

# The prelude phase of the graduation project of the Fusion master.

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This document outlines the main aim, activities and deliverables in the Prelude Phase of the graduation project. It is meant to provide guidelines for students and graduation supervisors, not as an official, exhaustively detailed study guide.

Please address any specific questions or comments about this document to the Prelude coach, Wybo Houkes.

## Aim

The first 6 to 8 weeks of the graduation project is a well-defined phase of the project, the 'prelude'. The main aim is to come to a well-formulated and motivated research question, an appropriate set of sub-questions and research methods, and a project planning, which will form the basis for the graduation project.

The prelude phase introduces students in an early stage to some of the complexities of formulating a suitable research question that is of sufficient interest to the field. This is not only a crucial research skill in itself, but it also facilitates timely execution of the graduation project and provides students with a sense of ownership over the project. Thus, the ultimate aim of the prelude phase is to lead to more valuable and manageable graduation projects.

A secondary aim is to teach students to review and provide constructive feedback on the work of others. They do this in the form of reviewing a research paper and, more importantly, by being active and constructive members of the graduation circle.

## Graduation circle and coaching

Students start their master thesis project at the start of a quartile<sup>1</sup>. Students starting in the same quartile are grouped to form a graduation circle. There are 4-6 students to a circle, if more students start in the quartile, they will be divided over more 2 or more circles.

Peer feedback in the graduation circle is an essential element of the prelude phase. It is expected that a circle meets at least once a week – or more often if the participants wish. During the remainder of the project, and especially around the reporting moments (mid-term, end of project) the peer group has a clear role, too: the students are each other's first readers, provide feedback on the first draft of text and slides, before they go to the supervisors. Next to that formal role, we foresee that the circles will turn out to be effective as teams. Even if the students work on different topics, many challenges that they face during their graduation project are similar, and discussing them with peers is highly effective in dealing with them.

Graduation circles are coached by Wybo Houkes. He provides feedback on presentations and draft reports (see Deliverables below), mainly with an eye to general scientific methodology, clarity of exposition, and feasibility of the project. Additional coaching may be provided by Tijn Borghuis (design methodology, scientific modeling) and lecturers from the Fusion master program (domain knowledge).

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<sup>1</sup> See more details in the last section: *note on the start of the graduation project*

## Activities

The prelude phase consists of four stages:

- (i) Review of a relevant research paper. (weeks 1 and 2) Each student will read and analyze a research paper that is relevant to their topic. The paper will be selected together with their supervisor. Pre-recorded lectures on scientific methodologies, and a template for the review of the paper are made available to help with the analysis.<sup>1</sup> The review of the paper is shared with the graduation circle and the prelude coach. Ideally, it provides a first step in the literature review needed for the project and it generates:
- (ii) Initial research idea. (weeks 3 and 4) Based on the paper/literature review, students formulate a preliminary research question. They present this, together with a brief motivation (indication of value to the research field), to the other members of the graduation circle and the coaches. Constructive feedback is provided by all participants, to help to arrive at:
- (iii) Research proposal. (weeks 5 and 6) Based on the feedback on their idea and additional literature review, students come to a well-formulated and motivated research question, now including an appropriate set of sub-questions and research methods, and a project planning. These are the elements of the second and final presentation – now also attended by the graduation supervisors. Main goal of the presentations is to collect feedback from the supervisors, necessary to write the:
- (iv) Prelude report. (week 8) This written report should contain a description of the context and a short review of the essential literature, leading to the research question (or a design specification/requirement), and the plan of approach mentioned above. Feedback to a draft report is provided by fellow members of the graduation circle and Wybo Houkes. Additional to this report, the student should make a phased project plan with milestones and deadlines. In projects in which external factors play a role, such as the availability of experimental devices or time needed for the delivery or construction of components, this should be explicitly included in the project planning. Ideally, the prelude report is written such that it can be used as the introductory chapters of the final master thesis. At the end of the prelude phase, the report is submitted to the academic supervisor for approval. The exact deadline for this can be set in consultation with the supervisor.

## Timeline with intermediate deliverables

Week numbers refer to the quartile in which the prelude phase takes place. Exact time of presentations, submission of draft reports and prelude reports is determined in consultation with students, coaches and supervisors.

Note that intermediate deliverables may differ between students in the level of detail and finality: for some projects, it is more straightforward to formulate an initial research idea and to find a suitable method than for others. The goal is, however, to have approximately the same level of detail by the end of the prelude.

We strongly recommend that, in addition to the activities listed below, the graduation circle meets

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<sup>1</sup> Presently 4 lectures are planned: Introduction and motivation (15'); Arguments in scientific papers (30'); Reasoning strategies in scientific papers (30'); An example from fusion research (20').

at least once a week during the prelude phase to discuss progress and bottlenecks.

<b>Week no.</b>	<b>Activities</b>	<b>Deliverables</b>
1	Introductory meeting Contacting supervisors Watching pre-recorded lectures	
2	Reading and analyzing research paper	Paper review (submitted via Teams)
3	Formulating initial research idea	
4	Formulating initial research idea Preparing and giving 'midterm' presentation	'Midterm' presentation
5	Incorporating feedback on initial idea Formulating research proposal	
6	Formulating research proposal Preparing and giving final presentation	Final presentation
7	Incorporating feedback from supervisors Writing draft report	Draft report (submitted via Teams / email)
8	Incorporating feedback on draft report Submitting prelude report to supervisors	Prelude report

### **Roles and responsibilities**

- Students – Submit deliverables on time; inform supervisors about prelude procedures; plan on-campus meetings for midterm and final presentations; participate actively in graduation circle activities.
- Prelude coach—Provides information and materials via Teams channel; provides timely feedback on all deliverables except prelude report.
- Supervisors—Select relevant research paper; participate in final presentation and provide feedback; approve<sup>2</sup> prelude report and inform the student (and fusion secretariat of the decision).
- Other coaches—Participate in midterm and/or final presentation (if possible) and provide feedback.

### **Note on start date of graduation project**

To ensure that this setup will work efficiently and effectively, the requirements are: i) all students are at the start of their project, before the research question and project plan have been defined, ii) we have a sufficient number of students to take part in the graduation circle, iii) not more than 4 starting points per year are feasible (to make it manageable for the lecturer). Therefore it has been decided to allow starting of the project only at the start of the quartile.

However, this has one negative consequence: an appreciable fraction of the students is not ready to start the graduation project at the start of the quartile, immediately following the completion of their previous education component (usually the internship). To mitigate this, the following measures are place:

- The overall structure of the prelude program will remain unchanged, including a common starting date at the beginning of the quartile, graduation circles, and coaching sessions.

- Before the *internship* begins, students will be informed of the starting dates for their *graduation* project's graduation circles. This information will allow them to plan accordingly and enable the program management to schedule the circles and start dates.
- Coaching sessions will commence in week **three** of the quartile. For students who are prepared to begin in week one, they may become acquainted with their topic and study the literature provided by their academic supervisor during the first two weeks. Delaying the kickoff meeting of the graduation circle by two weeks will allow students who experience slight delays during their internships to join the circle.
- Students who experience a 3-4 week delay in their internships may join the graduation circle before completing their internship if they demonstrate to their academic supervisor a strict plan that shows this will not interfere with their ability to complete the internship before the deadline. Note that according to the examination regulations, a delay of more than 4 weeks for the internship is not allowed.
- Students who experience a delay of more than 4 weeks must wait for the next opportunity to join a graduation circle, which may result in a delay of up to 6 weeks. For these students, we offer a 0.5-hour private coaching session to help them get started with their projects, define research questions, and benefit from peer feedback from other students in the graduation circle.

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<sup>2</sup> Because the process includes input and feedback from supervisors at several stages, the expectation is that there will be a high success rate at this stage. But if the student fails to submit the report or if the supervisor deems the quality insufficient, the project will be put on hold until a satisfactory prelude report has been achieved. This to avoid a situation in which a student starts to work on an ill-defined project and runs into problems later on.