DH2321 2023 Information Visualization Course Analysis

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Description of the course analysis process

The course instructor and examiner, Mario Romero, the course teaching assistants, Alessandro Iop and Marko Petrovic, and the Visualization Studio's Björn Thuresson and Ingemar Markström, together analyzed the results of the course evaluation. They synthesized the main topics and included them in this report.

Changes introduced in 2023

1. Project One was altered to be an individual assignment (rather than in groups of 2-3).
2. course evaluation was an assignment with 0 points, but that allowed us to remind students who did not complete it. This produced significantly more participation in the course evaluation. 40/45 participated.
3. initially we had rooms in the U building and we voted with the student and majority chose VIC. This year is all VIC. Confirmed in Kopps.
4. We only had one offer from an industrial partner, Angie Skazka from Gapminder. Angie presented the day after people formed groups and some of these groups had already chosen a topic. We must return to offers on the day of group forming.
5. Small updates to quizzes to account for live data visualization. We opened the quizzes at 8:00 to 12:00.
6. This year we had an online open house with InfraVis participation which included critical feedback for InfraVis Application Experts in visualization. This was a 4-hour event that was also recorded and broadcast live.
7. Mario recorded video feedback to the project drafts without handing grade. It takes 3 hours. We will continue to do it.
8. We link to their final slides in the project table and this is useful content. We will keep this change.
9. In 2022, we proposed and completed these changes:
    a. Re-structure the lectures to give more time to visual perception.
    b. Redesign the tests to give the students more time and have more questions that are stable. For example, for the tests where students use online visualizations, we can't use live data.
    c. Re-introduce external offers for final projects - partially with Angie's offer.
    d. Re-define first project to be individual.
10. This one change we did not introduce:
    a. We introduce a voluntary tutorial of D3. We decided that there exist enough online tutorials for D3.
11. We must make sure that we provide special requirements for people with needs. This can be recorded and communicated clearly and repeatedly.

Comparing results with previous years

Online open house is here to stay. It was a very positive experience both for students as well as InfraVis experts. We simply need to put it in people's calendars as early as possible to maximize participation.

Analysis of the course evaluation with planned developments for the next round of the course

Response to course evaluation

In 2022 the course evaluation participation was low at eight responses out of 43 course participants. This year, we made an assignment with 0 points simply to state "I have sent the evaluation" and this allowed the instructors to remind only those who had not stated it. We got 41/45. This is a change that stays.

Time spent on course activities

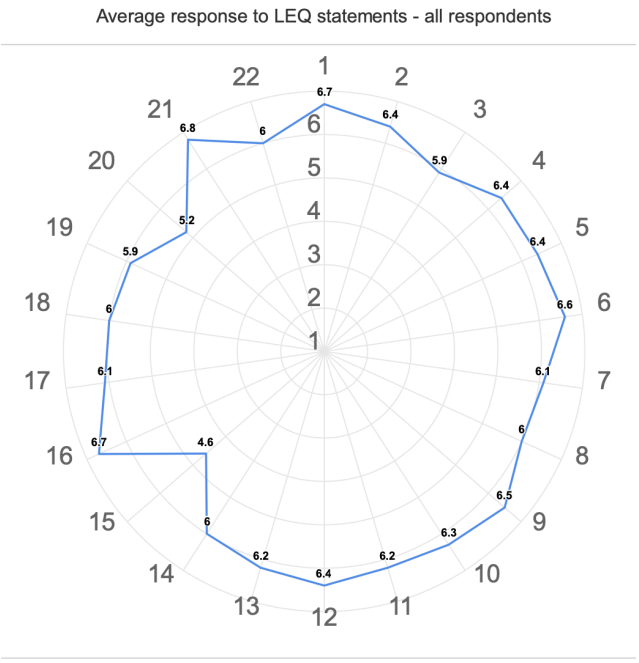
The course is a 6HP course. Using 27 hours of work per credit, that amounts to 162 hours of work which distributed over 9 weeks from week 3 to 11 gives 18 hours of work per week. In **2022**, students on average reported working **18.3** hours per week. In **2023**, students on average reported working **17.7** hours per week. This is expected, as the sample went from 8 to 41. One student reported working less than 2 hours per week while one, more than 40. Comments from students:

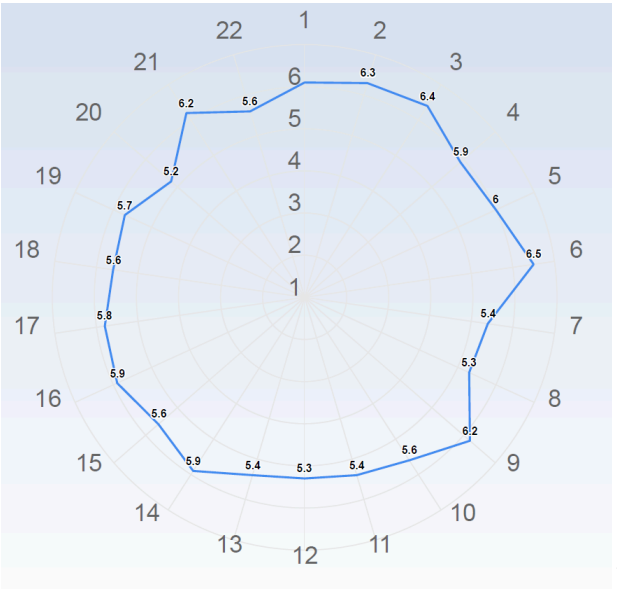
- Comments (I worked: 9-11 timmar/vecka)
    - Hours-wise, it was an exponential. It started slow (except for the individual project), but once we got into development I really put many hours into it.
    - I would have liked to spend more time on the course however I felt I couldn't as I needed to spend a lot of time on other courses.
- Comments (I worked: 12-14 timmar/vecka)
    - The amount of work varied a lot in the first half of the course, then became more regular. The reading seemed time-consuming compared to what I learned from it. I think a video format would be a nice replacement of reading as it seems more adapted to the type of content (visualization of information), and would make concepts more clear I feel.
    - I think that the workload was reasonable.
- Comments (I worked: 15-17 timmar/vecka)
    - *Do not take my estimate of hours for this seriously.* I do not keep track of the time I actually use (and I do not like the credit system due to its link to time, so I do not care) I can offer this comment instead: Compared to other courses, the workload here is definitely very high and it's a very intense course.
- Comments (I worked: 18-20 timmar/vecka)
    - I don't think my amount of workload is what this course actually requires, i just ended up in a team with people barely working.
- Comments (I worked: 24-26 timmar/vecka)

    - I really liked the course so I wanted to spend more time with it.
    - I put a lot of effort into the course because I wanted to, but it was not really necessary to work as much
- Comments (I worked: 27-29 timmar/vecka)
    - Amazing course in which you can decide how much time one want to put on the assignments. The time required is dependent on one's skill level going in. However, it is not required to put in an enormous amount of time, but I got encouraged by the atmosphere and by how fun the subjects were in general.
    - This course was more fun than my other course and therefore I spent more time in it.
- Comments (I worked: 36-38 timmar/vecka)
    - **Too much work in too little time.**
- Comments (I worked: > 41 timmar/vecka)
    - The vast majority of the time was spent on the project.

It is important to split these estimates based on the subject major of the students. How much time do people from computer science spend programming?, for example. Otherwise, this is an expected response. In the future, we can warn students that it starts at one level and then ramps up. Towards the end of the final project, it requires significantly more effort.

Analysis of LEQ survey statements



 [1]

All the LEQ survey statements were above 5.0, meaning all average entries are positive. The three statements we will focus on to analyze are 7, 8, 10-13, 20, 22 which received the lowest scores. Comparisons with last year's answers are avoided due to the great difference in sample sizes.

[1] 2023 chart is on the right

Statement 7 is “The intended learning outcomes helped me to understand what I was expected to achieve”. The average is 5.4.

- Comments (My response was: -2)
    - They were very generic and were not what I expected of it when I read it.
- Comments (My response was: +1)
    - I did not look at them that much

Reflection: Mario can make a point to give concrete examples of achieving ILOs and make a recording. Flip it.

Statement 8 is “The course was organized in a way that supported my learning”. The average is 5.3.

- Comments (My response was: -3)
    - Same as above.

Reflection: In the same flipped video, Mario can explain how the course structure is meant to achieve ILOs.

Statement 10 is “I was able to learn from concrete examples that I could relate to”. The average is 5.6.

- Comments (My response was: +1)
    - My teammates were great.

Reflection: We give concrete examples constantly. Could this be concrete examples of code solutions? We do not give tutorials on technical issues.

Statement 11 is “Understanding of key concepts had high priority”. The average is 5.4.

- Comments (My response was: -2)
    - Sometimes I felt like we spend a lot of time in the lecture just talking about stuff that was not very relevant for the course topics. For me personally, I would have wished that the lectures contained more content directly related to information visualization.
- Comments (My response was: -1)
    - We had quizzes that were worth too many points and the professors didnt teach us the basics for codic and dont code themselves, while expecting us to know.

Reflection: we can be clearer about what “key concepts” means vs. particular examples of coding in specific languages, for example. We can also make it clearer that we are not going to cover specifics of programming.

Statement 12 is “The course activities helped me to achieve the intended learning outcomes efficiently”. The average is 5.3.

- (My response was: -3)

    - Large parts of the project had no relation to the learning goals, i.e. setting up a website, processing data, etc.
    - The expectation were really high for a high grade and they didnt really transfer that knowledge to us to be able to demand that in return.
- (My response was: 0)
    - i feel like the readings and projects (self study) was more important than lecture itself, maybe lecture could have some more content

Reflection: Again, we can specify how activities and structure support ILOs in a flipped video. This is a common problem with ILOs. They are high-level and abstract. They should not be specific to technologies, for example. The students want a map between what they are supposed to do to achieve an ILO.

Statement 13 is “I understood what I was expected to learn in order to obtain a certain grade”. The average is 5.4.

- Comments (My response was: -2)
    - Grading criteria were vague at points.
- Comments (My response was: -1)
    - Not really, aince the quizzes were quite subjective (What is the most/least important thing here) and the journal were just so open.
- Comments (My response was: +1)
    - Occationally the assignment descriptions were a bit too vauge ie final submission could have been elaborated a bit to make it more comprehensive what aspects of the learning goals you wished to know (assumed general course learning goals not individual as well)
- Comments (My response was: +3)
    - often good, concrete grading scales given

Reflection: Flip all assignment descriptions and grading criteria and open a discussion in Canvas.

Statement 20 says: “I had opportunities to influence the course activities”. The average is 5.2.

- Comments (My response was: -3)
    - Not really, all the feedback is going to be implemented next year and the quizzes remained the same

Reflection: The course activities and structure are not up for debate. Students can suggest changes and we may consider them. For example, moving a date or a content of a presentation. Also, students can propose changes for next year. Too much of the course is planned too far in advance for student influence to meaningfully affect course content/scheduling for the current year.

Statement 22 is “I was able to get support if I needed it”. The average is 5.6.

- Comments (My response was: 0)
    - Maybe put more emphasis on technical support, in terms of coding help.

- Comments (My response was: +2)
    - Same as above.

We designed the course carefully to be structured in such a way that we can fit relevant activities that are structurally aligned with intended learning outcomes from the beginning. There are very few opportunities to have a flexible structure of activities supporting the students' learning. Yet, we think that we can engage the students in thinking about different activities that they can do that relates to their learning both as part of the regularly scheduled meetings and as part of events which students handle on their own as team members. It is important to note here that we aim at enhancing the richness of activities at the students to to learn without increasing the responsibilities of and time required from the instructors.

The split averages by gender and by nationality of the students are different from the overall average, but they are difficult to interpret with lack of statistics. We just get the average.

Analysis of general questions

To the general question "**what was the best aspect of the course?**", we received a number of replies. Here's a representative sample directly quoting the students:

- Honestly the lecture were a breath of fresh air. It finally made me feel like I was a Master's student and not an undergraduate. Kudos.
- Very open, learn by doing format, with a teacher who is clearly passionate about the topic. And unlike some other courses which has the learning by doing format, it does not rely on a rigid skeleton of labs with extremely specific scenarios and expecting specific solutions. But rather grants the students a large tool box of tricks and resources, and the freedom on how to solve the problem.
- That the grade was based on scores from muliple different assignments rather than one big exam or deliverable. This is good because ones capasity can vary from week to week, and one could have a bad week or day at the time of an exam, whereas this way you can distibute the stress/pressure. On the other hand, this also lead to more stress thorughout the whole of the course... buuuuut I'd still prefer this over a big exam/deliverable.
- The lectures which covered interesting topics and where well executed.
- I loved the professor taking advantage of the VIC - I thought that was unique idea
- - project was very open, you could do whatever you wanted to do - actually quite nice with only one lecture a week
- The interactive sessions with the lecturers.
- 1) The lectures are actually quite great and the teacher manages to convey the topics in a very understandable (and also entertaining way) 2) I love the passion the lecturer has and how engaging the lectures are (classroom feels alive) 3) I love how professional it all is set up. 4) The projects and especially the freedom you have with them are absolutely great.
- Actively discussing with the teacher and with the other students during the lectures!
- To learn from my teammates, which all had a very different skill-set. This made me learn both technical skills and more design-oriented knowledge
- The freedom for everyone to spend more time than needed to create something good

Reflections: The positive feedback conveys the results that the team intended for the course when designing its activities and lectures. There is no miscommunication here.

For the question "**What would you suggest to improve?**", we have a number of answers which we synthesize below.
The feedback was very distributed. a selection of quotes:

- 1) Lectures were a waste of time. Everything discussed in lecture was something we had already read in the required readings. Why not use lecture time to actually teach students the skills required to create a visualization, rather than just pontificating on the philosophy and tradeoff of design styles and best practices. A better use of time would be for lectures to have tutorials of the hard skills that students need to succeed in the course (ie D3, JavaScript, etc.)
  2) Learning journals were far too structured and added unnecessary requirements. See comments in below questions
- Nothing comes to mind.
- Probably giving more time for the first individual project. Cut us some more slack.
- Feedback was usually discouraging and didn't really help me learn
- The presentation sessions were a bit too long. It is a bit hard to concentrate for the whole session and give the later groups as good feedback as those in the beginning.
- Sometimes the quiz questions were a bit unclear. We discussed which questions had issues in class.
- To increase the credits of this course to 7.5 or 9 hp and to split it over two periods to give the students time to work on their project for a more extended period

  Add some additional information about what is expected out of the hand ins. Ended up missing the inclusion of individual learning goals when only learning goals was listed (assumed the course's learning goals in that scenario).

  Having some lab sessions before the group project to test implementing visual structures, it would help to have guidelines on that and have sessions where you can easily ask for help with technical questions
- *I've assembled some, theoretically, actionable feedback items and prioritized it in terms of how important I think these are.*
  # Priority 1: Spreading out the course over one semester

  Time is often a very overlooked factor in many things.

  Having now experienced both the "courses run the entire semester" and the KTH "two-period" system, I sadly have to say that the former is better in almost every aspect.

  For this course this goes double. A lot of the content, it needs a bit of time to sink in. Having the course run over the entire semester will help people learn more and develop even better projects. This does not mean that the overall credits need to be increased for this in the first step, simply spacing out things more will almost certainly lead to better learning.
  # Priority 2: More time for the individual project

  I get that KTH loves group projects, but there is a LOT LOT LOT of value in doing individual projects, because that's when you really learn most. Especially in programming projects. I'm now doing a course where I can do the course project individually and it's pure bliss.

  The individual project in this course should therefore receive more attention,

more time. Maybe the course can be split half/half individual /group project. If you take action on prio 1, maybe the first period could be about the individual project, the second period about the group project.

Either way, currently the first project already has very high quality standards for the time it's done in the course, and it feels very rushed. It's not really fair to those without prior experience.

 # Priority 3: All grades should be targetable

Grading criteria sometimes need to be more precise and fixed, such that students know exactly what to do to receive a certain grade. This is not always the case and that is detrimental from a motivational perspective.

 # Priority 4: Learning journals are not useful

I don't think the learning journals are a good tool. Not everyone benefits from this kind of writing, it is not a good planning tool and also, for a variety of reasons, it is not good at measuring individual contributions. I would suggest leaving it out, or at least replace it with a "low maintenance" solution. That will make both your lives and student's life easier without taking value away.

 # Priority 5: Tests are good, but could be fairer

*1) No "most important" questions, unless the literature specifically states "most important". People extract different meaning from these things. It is impossible to judge what an author *could have meant* to be most important.*

2) Give double time for all the questions. People still won't be able to find answers in the book in that time, but especially the earlier tests felt a bit stressful. There is no need for that.

3) Interaction tests are great, but it should be discussed in class before that the scheme of test changes a bit. To get people to use right devices immediately, and also, surprises like that are always bad in tests. People should be aware of the format before going in.

 # Priority 6: Increase credits in the long run

Long term, this course still definitely deserves much more credits than it currently has. 9 would be appropriate for the effort, when compared to other courses. It will be worth starting this process. Also, consider adding an "Advanced Topics in Info Viz" course on top that starts exactly where this course has left off and aims to broaden horizons more.

- The lectures are quite vague. I would like to have more facts in the lectures (i.e. more teaching me things I didn't know and less discussion of things I'm already aware of). IMHO this is especially a problem for the "better" students or those that are further along in the studies as the discussions provide me with little additional information.
- Sometimes I felt like we spend a lot of time in the lecture just talking about stuff that was not very relevant for the course topics. E.g. the first visit in the visualization studio contained too much content that I did not consider as very relevant for me personally, e.g. looking at the screen and the projector in such detail. Later in the course, I felt like it was too much time spend on discussing our answers from the reading quizzes, e.g. I know that for at least two lectures, we spend the first approx. 40mins just on discussing the reading quiz, which was clearly too much time spent on this for me. Therefore, for me personally, I would have wished that the lectures contained more content directly related to information visualization in a more efficient way.

- Individual grading should be more fair. The learning journal doesn't measure the actual time and effort spent by a person. I ended up in a group where people were barely doing something, and ended up with getting a lower grade because my learning journal wasn't fulfilling some requirements which i find kind of "useless" (references written in the right place and stuff like that). I know that in the group forming activities you're supposed to choose carefully your teammates, but even so you can never know if somebody's actually going to work.
- Add some possible tuition for skills like d3
- Although I learned a lot from the lectures, I think they could be a bit more structured.
- It would be nice if the course was even bigger (a.k.a worth more points) since you would be able to take the projects further! Of course, that is a difficult thing to do within KTH's rigid regulations.
- maybe clearer structure of the lectures, i understand having discussions for a more interactive lecture, but sometimes it felt like the content was fully lost in it
- Project 1 was a bit stressful and it felt like it came a bit out of nowhere. After we had the lecture about it, it felt a bit more clear what was expected, but maybe it could be clarified a some more.
- Not much. Some of the quizzes were a bit odd, but it was explained that they were trying new things. But til next year, all quizzes should provide one page with all questions, instead of handing in one question at a time. This enables you to skip a question that you find difficult to come back to later.
- Have a D3 bootcamp at start of course - where you learn how to set up an environment with html, css and javascript with D3
- I would have liked to have the reading quiz not so early in the morning before class since it made it hard to make it to class do the quiz and have time for lunch.
- Give a tutorial about d3.js and just lessen the load, remove the quizzes.
- Would be nice if the lectures weren't all on the same day and time of the week.

Reflections:

1. Learning to program is a life-long activity that needs to be addressed daily for professional programmers. It takes much longer than we have in lecture and should be done in their own time.
2. We can’t avoid the length of the presentations, four hours, but we can include activities to activate students. Make sure people use the breaks.
3. The reading material and the quizzes need a revision.
4. Marko could host a workshop to give constructive feedback.
5. We are changing the learning journals to exist only in Canvas, perhaps with links to videos and screenshots in the cloud.
6. We can focus on the course map at KTH and, towards the end, point the students who are interested into DD2470 Advanced topics in visualization and graphics.
7. Remind students who are advanced that it is not just about their learning, they can contribute to the advancement of the group.
8. Record the answers to the quizzes. Discuss these videos in the discussion board of Canvas.
9. When forming groups: “what grades are you aiming for?” In order to answer this question, we need to flip the details of how much work is in getting a grade.
10. When redesigning the quizzes, show all questions up front.

For the question “**What advice would you like to give to future participants?”**, we list all answers as we find they are valuable.

- Pick your teammates conservatively. Not everyone shares the same passions as you do.
- Have fun and explore different webbsites
- SPEND TIME LOOKING FOR GROUP PARTNERS THAT SHARE YOUR SAME OBJECTIVES
- Examine data and plot/map them in different ways to explore-> Basic functions -> layout and interactions prototype -> refine interactions and layout -> user testing -> refine -> hi fi prototype
- - there is a tutorial for everything if you were to get stuck, and also ask for help if that doesn't solve it - if you want your project to turn out well, you will have to spend a lot of time with it, a couple of hours every day. it doesn't matter if it is a new big implementation or just bug solving
- Pick a project topic within an area that you are familiar with. It makes it better to come up with what a user needs.
- Don't care about the grades that much, focus on the project even though this will not directly translate to a good grade.
- start early to get used to the programming framework, use project 1 as an opportunity to get to know d3, that helps
- Take the opportunity to do something that you can proudly show off in your portfolio!
- Just try to get something down initially for the project, doesn't matter if it looks like crap.
- Do the quizzes its good knowledge that you will need in order to make smart decisions about your visualizations and its free points which could give you a higher grade if you just spend little time.
- Try to learn as much as possible about HTML/CSS/Javascript and D3.js before the course starts.

Reflections: we agree with these suggestions, except the one that a good project will or may not translate to a good grade.

Finally, to the question “**is there anything else you would like to add?**” Oh, we included all replies as we found them particularly encouraging.

- Could be fun if the students could add items such as advice, datasets they considered but didnt use, pitfalls they encountered during the project, for future students
- I think the professor should work on giving feedback in a more positive way. I understand giving us constructive criticisms to help us advance our projects, but usually the feedback was worded in a way that hurt us or made us feel bad about our project. This discouraged us from working and we had to force ourselves to continue on a project that seemed worthless.
- I'm really content with the course - definitely one of the best courses I've taken at KTH.
- Explore a lot. There is a lot of visualizations so do not get to caught up in the first thing you find. [underlined at analysis point]. There might be better solutions out there

you just have to search a little. Discuss with other groups to get ideas. Its often easier to see improvements when you take a look from outside.

Reflection: while we aim to be always constructive in our critical feedback, we can always double check. A good formula is to focus on the most positive features of a project in the beginning and end of the feedback and reserve the constructive comments for the middle. Also, keep them focused on ways of being better rather than on the mistakes or poor choices they have made.

Proposed changes for 2024

- Regarding the journals, rather than producing journals we could schedule short Zoom-calls with the individual students and conduct short interviews/let them make a mini presentation. We make sure to steer focus away from formalities but make sure they answer the same questions we would like them to have considered with the journals. (A student having prepared screenshots and/or github pages, trello boards etc; gives the assignment points)