

Mandatory coursework in higher Norwegian IT education

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Abstract

Obligatory exercise, mandatory activity and work requirement are all examples of terms describing the same phenomenon in higher Norwegian education: Something a student needs to pass in order to get access to an exam. In this paper we call them mandatory coursework in alignment with relevant existing research. Some argue that mandatory coursework assignments can, and should, be eliminated. Before we can discuss this within Norwegian IT education, we need to know to what extent mandatory coursework is in use.

A course description should describe any mandatory coursework within a course. In this paper we present extracted data from course descriptions from 12 institutions delivering IT education in Norway. The data tells us the frequency in which mandatory coursework is in use, the different types used, how many there are, in what stages within a study programme they are most commonly in use and the variation between the 12 institutions.

The results tell us that mandatory coursework to a large extent is in use in Norwegian IT education, although there are significant variations among the different institutions. The most common coursework are labs, assignments and submissions, but participation is also quite common. Mandatory coursework is in use in both bachelor and master programmes with year one in a study as the most coursework intensive.

1 Introduction

Educators may find students procrastinating student work [1] when a final exam is months away. In order to *force* the students to work continuously through the semester, a possible solution may be to introduce a steady flow of exercises or tasks that a student should deliver. The exercises may be assessed, and if so, using formative or summative assessment. Multiple definitions of formative and summative assessment exist. A distinction between the two can be described with the primary purpose of the assessment [2]. For summative assessment, the primary purpose is assessment *of* learning. Formative assessment is assessment *for* learning.

The assessment of mandatory coursework is an intriguing hybrid between summative and formative assessment. It is summative as the work must be assessed to be passed in order for the student to get access to the final exam. It may be formative as the student can receive feedback on her work. The feedback may be as simple as the outcome of the assessment (pass or fail), but it may also be accompanied with a more thorough feedback helping the student in her learning process towards the final exam.

Norwegian authorities do not encourage or discourage the use of mandatory coursework in higher education. It is left to the educational organizations to handle access to the exams. Universities and university colleges act, section 3.9, part 7 (translated into English) [7]:

“The board itself provides regulations on the preparation and conduct of examinations and tests, including conditions for taking the exam (...)”

We therefore find the definitions of mandatory coursework in the organizations' regulations. The terminology for the mandatory coursework itself varies, such as "Mandatory activities", "Mandatory teaching activities", "Work requirements" and "Mandatory requirements". But the outcome is the same for all definitions: it is something that must be passed in order for the student to get access to the exam. In this paper, we use the terminology "Mandatory coursework" in alignment with previous research on the subject.

2 Background

Haugan et al. explicitly argue that "Mandatory coursework assignments can be, and should be, eliminated!". In their case study [5,6], they describe how mandatory coursework assignments were replaced by formative assessment in five courses within an engineering bachelor degree programme. A total of 28 mandatory coursework assignments were removed and replaced with voluntary peer-assessment sessions. The findings in the case study are promising. The students performed very well on the examinations. Perhaps more surprisingly: The average number of study hours increased in all the courses.

The authors describe an *engineering* education where mandatory coursework assignments are heavily in use, at least at their own institution. Engineering and IT are both STEM disciplines and share some common ground. If we want to discuss whether mandatory coursework should be eliminated from IT education or not, we first need to know to what extent mandatory coursework is in use. We have, to the best of our knowledge, not found any study describing the use of mandatory coursework in IT education. This leads us to the following four research questions:

- **RQ1:** To what extent is mandatory coursework in use in Norwegian IT education?
- **RQ2:** What types of mandatory coursework is in use in Norwegian IT education?
- **RQ3:** Does the use of mandatory coursework differ between the organizations delivering IT education in Norway?
- **RQ4:** Are there certain stages in an IT education where mandatory coursework is more common than others?

3 Method

When mandatory coursework is used in a course, it should be described in the course description. An initial attempt was made to harvest information regarding mandatory coursework through a web crawler. The task turned out to be more difficult than expected, so we decided to perform manual data extraction from publicly available course descriptions. We used studiebarometeret.no as a starting point for limiting which institutions to include. Using filter with subject group: "Information and computer technology" resulted in 96 study programmes delivered by 12 different institutions. The initial plan was to extract data from within these 96 study programmes, but we discovered that information in Studiebarometeret is not completely up to date, and also includes historical data. As an example, Nord University is in Studiebarometeret listed as one of the 12 institutions because they are listed as delivering the bachelor: "Games and Experience Technology" (G&ET). Visiting the Nord University web site, we find that the programme is no longer accepting students. But they are accepting students to a bachelor within information technology and computer science called "Digital economy and organization"(DE&O).

We defined the institutional scope to be the 12 institutions providing "Information and computer technology" education, as defined by Studiebarometeret, but used the institution's own web sites to find IT study programmes offered to new students starting fall 2019. Following the example from Nord University, DE&O is kept as part of the scope, but G&ET is not as it is no longer accepting students. We further limited the scope to only include full time studies at a Bachelor or Master level. Some institutions provide filtering where IT is included within a broader category. In that case, we performed a further subjective filtering to find what we considered to be IT programmes.

Table 1 displays the institutional scope and the programme filter used at the institution web sites.

Institution	Abbreviation	Programme filter
Norwegian University of Science and Technology	NTNU	Information Technology and Informatics
The Arctic University of Norway	UiT	Engineering, natural sciences, vocational and technical subjects ¹
Western Norway University of Applied Sciences	HVL	Engineering and maritime studies ¹
University of Bergen	UiB	Technology or engineering ¹
University of Agder	UiA	Computer Science
University of Stavanger	UiS	Engineer and civil engineer ¹
University of Oslo	UiO	Information technology and informatics
Kristiania University College	HK	Institute of technology
Østfold University College	Hiof	Information technology
Oslo Metropolitan University	OsloMet	Institute of information technology
Nord University	Nord	Information technology and informatics
University of South-Eastern Norway	USN	Engineering, Technology and IT ¹

Table 1: Scope within Norwegian educational institutions

We applied the following rules when extracting data from a study program:

- Exclude courses where the course description is not publicly available.
- If a programme has specializations, extract all IT specializations.
- If a course description is missing for an upcoming course, look for earlier versions of the same course (based on course code) and extract data if found.
- Extract all mandatory courses in the programme. If a student may choose courses from a list of *recommended* courses, extract all recommended courses.
- If a course is present in more than one study program, extract it only once.
- If a course may be completed at several stages within a programme (i.e. 2. or 4. semester) use average when extracting semester number information. If a course is completed in different stages in different programmes, use only the first value found.
- Extract all mandatory activities found, even though they may not be explicitly described as a requirement for exam access.
- If a mandatory coursework describes a repeating activity (i.e. a mandatory delivery to each lecture), use a qualified guess to count the number of mandatory activities.

¹Further subjective filtering was performed due to broad categorization at the institution.

- If the course description describes a use of mandatory coursework, but no further information may be retrieved, look for a publicly available course site. If further information is still not found set the coursework count to *unknown, but existing* (as opposed to 0).
- If *one* mandatory coursework consists of a specific number of separate activities (i.e the coursework is three separate deliveries), count the number of separate activities.
- If a mandatory coursework consists of an unspecified number of tasks (i.e obligatory assignments must be approved), count it as one coursework.
- Exclude courses that have been replaced by a new course. Extract the new course if found.
- If a course description describes a maximum number of mandatory coursework, extract the maximum.
- If a course description describes activities that may or may not be mandatory, exclude the course.
- If no information regarding mandatory coursework can be found, set the number of mandatory coursework to 0.

4 Findings

We defined 45 Bachelor and 37 Master programmes in 12 institutions to be within our scope. Table 2 displays the scope and the number of programmes and courses where we have extracted data. We extracted mandatory coursework data from a total of 668 course descriptions within the scope.

Institution	Bachelor programmes			Master programmes		
	F	E	C	F	E	C
NTNU	8	2	39	5	2	36
UiT	2	1	20	3	1	18
HVL	2	1	25	1	1	6
UiB	9	1	19	4	1	9
UiA	3	1	26	4	1	12
UiS	1	1	19	2	1	12
UiO	7	2	30	11	4	51
HK	1	1	53	4	4	23
Hiof	4	4	43	1	1	9
OsloMet	3	3	43	1	1	26
Nord	1	1	25	0	0	0
USN	4	4	108	1	1	16
Total	45	22	450	37	18	218

Table 2: Course description data extraction by institution. F = Found programmes, E = Extracted programmes, C = Course descriptions extracted.

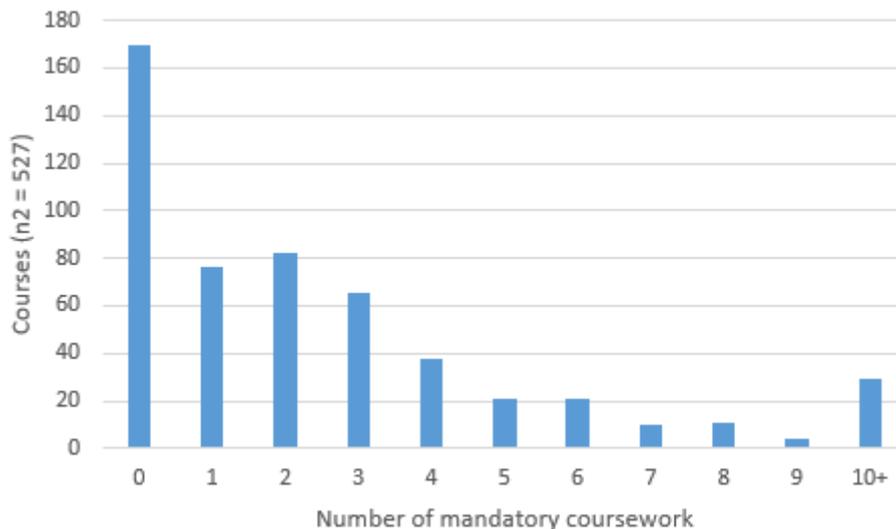
RQ1: To what extent is mandatory coursework in use in Norwegian IT education?

The course descriptions found at the different institutions all followed a pattern with common traits. They provide a short summary of the course and describe learning goals, structure, prerequisites, teaching methods, how the students are evaluated, mandatory coursework, etc.. Although mandatory coursework is present within the course description template, the level of detail of how they are described differs significantly. Some only provide a generic description of whether or not mandatory coursework is in use in the specific course. We therefore provide two types of answers to the research question. First we present an overview of courses with or without mandatory coursework. Secondly we provide data on the amount of mandatory coursework within the courses where the number of mandatory coursework could be retrieved from the course description.

From our pool of extracted course descriptions (n1=668), 75% of the courses use mandatory coursework.

We were able to retrieve the mandatory coursework count within a course from 527 courses. These were found directly in the course description or by looking at the course site (as described in chapter 3:Method). We found the mandatory coursework count to be 1362 within these 527 courses. Figure 1 displays the distribution of coursework in these courses.

Figure 1: Mandatory coursework count per course



From our pool of courses where the number of coursework could be determined (n2=527), the average number of coursework were 2,6.

The largest amount of coursework we found in a single course was 22: Obligatory attendance at the first lecture, 15 obligatory lab sessions and six submissions.

Counting coursework is not always easy. Some courses use specific rules on what needs to be achieved in order to take the exam. Here is an example from UiO:

“The course includes the following mandatory elements:

- *4 compulsory submissions*
- *Lab work*

- *Computational essay with presentation*

Participation in at least 75% of the group sessions exempts one compulsory submission.

Participation in both introductory and final mapping exams exempt one compulsory submission.”

Rules, such as the one above, and a variable level of detail in the course descriptions make it hard to give a precise number of coursework for each course. The numbers we present are our best effort when applying the rules described in chapter three: Method.

RQ2: What types of mandatory coursework is in use in Norwegian IT education?

When describing coursework type information, we use the same pool of courses (n=527) as for the previous research question where details of the coursework could be found. As there is a difference in the level of detail for coursework descriptions, some types will be more general than others. After first extracting the terms used in the course descriptions, we translated and grouped them. Table 3 displays the type groups found in the pool.

Type	n	%	Example types
Lab	336	24,7	Lab, lab exercise, øving (N)
Assignment	316	23,2	Assignment, oppgave (N)
Submission	172	12,6	Innlevering (N)
Participation	122	9,0	Attendance, Participation
Project	79	5,8	Group work, project, project deliveries
Presentation	74	5,4	Group or individual presentations
Other	49	3,6	Blog, video, article
Generic	49	3,6	Work, activity
Meeting	38	2,8	Supervisor meeting, meeting notes
Report	37	2,7	Project, progress and status reports
Test	37	2,7	Test, quiz, exam
Assessment	36	2,6	Self evaluation, peer review, opponent
Contract	17	1,2	Group, supervisor, customer contracts
Total	1362	100	

Table 3: Groups of mandatory coursework type. N = Norwegian term

The top three type groups are similar as they are all activities where students need to apply acquired skills and knowledge to solve assignments within our outside lab sessions and submit a result to be assessed. Combined, they account for over 60% of the coursework within our pool of courses. Motivation for providing assignments throughout a course can sometimes be found in the course description, such as this example from IN1900 at UiO:

“Programming is a subject that requires training, and in IN1900 there are compulsory assignments every week. You do not have to submit all the assignments, but you have to obtain a sufficient number of points to be able to take the exam.”

A project is also an activity where students need to apply acquired skills and knowledge, but the task at hand is normally larger and is solved over a longer time period. There is usually a group of students involved in a project, but not always. Participation, on the other hand, is something very different. The participation type group includes:

- Registration (normally obligatory registration at the first lecture or session)
- Attendance at lectures, labs or special occasions such as camps or exhibitions.
- Participation.

Attendance is often set to a specific level of acceptance, such as attending at least 70% of all lectures. Participation is different. The student is not only required to attend but to actively take part in the activity, such as this example from a masters course, IN5420 at UiO: "Active participation in lessons and discussions is required".

Another coursework type we would like to mention specifically is "Assessment". In the previously mentioned case study [5, 6], voluntary peer-assessment sessions replaced mandatory coursework assignments. Currently, assessments are not widely used as mandatory coursework. Of all the mandatory coursework we extracted, assessment only accounted for 2.6 percent.

The most peculiar coursework we found (categorized within the "Other" group) was in ITF15019, Introduction to computer security at Hiof:

“Using the knowledge and techniques learned in the course against fellow students, staff or the school’s infrastructure without this being agreed upon in advance will mean that the student will not be allowed to take the exam.”

RQ3: Does the use of mandatory coursework differ between the organizations delivering IT education in Norway?

When presenting variation among the institutions, we provide data on whether mandatory coursework is in use or not, and (if available) how many. This is displayed in table 4. As the number of courses involved differs within the institutions, we also provide the total number of courses by institution (n1) and the number of courses where details of amount and type could be retrieved (n2).

Institution	n1	MCW%	n2	Avg
NTNU	75	73	48	1,8
UiT	38	74	29	2,6
HVL	31	100	29	4,2
UiB	28	96	10	2,4
UiA	38	82	23	1,3
UiS	31	65	29	3,3
UiO	81	91	67	4,0
HK	76	32	57	0,1
Hiof	52	73	52	3,6
OsloMet	69	67	69	2,7
Nord	25	48	14	0,1
USN	124	90	100	2,7

Table 4: Mandatory coursework by institution. n1 = Courses extracted, MCW% = % of courses using mandatory coursework. n2 = Courses where amount and type could be retrieved. Avg = Average mandatory coursework count.

We see that there is significant variation among the different institutions. At HK, only 1/3 of the courses use mandatory coursework with an average of 0,1 coursework per course in courses where the number of coursework could be retrieved. At HVL, we found mandatory coursework in all courses, with an average count of 4,2.

RQ4: Are there certain stages in an IT education where mandatory coursework are more common than others?

Table 5 displays the frequency in which a course uses mandatory coursework and the average number of coursework during the five years of a bachelor and master programme.

Year	n1	MCW%	n2	Avg
1	115	86	87	3,3
2	150	71	118	2,8
3	185	75	148	2,7
4	174	70	136	2
5	44	73	38	1,7

Table 5: Mandatory coursework by programme year. Bachelor 1-3, Master 4-5.

The numbers tell us that mandatory coursework is common in both bachelor and master programmes. IT students experience more coursework in the first year than later in their study.

5 Discussion

There is a big variation in the amount of mandatory coursework in use among the organizations, from an average mandatory coursework count of 0.1 (HK and Nord) to 4.2 (HVL). While there are differences from course to course within the organizations, there seems to be a general understanding within an organization

of the "right" amount of mandatory coursework (with a value that differs from organization to organization). At HK (the authors' organization), there has been a recommendation to have a zero-to-low amount of mandatory coursework, leading to a lot of courses eliminating earlier used mandatory coursework. A higher amount of mandatory coursework could likewise come from internal recommendations. At HVL, the bachelor education where we extracted data had exactly four mandatory coursework in 12 out of its 25 courses. This could come from recommendations from the organization itself, or it could be an internal fight for the student's attention. If one course in a given semester has more mandatory coursework than the others, one could argue that the other courses would aim for the same amount of mandatory coursework to even out the student's attention.

Hattie and Timperley [4] describe feedback as a way of "reducing the discrepancy between current and desired understanding". Within their feedback model they define four levels of feedback focus:

- About the task.
- About the processing of the task.
- About self-regulation.
- About the self as a person.

A "pass" on a mandatory coursework will say something about the task; it is "good enough" - passed. But, from the course descriptions, we do not know if there is additional feedback (or "feed forward") on possible improvements that could help the student moving forward. And we do not know if there is any feedback on process or self-regulation.

The type of coursework does say something about feedback, or the potential for feedback. For some types, such as labs, assignments, submissions and projects, there is reason to believe that more feedback than just the verdict is presented to the student. Additional feedback could help the student moving forward in order to reach the stated learning goals for the course.

But for other types, it is difficult to find any reason to provide any additional feedback at all. The most obvious case is the participation type, and especially attendance. In the context of constructive alignment [3], where teaching and learning activities, as well as assessment tasks, should align with the intended learning outcomes, it is hard to see how attendance fits in. Participation is the fourth most popular choice for mandatory coursework (covering 9 percent of the total mandatory coursework used). While most of the coursework types require the students to somehow display their knowledge within the relevant subject, Participation simply requires the student to be present and possibly actively participate. The coursework types "Presentation" and "Meeting" might fit the same categorization. If we add these, the amount of mandatory coursework that requires students to be present is 17.2 percent out of all mandatory coursework. Participation could represent an activity that has an *indirect* effect on learning outcome as it may contribute to the learning environment. As an example, a masters course where students read and discuss articles may depend on student attendance and participation. It is highly unlikely that there is a dedicated attendance learning goal in the course, but the students achieve other learning goals from reading and discussing the articles. It

could also be that lecturers believe that the general student improves his or her knowledge by being forced to attend in lectures and/or lab exercises, and thus use these types of mandatory coursework. They may also find support for mandatory attendance in existing research, such as Marburger [8] who found that "enforced mandatory attendance policy significantly reduces absenteeism and improves exam performance" in a macroeconomics course.

The test type group includes tests, quizzes and exams. The latter could be an indication that mandatory coursework and exam can be confusing terms. An example can be found at one of the course sites:

“The Exam will count 70% or 100% - depending on what gives the best result for the student – Oblig 10+10+10 % + Exam 70% as suggested earlier for the course - or Exam 100% (It means that the grades for the Oblig only can help to improve your overall grade – it will not be able to reduce the overall grade). Due to the fact that Obligs normally do not work in the same way as Home exams. Properly our Obligs with grading (typically good group results between A and C) should then have been made as home exams – as this did not happen – we provide now a solution for the students of (...) for the 2019 spring semester – to take advantage of the best of this.”

An interesting finding within the test group was a course where tests were used in order to find students who struggled, so that these students could receive some needed help:

“Up to 6 tests will be given during the semester. If a test is not passed, the student must do a set of exercises related to the theme of the test, as well as participate in colloquium groups organized by the student assistants in the course.”

Regarding average mandatory coursework usage per year, we see that there is a decrease each year, with the largest drop coming between the third (end of bachelor) and fourth (start of master) year. The largest drop in MCW% is from year one to year 2. One can assume the earlier years have a higher cost and time investment for usage of mandatory coursework than later years due to larger class sizes and student drop out. So saving expenses can not be the motivation for more mandatory coursework at the start of an education. A possible answer could be that lecturers believe there is a higher need for mandatory coursework early in the education.

6 Conclusion

The course descriptions have told us about the amount of coursework distributed across different institutions and different stages in Norwegian IT education. Mandatory coursework is common practice in Norwegian IT education, although there are big differences within the relevant organizations. Many different types of coursework exist, but the majority of coursework involve a task where the student displays skills and knowledge achieved within a specific topic. Mandatory coursework is found in both bachelor and master programmes, but it is most common in the early stages of a study.

What the course descriptions don't say much about is the formative aspect of the assessment. We do not know what type of feedback the students receive other than hopefully a "pass" and access to the exam.

7 Further work

The purpose of this study was not to discuss if mandatory coursework in Norwegian IT education should be eliminated or not. The purpose was to investigate the use of mandatory coursework to see if such a discussion is necessary. After concluding that mandatory coursework is, at least in some institutions, heavily in use, further work should follow.

A natural next step could be to investigate how students and educators experience mandatory coursework. Are there certain types of coursework that are higher regarded than others? Or maybe there are certain ways of using coursework that are well accepted? And if mandatory coursework should be eliminated, do we need to replace it with something else, such as voluntary peer review activities?

8 Limitations

We cannot know with certainty that mandatory coursework listed in a course description are implemented. Likewise, we assume that all mandatory coursework in use are listed in their relevant course descriptions. When we see course descriptions that do not mention mandatory coursework at all, we assume the course in question does not have any mandatory coursework. Our data rely on course descriptions, but we do not know how they refer to the actual implementation when a course is delivered.

Finally, the exact design and wording of course descriptions differs from organization to organization. There is no set format for how different types of mandatory coursework should be named or described. We have compared and categorized mandatory coursework across different organizations with our best efforts, but some mandatory coursework descriptions could be argued to be either of one type or another.

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