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## Report - FEM3220 - 2020-09-29

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Respondents: 1  
Answer Count: 1  
Answer Frequency: 100.00%

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Please note that there is only one respondent to this form: the person that performs the course analysis.

**Course analysis carried out by (name, e-mail):**

Magnus Jansson (janssonm@kth.se)

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**DESCRIPTION OF THE COURSE EVALUATION PROCESS**

**Describe the course evaluation process. Describe how all students have been given the possibility to give their opinions on the course. Describe how aspects regarding gender, and disabled students are investigated.**

A standard LEQ course evaluation was published after the course during the period 2020-06-07 - 2020-06-20. We received responses from 25 out of 43 possible.

During the course we promoted students several times to contact us by email or by using the discussion functionality in Canvas in case of questions or concerns.

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**DESCRIPTION OF MEETINGS WITH STUDENTS**

**Describe which meetings that has been arranged with students during the course and after its completion. (The outcomes of these meetings should be reported under 7, below.)**

No particular meetings. See further above.

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**COURSE DESIGN**

**Briefly describe the course design (learning activities, examinations) and any changes that have been implemented since the last course offering.**

Course organization:

\* 9 meetings in class: 9\*2h

\* 9 sets of homework problems

\* For PhD students: 4 half-days of student presentations

\* For PhD students: peer-review grading

For PhD version: 80% of the total homework score for PhD students to get a Pass grade; in addition, completed peer review tasks and giving a presentation of a selected topic.

This year, the course was fully converted to an online course due to the Covid-19 situation. Half of the lectures were given live in Zoom while the other half used recorded video-lectures/presentations made available on the Canvas page. Student homework solutions and grading were handled by assignments and using student groups in Canvas. The student presentations part of the course was canceled. Partly because of expected difficulty to keep up the level of attention, and partly to ease the burden from students as it was assumed that the students suffered from having more difficulties to study and learn together during the course.

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### THE STUDENTS' WORKLOAD

**Does the students' workload correspond to the expected level (40 hours/1.5 credits)? If there is a significant deviation from the expected, what can be the reason?**

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In the responses of the LEQ the estimated workload among students vary a lot depending on background knowledge and level of ambition. Overall I get the impression that it is OK.

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### THE STUDENTS' RESULTS

**How well have the students succeeded on the course? If there are significant differences compared to previous course offerings, what can be the reason?**

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46 phd students showed initial interest.

35 students reached the passing level after the 9 sets of homework assignments.

5 students were close to pass and were given complementary exercises to reach the pass level. All of them solved their problems satisfactorily and received Pass grade.

6 students dropped the course at an early stage.

These numbers are quite similar to previous course rounds.

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### STUDENTS' ANSWERS TO OPEN QUESTIONS

**What does students say in response to the open questions?**

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please see the attached LEQ.

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### SUMMARY OF STUDENTS' OPINIONS

**Summarize the outcome of the questionnaire, as well as opinions emerging at meetings with students.**

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We really appreciate that there are many comments given in the LEQ responses. The responses seem balanced and relevant.

Some liked the live and interactive lectures in Zoom and others preferred the recorded lectures.

Course content and selection of exercises are mostly appreciated.

The peer grading system is appreciated by many but as usual there also many drawbacks such as the varying level of feedback both in terms of quality and quantity.

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### OVERALL IMPRESSION

**Summarize the teachers' overall impressions of the course offering in relation to students' results and their evaluation of the course, as well as in relation to the changes implemented since last course offering.**

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We are quite happy with how we managed to deliver the course in this new circumstance. The results achieved by the students were good, at the normal level, and received feedback from the students are in most respects positive.

One student quote: "Great course overall, I wish all courses were this good!"

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### ANALYSIS

**Is it possible to identify stronger and weaker areas in the learning environment based on the information you have gathered during the evaluation and analysis process? What can the reason for these be? Are there significant difference in experience between:**

- students identifying as female and male?

- international and national students?

- students with or without disabilities?

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Different lecture formats are appreciated by different students, maybe one could offer several alternatives in the future.

Some ask for more examples of the (engineering) usage of the matrix algebra tools/theory.

Questions 10, 15, 19, 21 were given the lowest scores; we need to think of if this is something we can influence in future offerings by changes in the course design or by other means. Otherwise, the lower scores on these questions were quite expected given the current design and the covid-19 situation.

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**PRIORITIZED COURSE DEVELOPMENT**

**What aspects of the course should be developed primarily? How can these aspects be developed in short and long term?**

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See analysis above.

Tip from a student: Check peer grading software (such as peergrade.io). Are there tools that could improve the managing of the peer grading?

One student mentioned that Gilbert Strang's popular Youtube lecture series was helpful for certain concepts. Maybe something to highlight to future students.

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## FEM3220 - 2020-06-06

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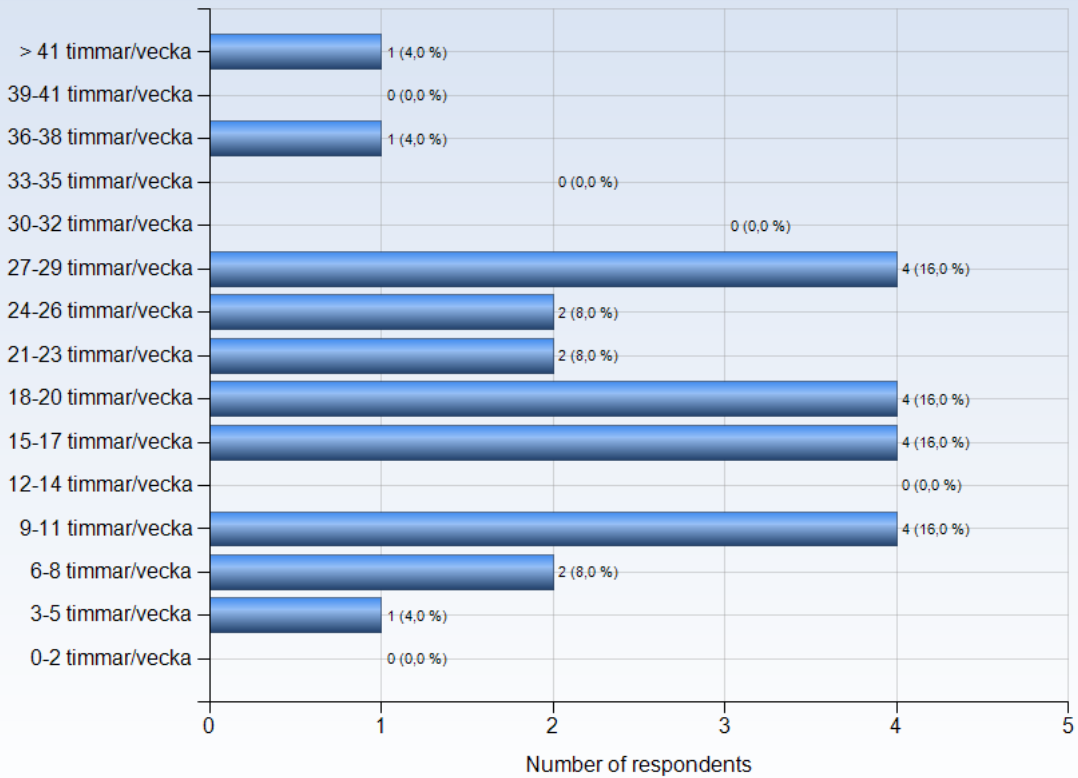
Antal respondenter: 43  
Antal svar: 25  
Svarsfrekvens: 58,14 %

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## ESTIMATED WORKLOAD

On average, how many hours/week did you work with the course (including scheduled hours)?





## Comments

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Comments (I worked: 6-8 timmar/vecka)

Good work load.

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Comments (I worked: 9-11 timmar/vecka)

This is an excellent course in my conclusion. Notably, the peer review system is fresh for me. Sometimes, I received low-quality comments on my homework. The grader didn't understand what I wrote just gave a random score even if I am pretty sure my answer was more precise than the average level. However, I also received some helpful feedback. Some grader understands what I convey and gives a constructive suggestion. They make me feel happy.

I would say this course is a box full of surprises. No one can make sure what happens next. What I learn is not only matrix algebra but also an attitude to the peer review system. I profit from this course. Thanks.

I have to say, at least for myself, I spent quite a portion of my weekday time in this course than I expected.

It was not much work. I would usually solve all the homework assignments the day before the deadline. You can always add the number of hours by going into every detail in Horn and Johnson, but I made it easy for myself by only going into details that were important for the assignments.

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Comments (I worked: 15-17 timmar/vecka)

It required much time to understand the concepts and solve the exercises.

Reasonable work load, about what I expected

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Comments (I worked: 18-20 timmar/vecka)

Great!

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Comments (I worked: 21-23 timmar/vecka)

It usually takes me about 3 whole days (afternoon and night) to read the textbook chapter and write the weekly homework.

That leaves me only 3-4 days working on other stuff (ex: research). It would be better to make this course longer.

Around 2-3 hours was spent every week for following and processing the lectures. I needed slightly more than 2 full days of work to finish the homework.

The homeworks take a lot of time. I didn't have time to go through the book in as much detail as I would have liked, because I had to spend most of my available time on the homeworks.

I could follow the book quite nicely in parallel with the lecture notes, which was good.

Some homeworks were more than 8 exercises, which was unnecessary.

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Comments (I worked: 24-26 timmar/vecka)

A significant amount of time needed to solve the weekly homeworks.

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Comments (I worked: 27-29 timmar/vecka)

The work load is fair enough for the total credits.

Very good and important course. Some more interactions may be enabled with instructor to get better understanding, and learning experience.

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Comments (I worked: 36-38 timmar/vecka)

During the 9 weeks took me basically whole time, but I am not used to proving mathematical theorems.

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## LEARNING EXPERIENCE

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The polar diagrams below show the average response to the LEQ statements for different groups of respondents (only valid responses are included). The scale that is used in the diagrams is defined by:

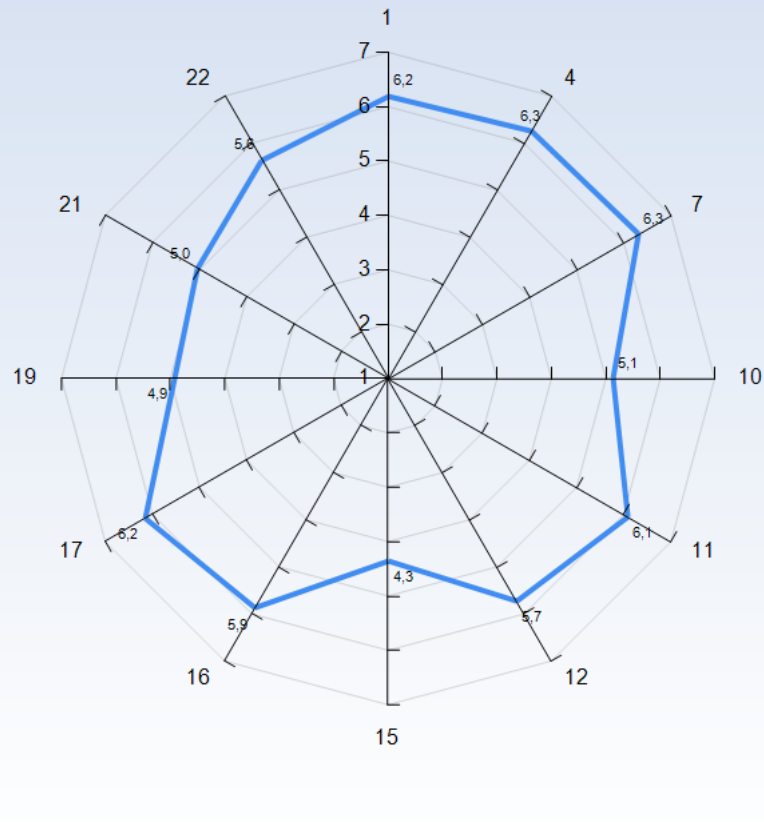
1 = No, I strongly disagree with the statement

4 = I am neutral to the statement

7 = Yes, I strongly agree with the statement

**Note! A group has to include at least 3 respondents in order to appear in a diagram.**

### Average response to LEQ statements - all respondents







## **KTH Learning Experience Questionnaire v3.1.4**

### **Meaningfulness - emotional level**

#### *Stimulating tasks*

1. I worked with interesting issues (a)

#### *Exploration and own experience*

2. I explored parts of the subject on my own (a)

3. I was able to learn by trying out my own ideas (b)

#### *Challenge*

4. The course was challenging in a stimulating way (c)

#### *Belonging*

5. I felt togetherness with others on the course (d)

6. The atmosphere on the course was open and inclusive (d)

### **Comprehensibility - cognitive level**

#### *Clear goals and organization*

7. The intended learning outcomes helped me to understand what I was expected to achieve (e)

8. The course was organized in a way that supported my learning (e)

#### *Understanding of subject matter*

9. I understood what the teachers were talking about (f)

10. I was able to learn from concrete examples that I could relate to (g)

11. Understanding of key concepts had high priority (h)



### *Constructive alignment*

12. The course activities helped me to achieve the intended learning outcomes efficiently (i)

13. I understood what I was expected to learn in order to obtain a certain grade (i)

### *Feedback and security*

14. I received regular feedback that helped me to see my progress (j)

15. I could practice and receive feedback without being graded (j)

16. The assessment on the course was fair and honest (k)

## **Manageability - instrumental level**

### *Sufficient background knowledge*

17. My background knowledge was sufficient to follow the course (f)

### *Time to reflect*

18. I regularly spent time to reflect on what I learned (l)

### *Variation and participation*

19. The course activities enabled me to learn in different ways (m)

20. I had opportunities to influence the course activities (m)

### *Collaboration*

21. I was able to learn by collaborating and discussing with others (n)

### *Support*

22. I was able to get support if I needed it (c)



## **Learning factors from the literature that LEQ intends to examine**

We tend to learn most effectively (in ways that make a sustained, substantial, and positive influence on the way we think, reflect, act or feel) when:

- a) We are trying to answer questions, solve problems or acquire skills that we find interesting, exciting or important
- b) We are able to speculate, test ideas (intellectually or practically) and learn from experience, even before we know much about the subject
- c) We are able to do so in a challenging and at the same time supportive environment
- d) We feel that we are part of a community and believe that other people have confidence in our ability to learn
- e) We understand the meaning of the intended learning outcomes, how the environment is organized, and what is expected of us
- f) We have adequate prior knowledge to deal with the current learning situation
- g) We are able to learn inductively by moving from concrete examples and experiences to general principles, rather than the reverse
- h) We are challenged to develop a true understanding of key concepts and gradually create a coherent whole from the content
- i) We believe that the work we are expected to do will help us to achieve the intended learning outcomes
- j) We are able to try, fail, and receive feedback before, and separate from, each summative assessment of our efforts
- k) We believe that our work will be considered in an honest and fair way
- l) We have sufficient time for learning and devote the time needed to do so



m) We believe that we have control over our own learning, and not that we are being manipulated

n) We are able to collaborate with other learners struggling with the same problems

## Literature

Bain, K. (2004). *What the Best College Teachers Do*, Chapter 5, pp. 98-134. Cambridge: Harvard University Press.

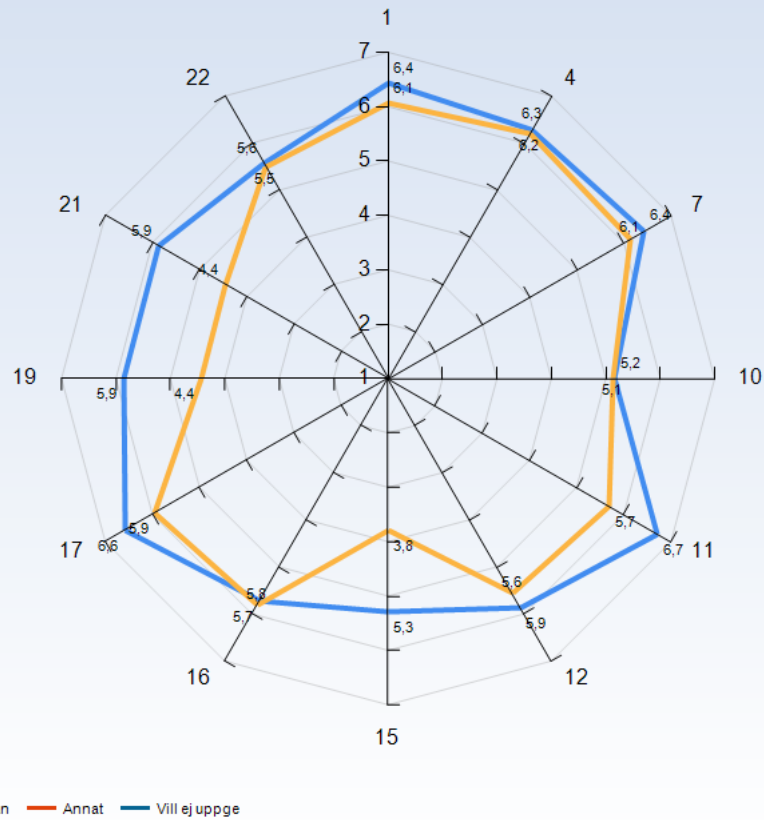
Biggs J. & Tang, C. (2011). *Teaching for Quality Learning at University*, Chapter 6, pp. 95-110. Maidenhead: McGraw Hill.

Elmgren, M. & Henriksson, A-S. (2014). *Academic Teaching*, Chapter 3, pp. 57-72. Lund: Studentlitteratur.

Kember, K. & McNaught, C. (2007). *Enhancing University Teaching: Lessons from Research into Award-Winning Teachers*, Chapter 5, pp. 31-40. Abingdon: Routledge.

Ramsden, P. (2003). *Learning to Teach in Higher Education*, Chapter 6, pp. 84-105. New York: RoutledgeFalmer.

### Average response to LEQ statements - per gender



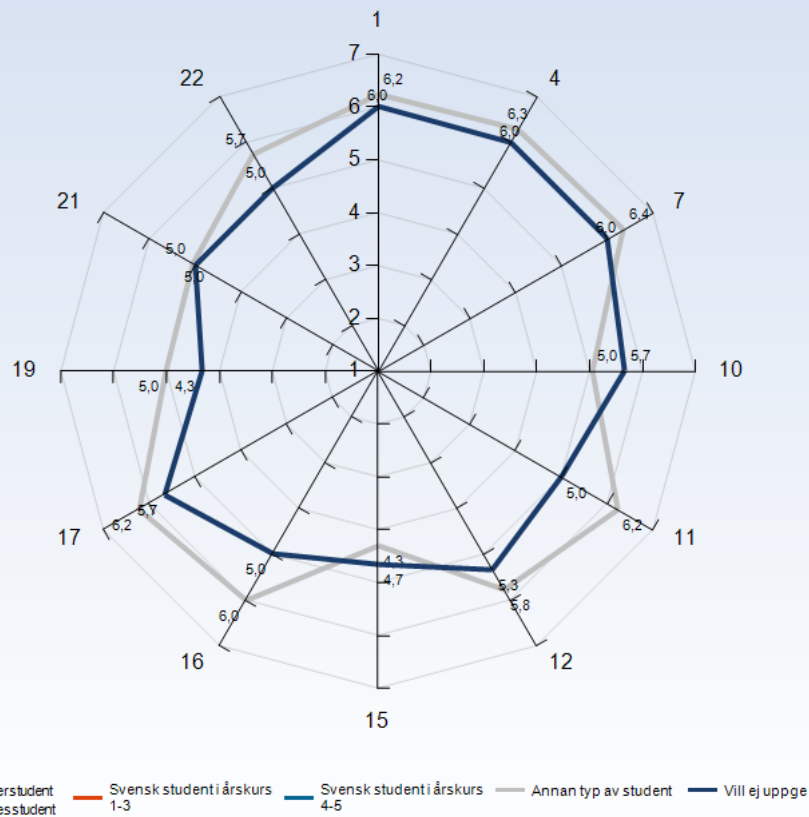
### Comments

Comments (I am: Man)

I'm not sure what to say, but I did notice that pretty much all other students taking the course whom I interacted with gave me the impression of being men.

I don't think there is a difference in this aspect.

### Average response to LEQ statements - per type of student



### Comments

Comments (I am: Annan typ av student)

International PhD in first year.

PhD student. Very useful course to take in the beginning of my PhD, and I am very impressed by how appropriate the level of challenge was. I found this course very motivating for my continued studies.

Ph.D. student

PhD student in year 2

1st year PhD student, not born in Sweden, but Swedish citizen (och kan svenska)

PhD

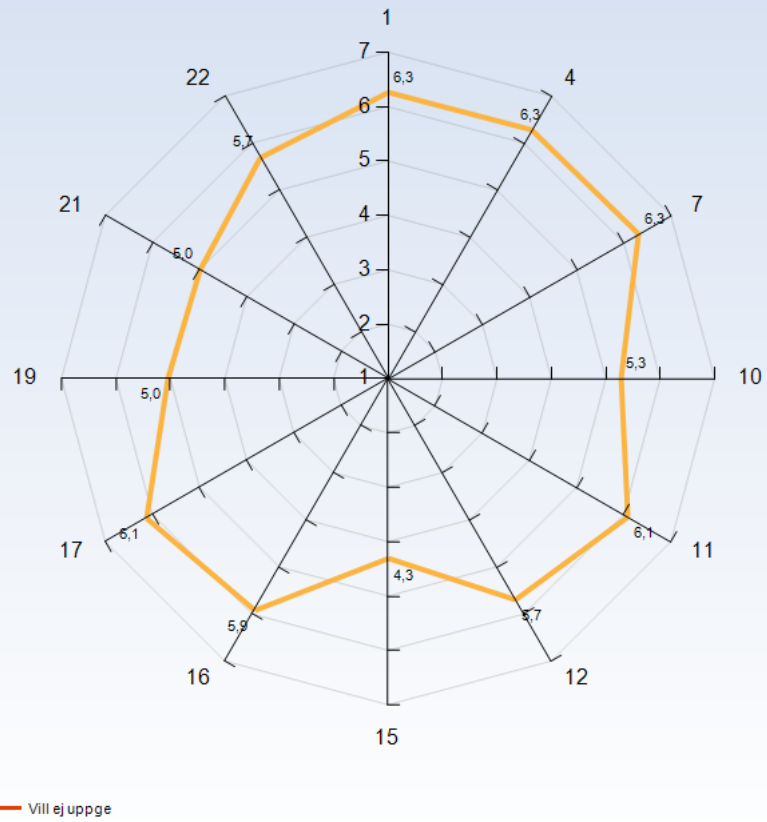
PhD student

2-nd year Phd student with an international master degree?

Industrial Ph.D.

Industrial PhD

### Average response to LEQ statements - per disability



Comments



## GENERAL QUESTIONS

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### What was the best aspect of the course?

What was the best aspect of the course? (I worked: 3-5 timmar/vecka)

the recorded lecture video is very good for reviewing.

What was the best aspect of the course? (I worked: 6-8 timmar/vecka)

The subject is truly important and useful.

Assignments

What was the best aspect of the course? (I worked: 9-11 timmar/vecka)

It is a very informative course and very research-related. The exercise also helps a lot in understanding the course content.

Solving the homework assignments was an enjoyable experience.

What was the best aspect of the course? (I worked: 15-17 timmar/vecka)

Learn new concepts

See different ways of solving an exercise when grading

I would say the combination of the contents feeling very relevant and it being presented in a very pedagogical manner

The lectures in the first half of the course were great. You did a good job using Zoom's features for interactivity.

What was the best aspect of the course? (I worked: 18-20 timmar/vecka)

A lot of freedom, could structure the course as I wanted to - no mandatory presence.

A broad overview of linear algebra.

What was the best aspect of the course? (I worked: 21-23 timmar/vecka)

1. The homeworks are nicely designed/chosen to evaluate both basic understanding and advanced usage.

2. Peer grading helps me understand what kind of proof writing is good and how to improve the readability.

I enjoyed the recorded video lectures and that it was easy to follow the book alongside the lecture (except maybe the chapter about eigenvalue-circles, that felt really messy).

The recorded lectures were preferred more than the live online lectures.

For the recorded ones, one didn't have to schedule according to the course, and could see them at any time and also in their own pace, pausing and rewinding.

The recorded lectures were also better than simply lecture slides, because Magnus was writing some examples by hand which was helpful!

What was the best aspect of the course? (I worked: 24-26 timmar/vecka)

review of all the high priority mathematics in journals published in the engineering field. students were learned how to use these mathematics tools for work with matrix equations and solving the matrix problem in their research field. (at least for me)

Feeling good after you complete the very difficult questions in the homework.

What was the best aspect of the course? (I worked: 27-29 timmar/vecka)

Interesting content

Very broad knowledge has been encountered from various subjects. Skills for solving difficult problems have been improved.

teaching and lecture sessions. Questionnaires in the lecture, and bit of interactions.

What was the best aspect of the course? (I worked: 36-38 timmar/vecka)

It was pretty clear what was expected and solved well considering the special times.





### What would you suggest to improve?

What would you suggest to improve? (I worked: 6-8 timmar/vecka)

Some of the home works did not target very useful problems and required a great deal of time to solve.

Maybe there will be one class about the homework solutions

What would you suggest to improve? (I worked: 9-11 timmar/vecka)

I really hope to have some way to flatten the difficulties of exercise problems. It takes me quite some time in some exercise questions and some hints would be really appreciated (especially when there is no hint from the book).

I would suggest providing the students with general guidelines on grading in the future. Right now, grading felt a bit like the wild west.

What would you suggest to improve? (I worked: 15-17 timmar/vecka)

Access to the correct solutions after submission of the homework sets. In that way grading would be easier and more precise.

Not much, but at some point I found that certain homework problems that seemed unreasonably difficult had associated hints in the book, which made them appropriately difficult. I wish we were told about those hints, as it doesn't seem fair that chance should decide if someone stumbles upon them or whether they try to solve problem that seem near-impossible without knowing about the hints. Based on my grading of other homeworks, I suspect some students never found out about the existence of those hints, and must have had a significantly harder time with the course.

- A lot of the homework questions were motivated by some engineering problem. For me (background in machine learning), this context was not always obvious and I think the questions would have been more educational if more of that context had been provided. The last question on the last homework sheet did this very well.

- Recorded lectures (second part of the course) are not a full replacement for live lectures: The lack of interactivity makes the lectures less engaging and less tailored to the audience

- The peer review process should be improved. First, it should be emphasized more that the reviewers are supposed to discuss with each other and write down their consensus view, not all of their individual notes. Second, there should be a possibility to question the reviewers' grading.

At several occasions, I felt graded inadequately and didn't know what to do about it. You could consider using peer grading software such as peergrade.io (I believe KTH has a license for it)

What would you suggest to improve? (I worked: 18-20 timmar/vecka)

The peer review does not seem like the most robust way of grading, several times in our group there was one person who consistently gave lower grades than the other members (being more stringent in his evaluation). It's hard to argue that someone's grading is "too harsh" especially since we - the students - don't really know each other. Also, some people did not really put in the effort, but rather just gave a full score without paying too much attention to it. Maybe a stronger criteria for properly motivated comments and grading should be given.

- More lectures would be good.

- Some more practical examples and problem-solving sessions using the concepts learned would be helpful.

- I felt the textbook was a bit cumbersome to follow at times and I actually understood many concepts by watching the lectures from Gilbert Strang's popular youtube lecture series.

What would you suggest to improve? (I worked: 21-23 timmar/vecka)

The course period should be extended 1.5x to 2x longer.

I think there is a problem in allowing hand written submissions. Some people have very bad handwriting and didn't seem to care to write a clean solution after they solved it.

This made grading very difficult at times, because it was difficult to understand the flow and any precise details.

Of course, formatting the solutions takes time, but I think it can be worth it from a learning and grading perspective.

What would you suggest to improve? (I worked: 24-26 timmar/vecka)

it's better to generate new homework from the application science and ask students to convert it to the matrix algebra equation and solve it. (as a part of homework)

Add more practical examples and usages of the matrix algebra in disciplines relevant to PhD students.

What would you suggest to improve? (I worked: 27-29 timmar/vecka)

More examples of application

More practical examples for various theories are appreciated.

More interactions and discussions for assignments.

What would you suggest to improve? (I worked: 36-38 timmar/vecka)

More of the concrete examples how to use the results for more efficient Matlab coding.

What would you suggest to improve? (I worked: > 41 timmar/vecka)

It could be helpful if the students could know the total marks of all the assignments from the beginning.



### What advice would you like to give to future participants?

What advice would you like to give to future participants? (I worked: 3-5 timmar/vecka)

work harder

What advice would you like to give to future participants? (I worked: 6-8 timmar/vecka)

Study the lectures and the book very hard before trying to solve the problems.

No

What advice would you like to give to future participants? (I worked: 9-11 timmar/vecka)

Never start to do the exercise near the deadline. Many exercises are harder than you see them at a glance.

What advice would you like to give to future participants? (I worked: 15-17 timmar/vecka)

Check the hints at the back of the book. Also, quickly look through the homework problem before sitting down and taking your time to read through the associated chapter in the book, it will help you to keep an eye out for important theorems.

The homework problems aren't ordered by difficulty.

What advice would you like to give to future participants? (I worked: 18-20 timmar/vecka)

Make sure you have enough time for the homework, it's fairly time consuming to make a proper work.

- Look for other avenues to learn apart from the textbook. You have to put a lot of time and effort by yourself.

What advice would you like to give to future participants? (I worked: 21-23 timmar/vecka)

Please make sure you have reserve enough time for this course.

The homeworks take more time than you think, plan accordingly! Google is your friend for difficult assignments.

What advice would you like to give to future participants? (I worked: 24-26 timmar/vecka)

Put more time to read the sourcebooks and try to fully understand what happened inside the theorem.

Start working early on the homeworks

What advice would you like to give to future participants? (I worked: 27-29 timmar/vecka)

Review the basic knowledge/textbook carefully.

Prepare yourself with matrix and vector algebra.

What advice would you like to give to future participants? (I worked: 36-38 timmar/vecka)

Talk to your fellow students!

### Is there anything else you would like to add?

Is there anything else you would like to add? (I worked: 6-8 timmar/vecka)

No

Is there anything else you would like to add? (I worked: 9-11 timmar/vecka)

None

Is there anything else you would like to add? (I worked: 15-17 timmar/vecka)

Great course overall, I wish all courses were this good!

Is there anything else you would like to add? (I worked: 27-29 timmar/vecka)

It will be appreciated that the threshold for passing can be reduced a bit. Since I am an industrial Ph.D. student, it is very likely that some week will be fully occupied by travelling, meeting the deadline, etc. Therefore it is inevitable that one assignment could be hard to complete if it is difficult. Missing one assignment significantly reduces the possibility for passing even though we have worked very hard for the rest of the time.

None.

## SPECIFIC QUESTIONS

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## RESPONSE DATA

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The diagrams below show the detailed response to the LEQ statements.  
The response scale is defined by:

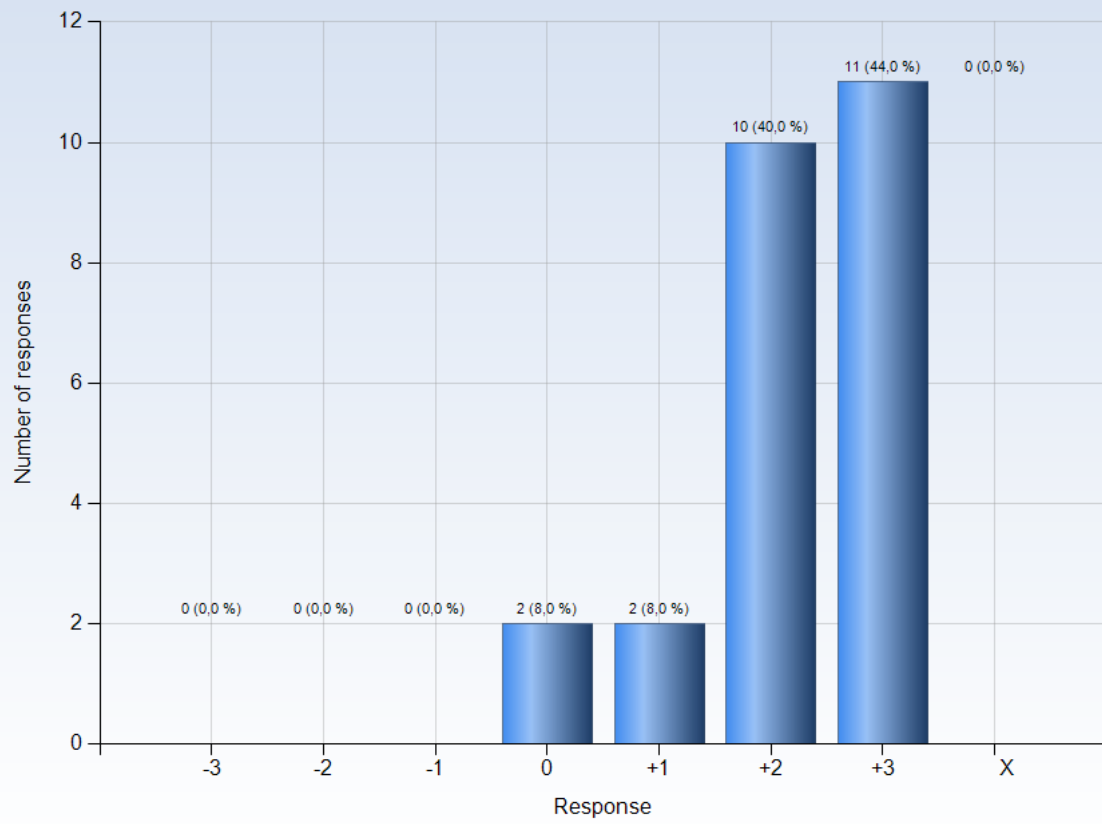
-3 = No, I strongly disagree with the statement

0 = I am neutral to the statement

+3 = Yes, I strongly agree with the statement

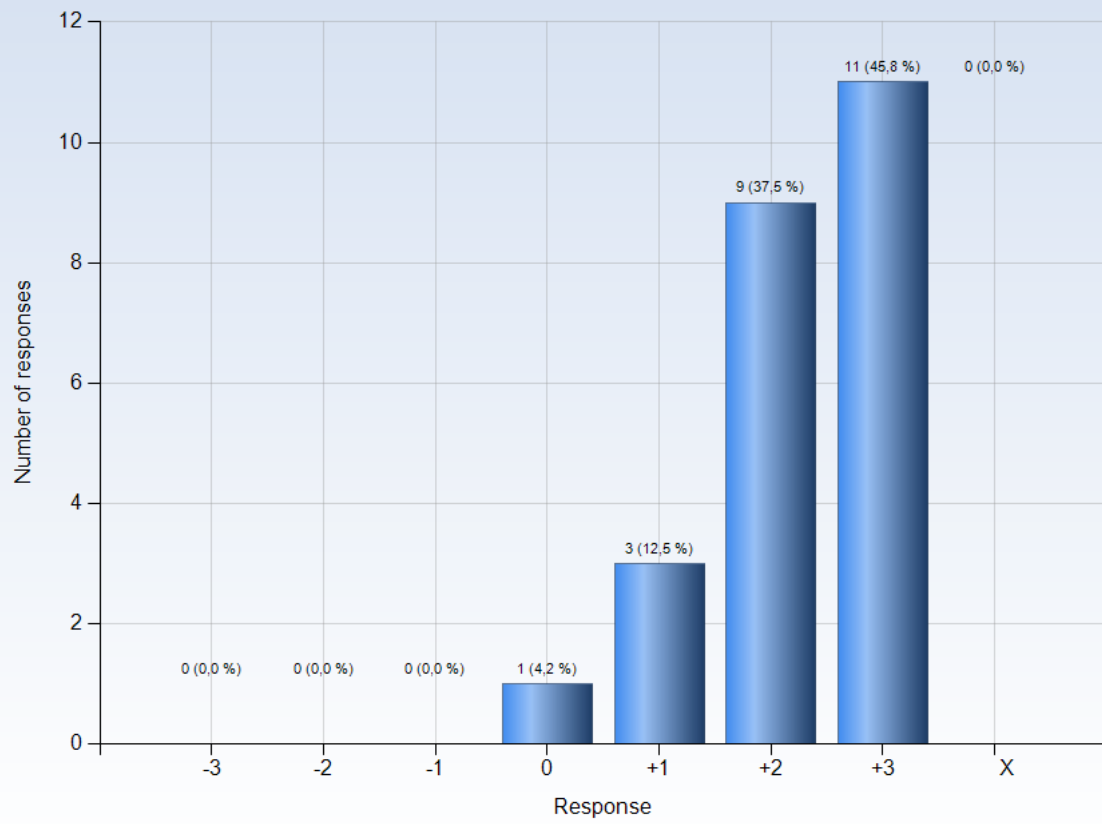
X = I decline to take a position on the statement

### 1. I worked with interesting issues



Comments

#### 4. The course was challenging in a stimulating way

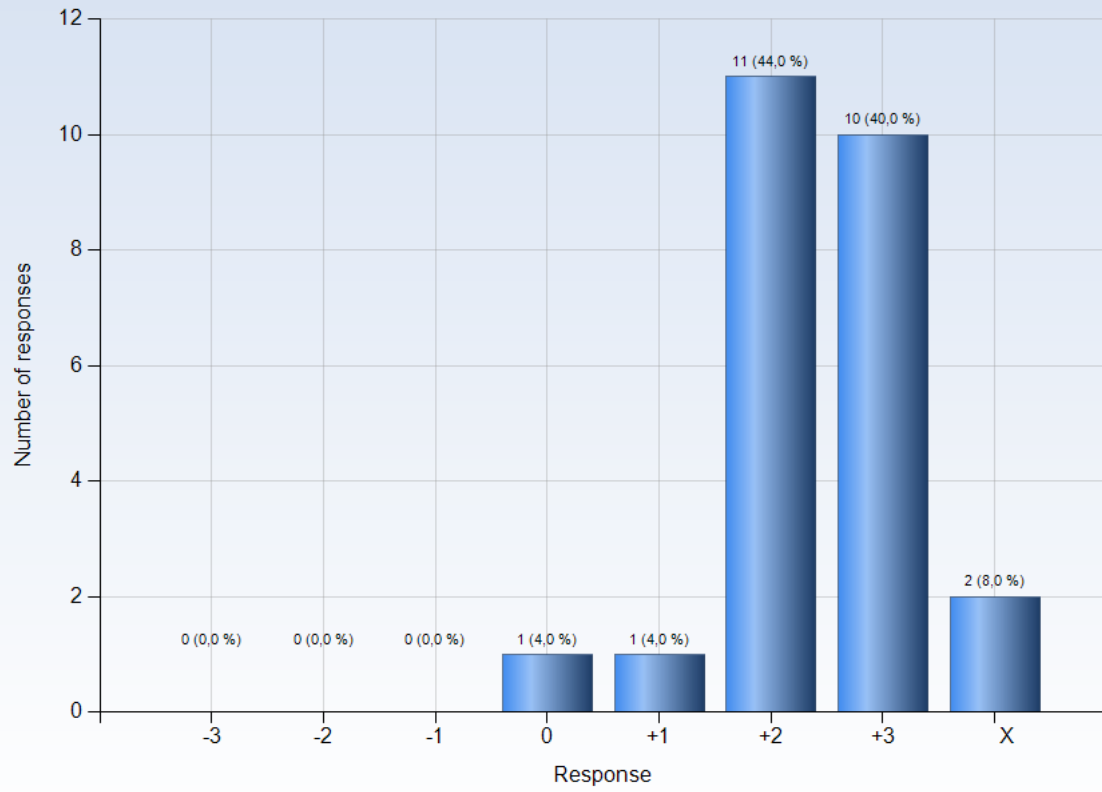


#### Comments

Comments (My response was: +1)

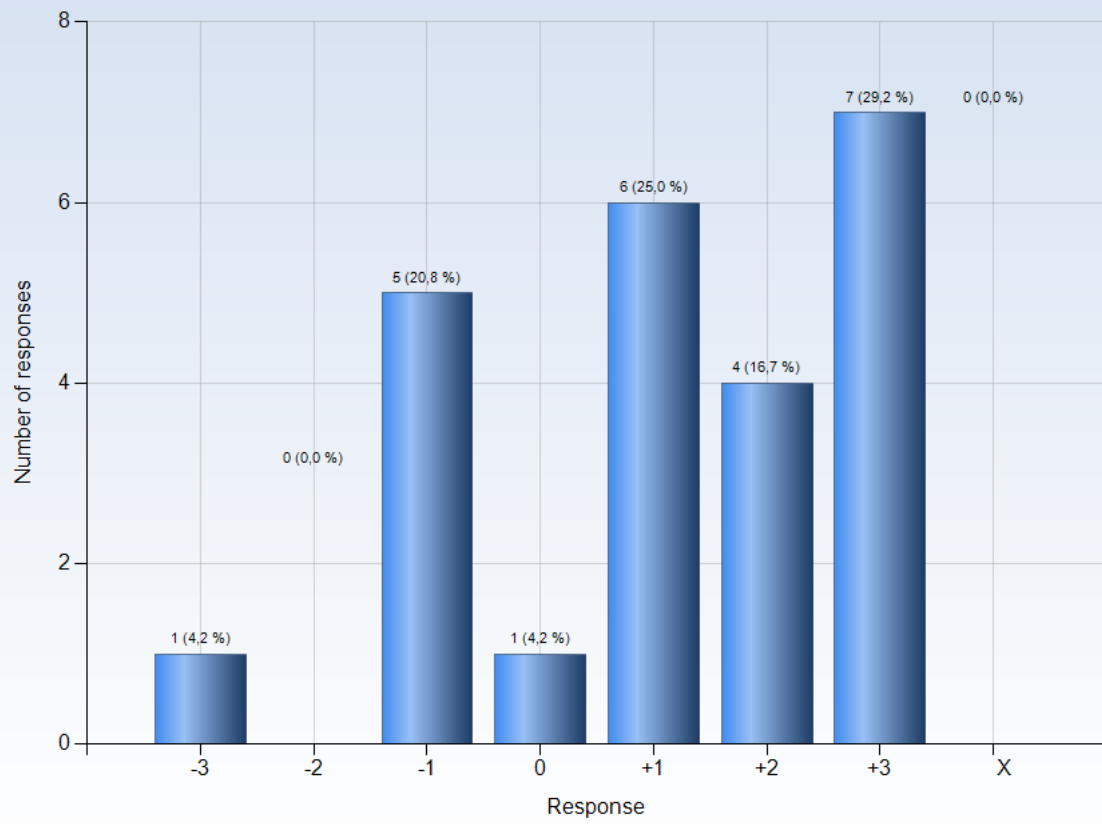
Many time challenging, but some exercises felt annoying -- i.e. not stimulating.

### 7. The intended learning outcomes helped me to understand what I was expected to achieve



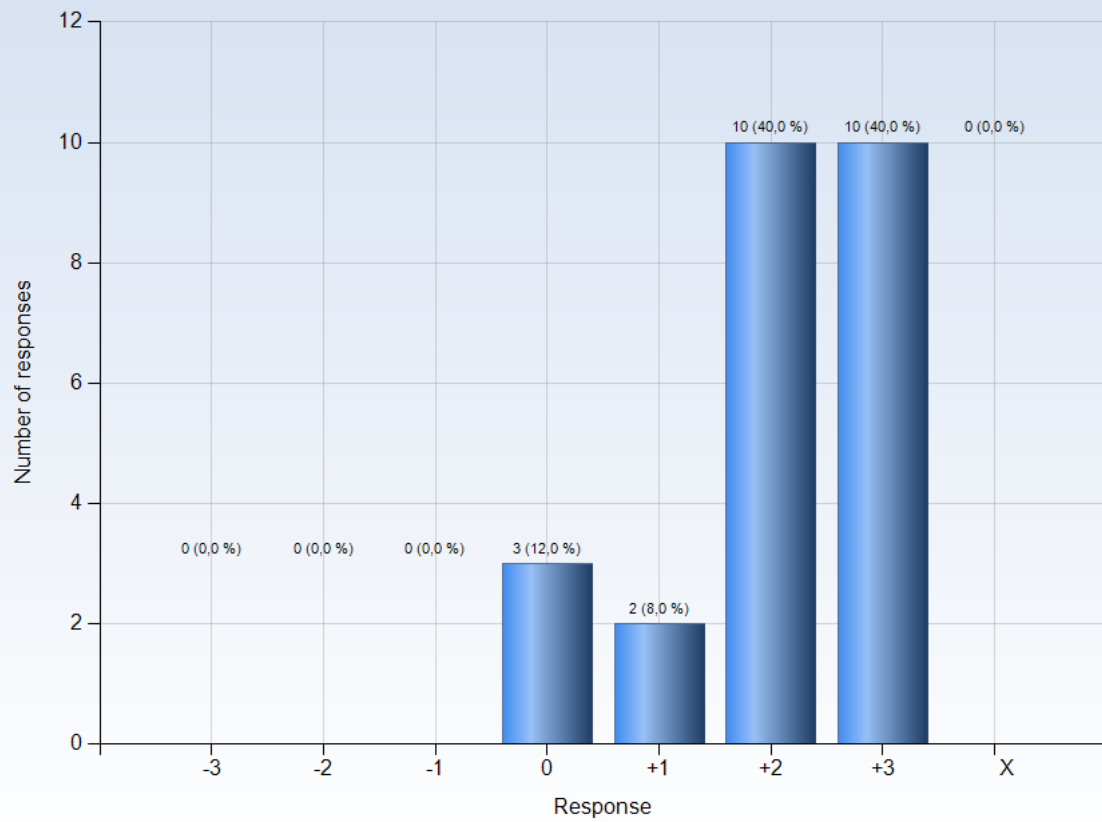
Comments

10. I was able to learn from concrete examples that I could to relate to



Comments

### 11. Understanding of key concepts had high priority



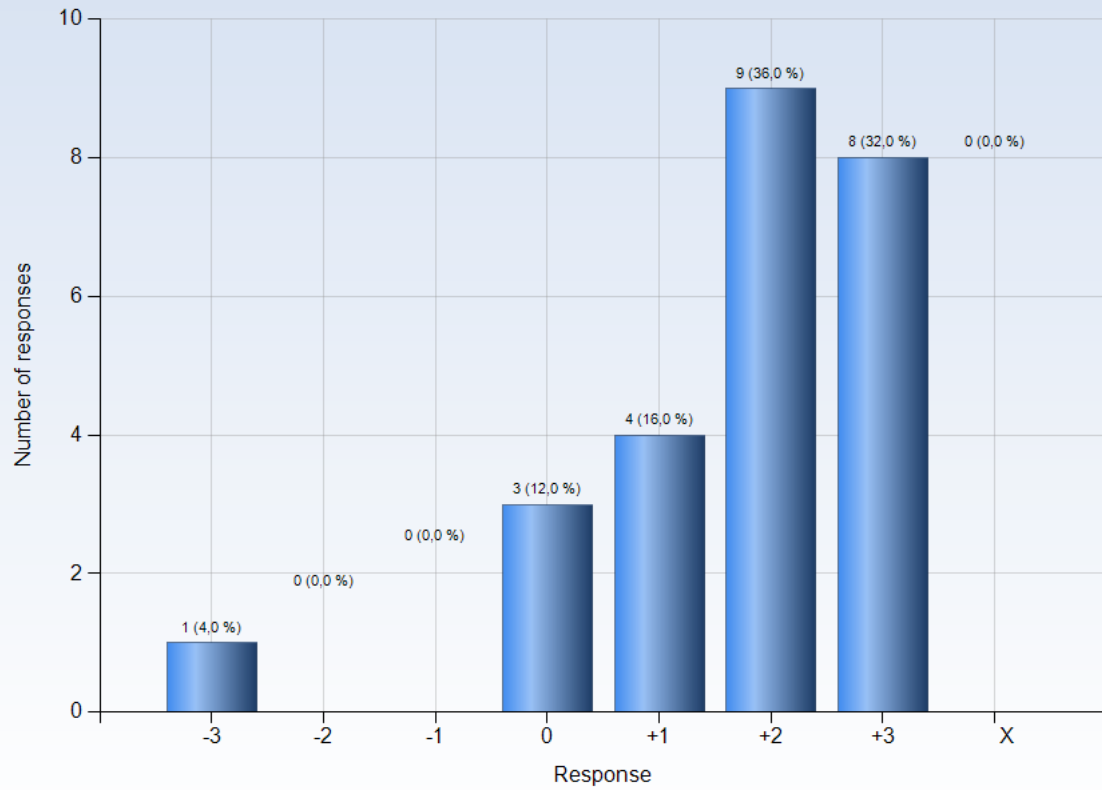
#### Comments

Comments (My response was: 0)

The topics were a bit all over the place but that's just in the nature of this course I think.



## 12. The course activities helped me to achieve the intended learning outcomes efficiently

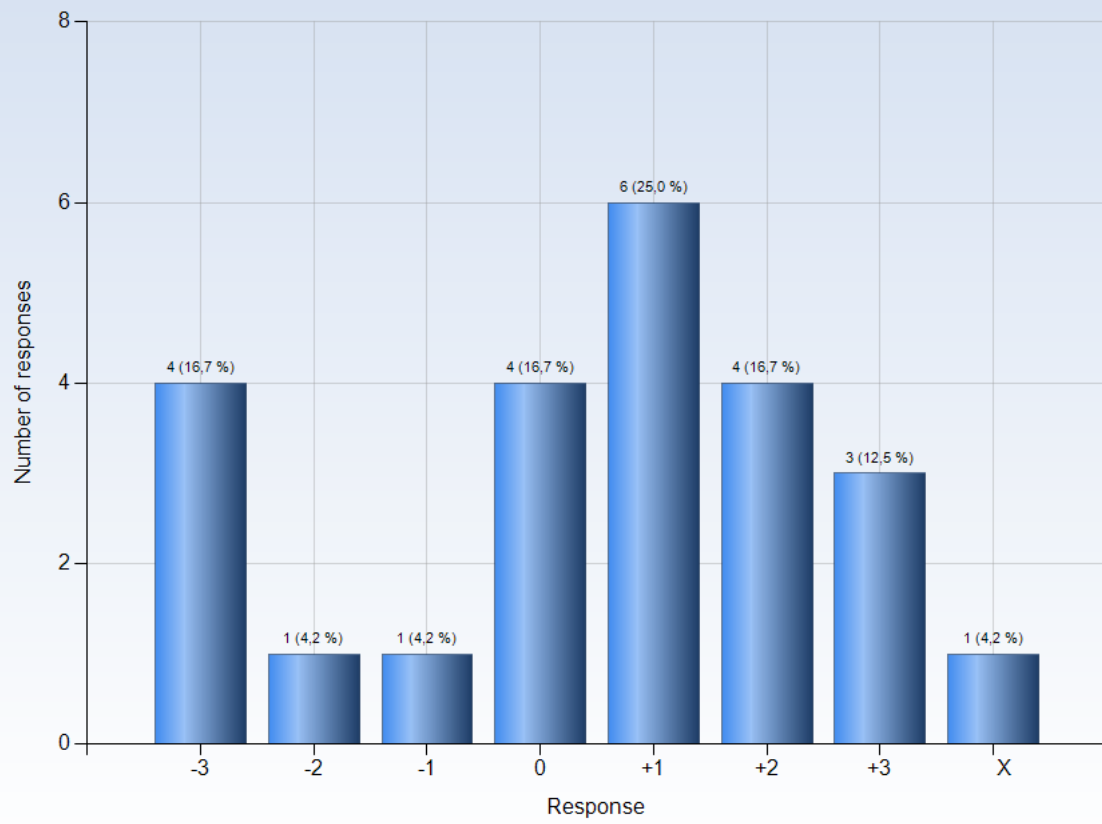


### Comments

Comments (My response was: +2)

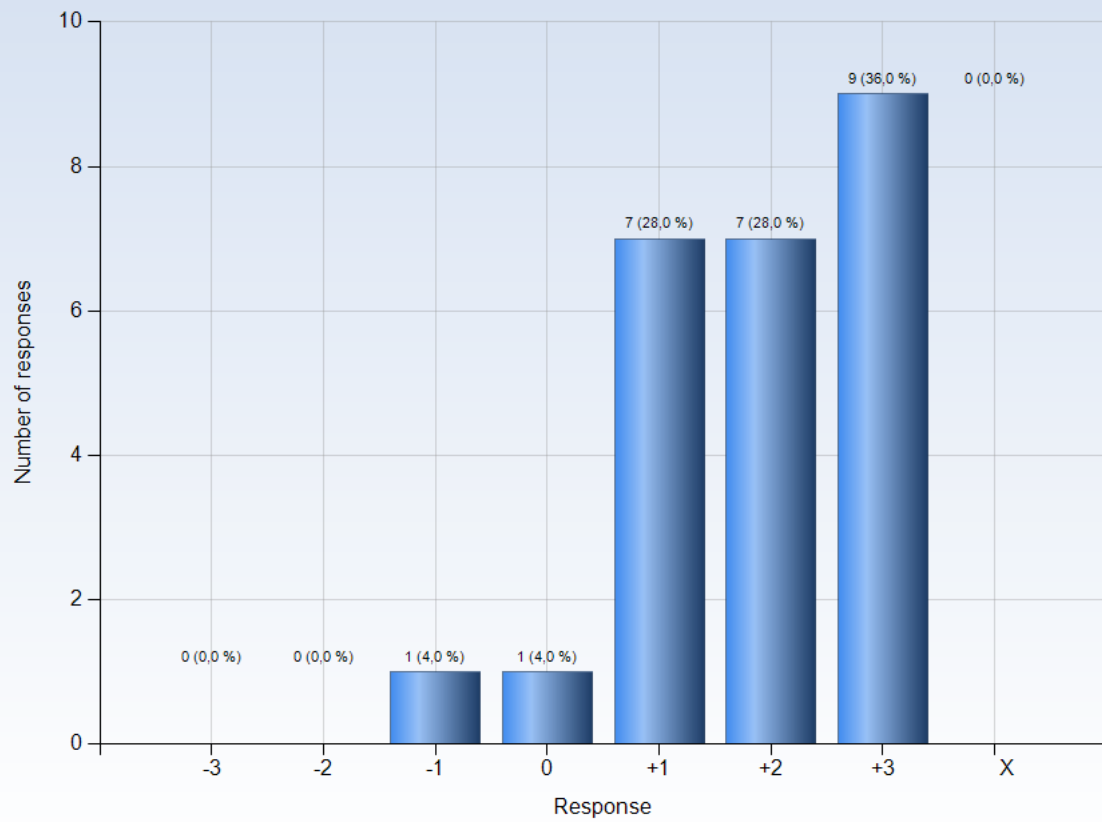
The homeworks is a good way to give incentive to follow the book. But I was often under time limit so I had to rush through some chapters.

### 15. I was able to practice and receive feedback without being graded



Comments

### 16. The assessment on the course was fair and honest



#### Comments

Comments (My response was: -1)

grading was subjective and depended on the examiner's knowledge

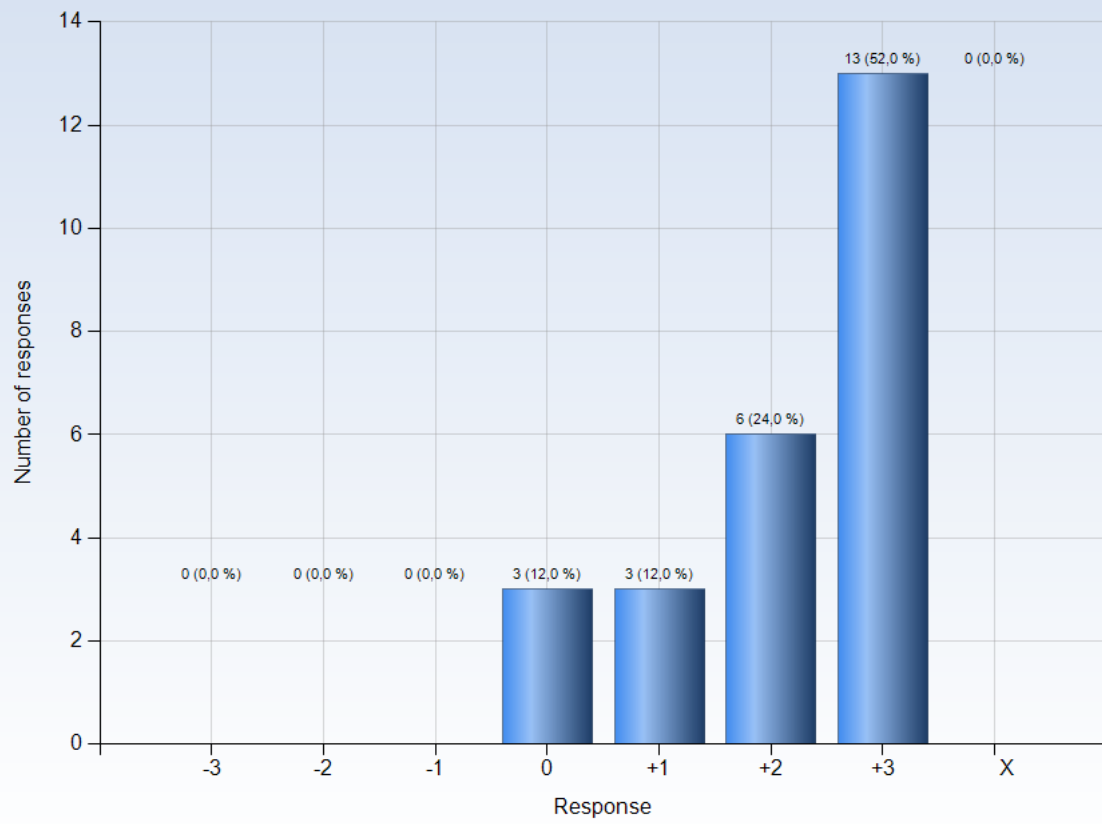
Comments (My response was: +1)

I got the feeling that some students who were grading were being "kind" instead of precise.

Comments (My response was: +2)

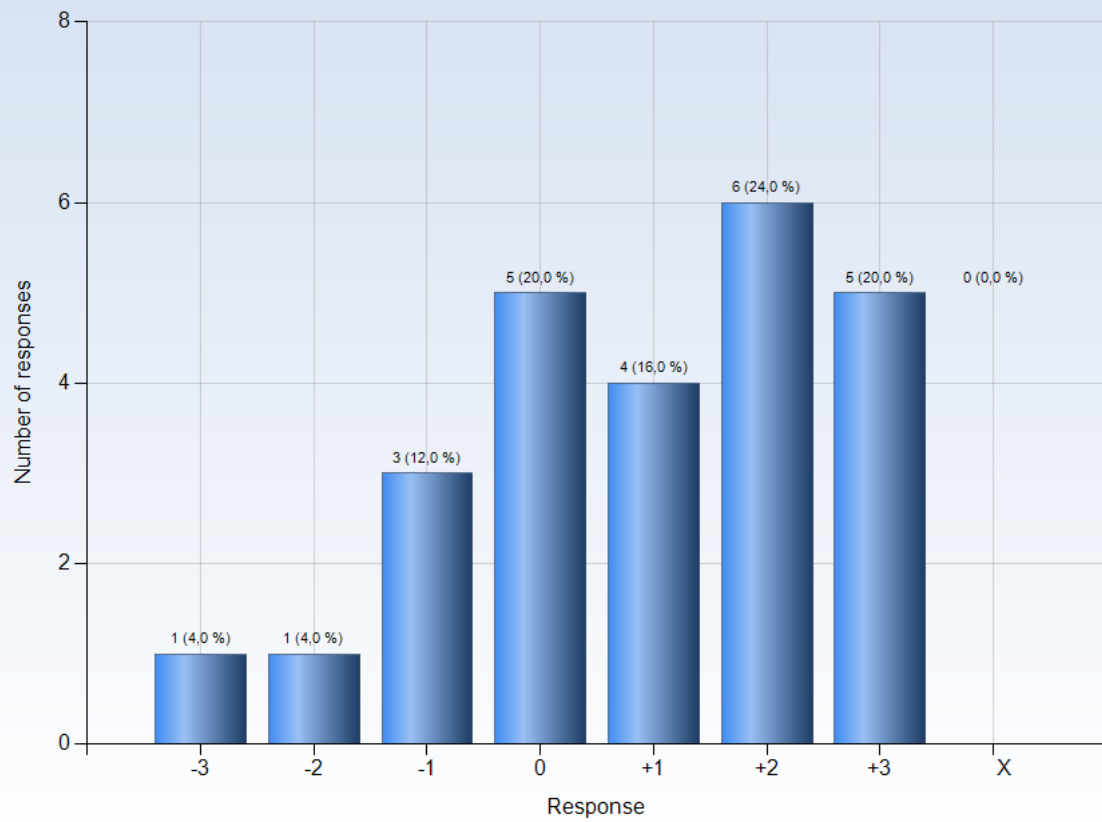
Missing one assignment makes the possibility of passing very low

### 17. My background knowledge was sufficient to follow the course



Comments

### 19. The course activities enabled me to learn in different ways

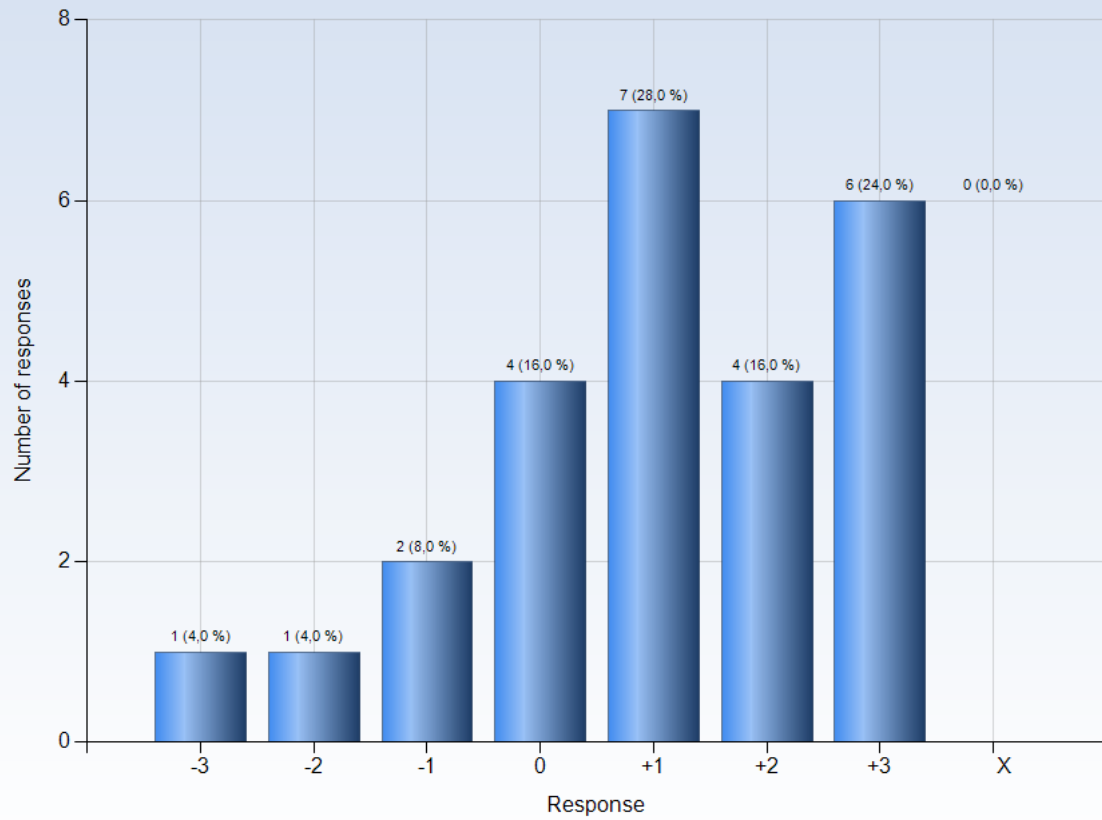


#### Comments

Comments (My response was: -1)

Very static learning process, same from every week.

### 21. I was able to learn by collaborating and discussing with others



#### Comments

Comments (My response was: -2)

This is mostly corona's fault

Comments (My response was: +1)

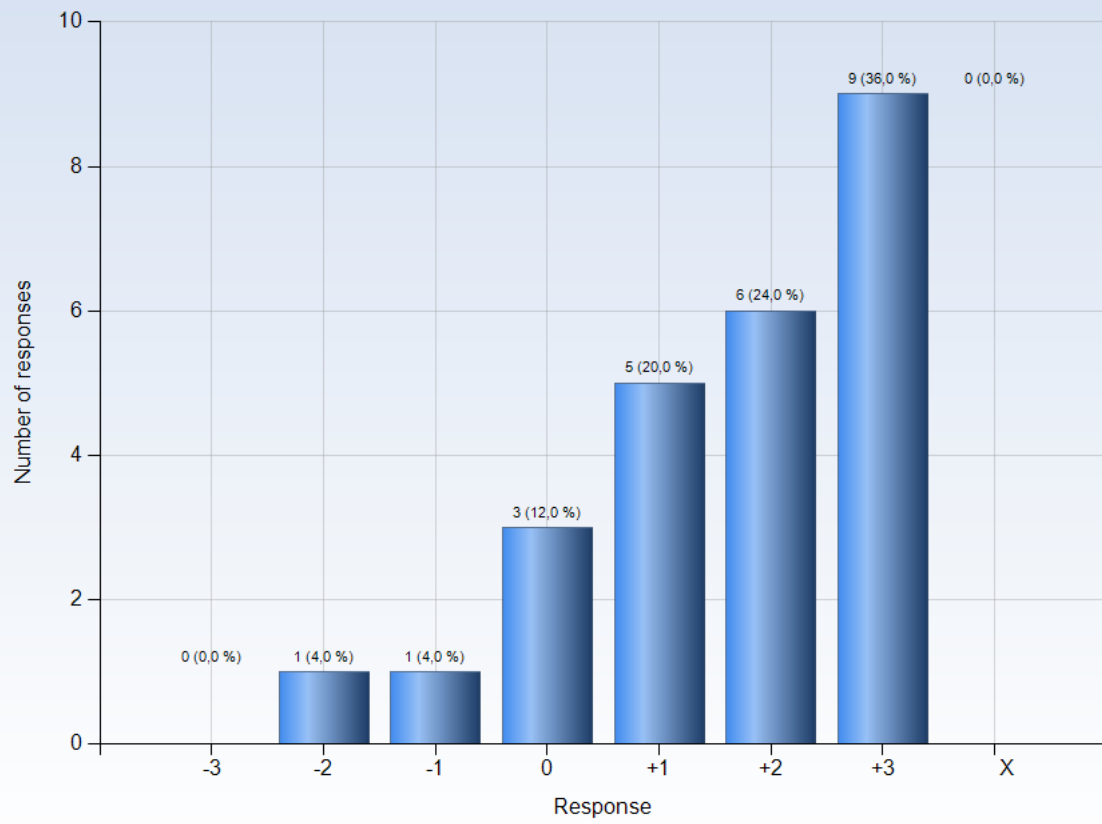
Since it was given at a distance, discussing with other became a bit harder

I don't know that the work can be done via collaborating. I have done all the work on my own

Comments (My response was: +3)

Would be better without Corona restrictions of course

### 22. I was able to get support if I needed it



Comments