e.g. quantitative or qualitative), and the choice of a particular one (e.g. interviews).

- An understanding of how the chosen research methodology matches to ethical issues, assessed by pointing at some likely ethical issues to appear.

This matches the E level of the criteria for each ILO associated with the written report. In other words, *the E level addresses ILO 1-4 by requiring the student to relate to how others have discussed these issues in the relevant area.* On top of this we want the student to read and reflect on other reports to get a broader understanding, which matches the E level of the criteria for the peer assessment. In other words, this is simply a matter of making a reasonable effort at reflection.

To go beyond the E level we want the student to show multiplicity, relativism or commitment as indicated in the previous section.

The D level is not used.

The C level thus requires the student to show an understanding of many relevant positions (multiplicity) in the research area (ILO 2), with regard to research methods (ILO 3) or with regard to possible ethical issues (ILO 4). In other words, *the C level assesses ILO2-4 by requiring the student to relate to the “many” or “likely” positions found in the relevant area.* This might be perceived as leading to a rather large gap between the E and C level. However, it should be noted that the course aims to introduce the students to frameworks that provide a basic knowledge of “many” positions on research, methodology and ethics that are “likely” to be found in relevant research areas.

The B level thus requires the student to justify choices (relativism) in regard to ILO2-4. This is assessed as the student motivating his choice of research question, research methodology or handling of ethical issues using the research area or logical reasoning. In other words, *the B level assesses ILO 2-4 by requiring the student to narrow down and motivate his/her particular choices.*

The A level thus requires the student to relate the engineering role (commitment) to ILO2-4. This is assessed as the student pointing out tension between the master thesis as an academic and industrial effort, and motivating the trade-offs between these perspectives. In other words, *the A level assesses ILO 2-4 by requiring the student to identify the difference between the course and e.g. the production of artefacts as part of the course.*

ILO 5 is assessed in a similar manner, but in regard to the constructive critique of the reports of other students.

Combining the Grades

ILO 1 is to set a minimum, so that ILO can be disregarded in regard to combining grades.

ILO 5 is tricky, since it is mainly there to broaden the perspective of the students. Therefore, I believe that it can best be disregarded when combining the grades. However, to ensure that students put an effort on it, I suggest that arguments in the peer reviews can be carried over to the written report where they are relevant. So, as an example, a student that is assessed as *almost* being at grade C for ILO 2 in the written report, and who has written a peer review to grade C that makes a relevant point, can be awarded grade C on ILO 2.

In my opinion, showing progression on the dualism, multiplicity, relativism and commitment ladder in regard to any of the 2-4 ILOs indicates a progression in regard to them all. The only difference lies

in the emphasis of ILO 2 on a broader knowledge of the research area, and the more narrow focus of ILO 3-4 on specific methods and issues. Therefore the highest grade in any of these ILOs should be the final grade.

So, the grades are combined by looking at the highest grade of ILO 2-4, and adjusting it slightly upwards in case ILO 5 allows for it.

Bibliography

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