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Essay

Supervision of Biomedical Master's Students in Norway

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Abstract: Working as a researcher, associate professor, or full professor in the field of biomedicine in Norway involves supervising students preparing for various degrees, such as Bachelor's, Master's, PhD, and MD. Additionally, there are visiting students from other departments and institutions in Norway, as well as from abroad, including various types of exchange students. Departments and Faculties provide guidelines and regulations on what is expected from students and their communication with supervisors throughout the study course. However, these guidelines are often too general, allowing for significant flexibility and varied interpretations from both the students' and supervisors' perspectives. This article focuses on personal experiences supervising biomedical Master's students in Norway. It covers several aspects, including student recruitment, initial instructions, routine work, graduation, and post-graduation interaction. The focus is on the supervisor's point of view, while the students' perspectives on this topic are reserved for further research.

Keywords: supervision; MSc; research project; biomedicine; biology; Norway

1. Introduction

Many researchers do not have formal education as supervisors, at least when they work with first students. Although many courses, sometimes mandatory, are available, these courses are often taken when the supervisor already has several years of experience working with undergraduate and graduate students and leading the students to graduation.

Supervision has gotten more attention in literature during recent years, with more attention given to supervising PhD candidates than for example Master's (MSc) students [1]. Moreover, there are differences between programs in various countries and institutions [2]. Thus, I am focusing on supervising MSc, in the biomedical field, and in Norway. These students could be enrolled into two-year MSc programs when previous BSc or equivalent education is required. Sometimes the students can be a part of continuous five-year programs that combine BSc and MSc equivalents under one name. This article provides examples of various stages of the supervision cycle, starting with advertising the project and research group, going through recruiting the students, actual time dedicated to work on the project, finalizing and graduating, and what happens after graduation.

2. Checklist for Supervising Biomedical MSc Students in Norway

2.1. Project Advertisement

1. The supervisor prepares an announcement of the potential project (Table 1). It is sufficient to have it up to one page, with references to recent relevant projects published by the supervisor(s), and contact information including email, phone number (optional), webpage, etc. This announcement is distributed by the MSc program coordinators depending on the focus program, e.g. Molecular Medicine, to new students.
2. Optional. This announcement can be distributed by coordinators of other relevant programs at the University, e.g., Biotechnology, Pharmacology, Neuroscience.
3. Optional. The potential project can be presented during ca. 5-10 minutes in frames of recruitment events if such activities are organized by coordinators of relevant MSc program(s).

4. Optional. A potential MSc project or an open opportunity for MSc student(s) can be announced via a personal network, i.e. personal contacts with other researchers, professors, and group leaders, and through Media platforms, such as LinkedIn, Facebook, Twitter/X, etc. (Table 1).

Table 1. Advertising potential MSc projects and opportunities to join the research group for MSc students.

Timeline	Supervisor’s task
Spring semester, summer	Prepare a written announcement of opportunities for MSc students to join the research group. Preparation is done in cooperation with the Program coordinator(s)
Summer, Autumn (first semester (optional)).	Contact coordinators of related programs, at other Departments and Faculties, in addition to the focus program at the Department
Summer, Autumn (first semester (optional)).	Present project and research group during MSc students’ recruitment days organized by Programs, Departments, and Faculties. Usually, it is a 5-10 minute presentation
Optional. Any time. Especially during the Autumn (first semester).	Announce your interest in recruiting MSc students for the project via personal network and media platforms.

2.2. First Contact and an Interview

1. After one or several students express an interest in working on their thesis in the research group, the supervisor asks student(s) several questions to find out more about the student’s experience, background, suitability, expectations, motivation, and to set an example for future communication in case the student will join the research group (Table 2). Example of the questions:
- a) Ask to send a CV, 2-3 letters of support (references), and a motivation letter.
 - b) What are your expectations from the MSc program and this project?
 - c) When do you plan to start and complete the project?
 - d) What do you plan to do after completing the MSc program?
- If the student has already provided answers to some or all of these questions during initial contact, the questions could be replaced by others, if still necessary, or skipped.
2. The supervisor evaluates the student’s answers and invites the student for an interview, in person, if possible. If the student is in another city, e.g. an exchange student, then the interview can be done by phone or using a video interview tool online.
3. If the student is offered to join the research team and project, the supervisor communicates it by email as soon as possible and invites the student for optional meetings, e.g. group meetings, project meetings, local conferences, and retreats, before the official project starts. It allows faster and smoother integration of students into the research team and networking with team members who might leave before new students start their project (e.g., final-year students or postdocs). Communicating with colleagues early helps students to start smoothly and establish the necessary contacts to facilitate the development of their research project (Table 2).

Table 2. First contact with the students and interview.

Timeline	Supervisor’s task
Autumn (first) or Spring (second) semester	Assess student’s motivation, expectations, and experience. Assess e.g. the students’: a) CV, 2-3 letters of support (references), and a motivation letter. b) expectations from the MSc project. c) timelines, and plans to start and complete the project. d) plans after completing the MSc program.

Autumn (first) or Spring (second) semester	Interview. Ideally in person, ca. 1 hour. To discuss potential project, mutual expectations, motivation, and working style, and clarify any other relevant questions
Autumn (first) or Spring (second) semester	Making an offer to join the research group. Inviting to join research-related activities, such as presentations, conferences, and retreats, if time allows (optional)

2.3. Planning Stage (Forming)

During the planning and introducing stage, the small sub-group of supervisor-student is forming [3] (Table 3). The latest time to start it is the Autumn semester when the work on the thesis has already started. However, often it can be done during the two previous semesters if the student and supervisors agreed on the work in advance. It is more convenient to prepare the formalities in advance as it saves more time to focus on the project and thesis writing. Planning includes several critical steps.

1. The student is writing a project proposal. It is usually required by the MSc program. As a rule, it is built on the original project announcement and includes working with literature. Upon agreement or depending on the program requirements, the project can be completely independent of those advertised. Overall, preparing this proposal by a student takes up to 1-3 weeks, and the proposal is 3-5 pages long, depending on the program’s requirements. One or more rounds of feedback from the supervisor are expected at this stage. As a result, the project description is submitted to the MSc program.
2. In parallel with writing, or immediately after the writing, depending on the student’s preference, the student is introduced to the lab, takes mandatory lab training and a lab tour, and gets familiar with local facilities and rules.
3. Introduction to the kitchen, infrastructure such as fridge for food, microwave oven, toaster (if available), and coffee machines (if available). It helps early networking during lunch or snack time.
4. The student is making a plan for the dissertation writing. This plan is discussed with the supervisor. The supervisor keeps in mind that additional time might be needed for each stage and makes the student aware of it. The first draft of the dissertation is expected to be ready one month before the submission deadline set by the department, program, or student, depending on the program’s rules. This would allow sufficient time for feedback from the supervisor and time to finalize necessary parts due to unexpected delays.
5. The student is reminded of an option to get examples of the previous year's students’ dissertations, e.g. those that got the highest grades “A”, a little lower but still high “B”, and an average “C”. This way the students get familiar with the traditions on how the dissertation is organized at the University/Faculty/Department/Program. Examples of previous years’ theses are usually available via the program coordinator or library, although the supervisor might have some copies as well.
6. At this stage, it is important to make sure that the student is aware of the assessment rules and various criteria used by the program to evaluate the dissertation [4]. In a two-year MSc program at a Norwegian University, the final project, thesis, or dissertation, gives about half of the final average grade.

Table 3. Planning, introduction to infrastructure, and initial stages of student’s work.

Timeline	Supervisor’s task
Autumn (third) semester, or earlier if possible	Supervise students during preparation of documents required by the program to start the project, e.g. Project description and Student-Supervisor agreement.
Autumn (third) semester, or earlier if possible	Supervise initial training of the student in the laboratory, obtaining required access permission and instructions
Autumn (third) semester, or earlier if possible	Facilitate introduction of the student to available infrastructure, including lunchroom, rooms for rest (if available), etc.

Autumn (third) semester, or earlier if possible	Supervise students in preparing a reasonable timeline for working on the thesis during the two semesters
Autumn (third) semester, or earlier if possible	Make the student aware that examples of the previous years' MSc theses are available at the University library, at the program coordinator's office, at the supervisor's office, etc.
Autumn (third) semester, or earlier if possible	Make the student aware of the rules, guidance, and criteria for thesis assessment
Autumn (third) semester	Supervise student's writing of the thesis (as early as possible)

This grade can be important for students because acceptance to PhD programs in Norway often requires the highest average grade from the MSc program, i.e. "A" or "B" out of the A to E range of scores (when "F" exists but is "fail" and requires a new attempt). It is rarely possible to continue in a standard PhD program in Norway with an average "C", while lower scores make acceptance to Norwegian PhD programs nearly impossible. Thus, it is necessary to make the students aware of the expectations of the programs and the supervisor regarding the final assessment.

Moreover, the supervisor is not the one who assesses MSc student's theses. To evaluate the dissertation, here are two sensors, one internal, from the Department, which is familiar with the internal routines. And one external, outside the University where the student is affiliated. The external examiner, or sensor, can be from another University in Norway, a private company or government-own agency or institution, as well as from similar organizations from abroad. Such a large choice of external sensors who will assess the work and grade it, makes evaluation and grading of MSc theses less standard.

It is important to make the students aware of the final assessment unless the students have already found the criteria. While there is no option yet for the continuous assessment of MSc theses [4], one important role of the supervisor is to provide continuous support and feedback which would allow students to continuously work on the project during dedicated time, usually two semesters.

7. Student is advised to start writing immediately ("today") and follow the next order:
- a) Materials and Methods (and literature references); figures if needed.

b) Results (and literature references); Figures are needed.

c) Introduction (and literature references); Figures if needed.

d) Discussion (and literature references); Figures if needed.

e) Conclusions.

f) Abstract; it could also have a Graphical Abstract.

g) Optional: Future perspectives.

This order is preferred because "Materials and Methods" is the section required to understand the procedures before the work is done.

The "Results" need to be reflected on while they are recent, and additional replicas and experiments need to be performed soon after the initial ones.

"Introduction" is a necessary section, however, students might spend much more time on this section than needed, because often there is a lot of literature on the topic, and it is easy to change focus from the student's main project to deeper than expected at this stage literature review. "Introduction" for many projects is a nearly endless task, the supervisor has to keep students focused and remind them that there are many other aspects of the MSc project, including the critical part which is original work.

"Discussion" is done after "Introduction" and "Results" and is used to reflect on the results obtained during preparing the dissertation and compare these results with ones available in the literature.

"Conclusions" should be concise. They could be based on Results already; however, more mature "Conclusions" would take into consideration information available in the "Introduction" and "Discussion" as well.

"Abstract" is done when most or all the other sections are completed. It briefly summarizes the entire dissertation.

Although optional, but often used section is “Future perspectives”. It can be part of the “Discussion” as well. Alternatively, it can make a section on its own. “Future perspectives” reflects the limited time proposed by the MSc program to perform the project. This section allows students to reflect on what else can be done to strengthen the project, or what new directions of the project exist and cannot be performed due to a time limit (Table 3).

2.4. Working Stage (Storming, Norming, and Performing)

Working stage (storming, norming, and performing [3]).

1. The student is performing the first experiments in the wet lab, or analyzes or modeling *in silico* if the project is in the dry lab (mainly computer-based) [5]. Ideally, there are three stages.
 - a) An instructor is performing the experiment, and the student is following.
 - b) The student is performing the experiment in parallel with the instructor.
 - c) The student is performing the experiment, and the instructor is following.

If successful, the student is ready to work independently. Other techniques are mastered similarly.

It can be also decided that some techniques the student will learn alone, without the instructor. This is a useful training by itself as it helps students to gain independence for their future careers. However, this independent learning can be also monitored by the supervisor to ensure that the project is developing without unnecessary challenges. The supervisor provides feedback and support if the student requires, even in the case when the student is mastering research technique(s) without an instructor. This strategy could be used after the student has mastered several research methods already and is confident in the research environment, e.g. in the lab.

2. First presentations during the group meetings. The students present a plan for the project, answer questions, and get feedback. Feedback can be only from the supervisor, or both from the supervisor and colleagues. At this stage, it can be decided whether the student is comfortable getting feedback from many people, which is a more traditional approach. Alternatively, the student only gets feedback from the supervisor, and this strategy can be revised when the student feels it is an option. This is an important point to make education more accessible, for example, when the student is not ready to get public feedback from multiple people [4].
3. The student presents the first results. The presentation includes 5 recommended stages:
 - a) What are the hypotheses to test?
 - b) Which methods are used to test these hypotheses?
 - c) What are the results obtained?
 - d) What are the conclusions? Are the results expected (reflection)?
 - e) What is next? Future directions.

This plan for the presentation is kept until the final presentation of the project (e.g. MSc project defense).

4. Routine (norming and performing). The student performs multiple experiments using the mastered methods, and holds multiple presentations, for example, during group meetings, department meetings, and local, national, and international conferences.
5. Experiments are planned to be finished one month before the dissertation submission deadline (Table 4).

Table 4. Supervision of initial working phase (storming, norming, and performing) of biomedical MSc students preparing a thesis in Norway.

Timeline	Supervisor’s task
Autumn (third) semester	Supervision mastering methodology
Autumn (third) semester	Supervision of making presentations, potentially public talks
Autumn (third) semester	Supervision result presentation
Autumn (third) and Spring (fourth) semesters	Supervision of routines, i.e. experiments, presentations, writing.

Remind the student to finalize experiments one months before the thesis is submitted to the program

2.5. Final Stage (Writing, Presenting, Graduating)

1. A goal for the first semester is to complete the “Materials and Methods” section of the dissertation and to have other sections started (i.e. “Results”, “Discussion”, “Introduction”, and “References”) (Table 5).
2. A goal for one month before the dissertation submission deadline is to have all the sections prepared as a draft. The final month is dedicated to completing writing based on the draft, getting feedback, and potentially performing final experiments (exceptionally, and if feasible in addition to writing).
3. Reminder to use responsibly AI-based tools to identify typos and grammar mistakes. Use AI-based tools according to the University rules and guidelines, if they exist, or according to the international practices used in the research discipline.
4. Reminder to fix common writing mistakes, e.g. to introduce, spell, and use abbreviations; to use units and terms consistently; to introduce reagents and materials in sufficient detail, i.e. including manufacturer and catalog numbers of products; to introduce research procedures with sufficient details that would enable using the research protocols by others; to describe protocols involving centrifuge using units as “g” and not only “rpm”, etc.
5. During the writing, at least during the last months of the thesis preparation, there is constant feedback from the supervisor based on 1-2 pages from different sections. It will help to identify and fix common mistakes. Final feedback from the supervisor on the entire dissertation, if time permits. Optionally, the feedback on the written thesis can be also provided by colleagues, if both students and colleagues agree on it.
6. After the dissertation is submitted, the student prepares a 20-30-minute presentation of the work, according to the program guidelines. The feedback from the supervisor is recommended at this stage, and the feedback from colleagues is optional, if both the student is willing to get more feedback and the colleagues are willing to provide the feedback. About a week before the presentation, the aim is to have a trial presentation with a timer and questions and answers session, with a supervisor only (at least) or with a small group of colleagues (optional, if the student and the colleagues agree on it).

Some programs do not require such presentations, which reduces the workload for both the student and supervisor. However, when the presentation is expected by the program, it is meant to improve the grade based on the written thesis. Presenting results is also a valuable transferable skill that is beneficial for students to master during the training (Table 5).

Table 5. Supervision of the final stage of thesis writing and preparing the final presentation.

Timeline	Supervisor’s task
Autumn (third) semester	Supervise writing the “Materials and Methods” section
Spring (fourth) semester	Supervise writing thesis draft by one month before the due date
Autumn (third) and Spring (fourth) semesters	Provide timely feedback on MSc thesis writing
Spring (fourth) semester	Supervise students preparing a final presentation (if required by the program)

2.6. Leaving (Departure, Closure)

1. The student cleans the workplace, including office space (if it was available), lab space (if it was required for the project and available), and fridge, shelves, etc. Unused resources, i.e. reagents, equipment, and materials, are returned to the research team (Table 6).
2. The lab book and electronic copies of the data are returned to the supervisor. The student is encouraged to have a copy of all data and the lab book. This is the part of the data management plan which is getting implemented, although is not standardized yet.

3. The student is collecting and submitting signatures and documents required by the program, department, faculty, and university, to finalize the study.
4. Optional. Celebration of completed study, farewell party. If all sides agree, if time allows, etc. There is no established tradition regarding the MSc thesis, and it varies between the programs and research groups.
5. The supervisor and the students exchange contact information, e.g. email addresses and phone numbers (optional). This was probably done at the beginning of the project. However, the student will likely change the institutional email address after graduating from the program.
6. contact details are needed regarding any potential manuscript that might result from the student's work if anything is publishable and the plans to publish exist.
7. The student and the supervisor agree that the supervisor will support the trainees' job search and the supervisor agrees to provide references and letters of support upon request (Table 6).

Table 6. Final stages of MSc student's work in the research group.

Timeline	Supervisor's task
Spring (fourth) semester	Instruct the student on how to organize working space, notes, and data before departure
Spring (fourth) semester	Instruct the student regarding administrative questions, with the help of program coordinators
Spring (fourth) semester	Agree regarding future publications (if expected) and letters of support from the thesis supervisor upon the student's request. Exchange of contact details, such as emails and phone numbers

2.7. *Post-Leaving*

1. The supervisor is providing a reference letter, or a letter of support, for example "to whom it may concern", supporting the future career of the student.
2. The supervisor provides contacts to the student (email, phone) for references (2.6.5.). The former trainees often need references or support for job or study applications for several months or several years.

3. **Discussion**

This short article focuses on supervising master's thesis projects in the biomedical field in Norway. Limitations are the focus only on the Norwegian education system, only on the biomedical field, and only on master's theses. Moreover, there are certain differences between the Universities, Faculties, Departments, and Programs (Table 7). There are also exceptions to nearly every step described in the article. However, the process outlined here can be optimized and adjusted to be suitable for supervisors of theses in different disciplines in Norway (or abroad), and for supervisors of biomedical students outside Norway.

Table 7. Instructions for MSc students made available online by several Norwegian Universities.

University	Link to the guidelines
Norwegian University of Science and Technology (NTNU)	Writing and submitting your master's thesis: https://i.ntnu.no/en/masteroppgave
University of Oslo (UiO)	Submit Master's thesis: https://www.ub.uio.no/english/writing-publishing/masters-theses/
The Arctic University of Norway (UiT)	Submission of theses and dissertations: https://en.uit.no/ub/writeandcite/submissions-munin

Several examples of exceptions and deviations from the process are outlined in the article.

3.1. Timelines

Traditionally, MSc programs in Norway are two years or four semesters. During the first two semesters, the students are expected to complete short theoretical courses with about four courses per semester, as well as identify potential supervisors and projects to focus on to write the MSc thesis. The last two semesters are spent preparing the MSc thesis, including practical and theoretical work, writing, and graduation.

Some students, however, can get extensions and work on the thesis for three or four semesters instead of two. This needs to be approved by the program, and it needs to be justified, for example, by significant delays in the project outside the student's control, changing the research topic, changing the supervisor, sickness, etc.

Some students decide to repeat one or several courses in parallel with working on a thesis, during the third and fourth semesters. For example, to take the exam again and to get a better score. Some students can take fewer courses during the first two semesters, which again means that they need to take some time away from thesis writing and catch up with the exams.

It is also possible that students start working on their thesis from the first semester, combining courses and thesis writing during the first two semesters, and then focusing on the thesis during the third and fourth semesters. This way, some students can complete an MSc faster, for example, after three semesters instead of four. Thus, the traditional four-semester programs can be flexible to a certain level, and the students can spend between three and six semesters.

3.2. Outside the Main Institution

Depending on the project, collaborators, and student's interests, MSc thesis preparation can be done outside the main institution associated with the MSc program. It can be as close as another Faculty or a different campus at the same University. The student might decide to prepare a thesis at another University in Norway, for example, going from Bergen to Trondheim, or from Trondheim to Oslo. Finally, the students can work on an MSc thesis mainly anywhere abroad and return to their universities only to graduate. The tasks of the supervisor in these situations are nearly the same, although it can be slightly more administrative work if the supervisors are actively involved in the student's exchange.

3.3. Changing Supervisor and Project

It is possible that the students change their interests during the MSc program and decide to change the research topic working with the same supervisor, or to change the supervisor while working on the same topic (although this is less likely), or to change both the topic and the supervisor. It is also possible that while working on an MSc thesis, students will have more than one supervisor. Having two or multiple supervisors is allowed, it can be decided before the project starts, or additional supervisors can be included during the working phase.

3.4. Accessibility and Equity

While allowing some flexibility, the MSc programs could further improve accessibility for students. Allowing extensions for students is one of the steps forward. However, more work needs to be done by the Universities and programs to inform supervisors of potential special needs the students might have to complete the program. Moreover, the programs themselves might further improve existing guidelines. For example, introducing more widely continuous assessment would allow students to reduce anxiety associated with writing and presenting the thesis during the final month of the study.

Presenting results and discussing progress with the supervisor is nearly not regulated. While some students do not have such discussions with supervisors for weeks or months, other students are asked to present and discuss nearly every day, in frames of the same program and at the same University. Certain programs are suggesting one hour per week for communication between MSc

students and supervisors, which is close to the real needs. It is important though to keep regular meetings and not to accumulate these hours of interaction by the end of the semester or program.

Commonly used weekly presentations and public feedback could be substituted with written reports provided by students and written feedback made by supervisors, if the student prefers this way. It might be more comfortable for some students regarding the form of communication and feedback, i.e. written versus verbal. It also allows great flexibility time-wise, when written communication can be done during a day in comparison to the 10-minute presentation during a group meeting. It also allows students to be more flexible space-wise, if they need to do something outside the campus.

Some programs offer to grade the MSc thesis solely based on the written work, while others expect all students to present their results, often publicly. One benefit of such presentations is an opportunity to improve the grade, which is based on the written part, by engaging in a dialog with examiners. However, this part should be optional, especially if the grade based on the written part is already corresponding to the student's expectations. These presentations should be optional, decided by the students, and the main reason should be to improve the final grade. This strategy would reduce anxiety for many students who might choose not to have the final presentation, as well as save a lot of resources for the Universities. It would improve accessibility and might reduce drop-out levels.

In this article, I summarized personal experiences and views in the form of reminders of what the supervisor does at various stages while working with biomedical MSc students in Norway. However, there are several supervising styles, and other supervisors might agree with some of the points outlined about, as well as have different experiences and visions of the process.

Conflicts of Interest: The author declares no conflicts of interest.

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