Teaching portfolio

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Reading instruction & description of contents

In this teaching portfolio I give an overview of my teaching biography and teaching principles. I present several cases where I demonstrate my teaching development and explain how they relate to my teaching principles. The cases are labeled by numbers and each case starts with a general discussion with references to explicit actions. Then, there are more detailed sub–cases which are additionally labeled by lower case letters. To conclude, I discuss my plans towards future teaching development.

The document consists of the main text in Sections 1– 4, of word count 6958. In the Appendix, I collect some additional material such as CV, teaching experience, examples and evidence of teaching development. Words within red boxes are clickable hyperlinks which make electronic navigation of the document easier.

Acronyms

FPS	Faculty of Physical Sciences
SENS	School of Engineering and Natural Sciences
UI	University of Iceland

Reference persons

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Contents

1 Teaching biography

I have been a student for as long as I can remember and as a kid I enjoyed nothing more than learning physics and mathematics. Somewhere early along the way I realized that sharing my knowledge and passion to fellow students was rewarding both to me and to them. What really inspired me was that even though it is necessary to have knowledge in order to share knowledge, it is not sufficient. I consider this the moment when *the conscious teacher* awoke in me. In junior high school I privately tutored many students and at that time I was already determined to become a professional teacher.

During my undergraduate and graduate studies in physics at the University of Iceland (UI) I was a teaching assistant in several different courses ranging from lab exercises in physics to more theoretical courses in mathematics (see Appendix A.2). In the beginning I felt disheartened, all of a sudden some students did not necessarily like my teaching and even seemed not to want to learn the subject! It took me a while to see the obvious: I had a very narrow point of view on teaching, which mostly depended on how I as a student had perceived good teachers. This was based on the dangerous assumption that I had been a generic student myself (and also that there even exists such a thing as a generic student). This made me more humble and I realized that it was not enough to simply mimic my favorite past teachers. Instead I reflected on what it was about them which made me appreciate their approach and how I could integrate that in my own teaching in order to serve a broader student group. I consider this the first step on the road to *actively developing my own teaching.*

In 2014 I started my current academic position in the mathematics department at the UI. Since then I have taught 10 different courses and supervised graduate students, see Appendix A.2 for a complete list of courses. At this stage in my career I encountered many new pedagogical challenges such as: teaching large courses (with more than 200 students), developing new courses, organizing small reading courses, using different types of assessments and supervising essays, student research projects and graduate students. I found it useful to discuss these challenges with more experienced colleagues in the mathematics department and learned a great deal about practical solutions, especially regarding subject related issues. I also learned of venues within the UI where one could discuss pedagogical practices and teaching with a broader group of academic staff. These meetings helped me look past my own experience and outside my own subject. Eventually, mostly thanks to the connections I made through these venues, I signed up for diploma studies for teachers in higher education in the spring 2017. I have already finished a 10 ECTS course on *Course design, assessment and evaluation* and plan on finishing the diploma in the coming year.

The diploma studies have given me a vocabulary to discuss pedagogical issues, some insight into the pedagogy literature and confidence when it comes to assuming leadership roles in teaching development. To name some examples of how this has benefited me in practice, I have participated in teaching development projects for the undergraduate studies in mathematics (see Case 1a), organized an ambitious graduate program in theoretical physics (see Case 3a) and been a member of the teaching committee of the School of Engineering and Natural Sciences (see Appendix A.1.6).

In addition to teaching courses I have supervised graduate students and employed students for projects related to research and teaching development, see Appendix A.2. I find this one of the most enjoyable and challenging aspects of working in higher education. In order to prepare for this role, I have attended courses on supervision at Miðstöð framhaldsnáms at the UI, see Appendix A.1.2.

2 Teaching principles

I really enjoy teaching and developing my teaching methods and I believe I have been successful in getting through to students. I am constantly looking for ways to improve my teaching so I find it important to listen to their opinion. I use informal discussions in class, I encourage them to participate in teaching surveys and make sure to address the results in class. In some cases when I have made more significant changes to a course I interview students to get a more comprehensive feedback. Transcripts from such interviews are included in Appendices A.8, A.9 and A.10 and some statistics and selected comments from teaching surveys are in Appendix A.3.

Around half my teaching load concerns teaching large service courses in mathematical analysis to students in engineering, physics, chemistry, applied mathematics, etc. The other half involves giving specialized mathematics courses to mathematics students and supervising graduate students. There are very different challenges involved in these different formats. The former student group is large and heterogeneous and the latter group is smaller and more like-minded. In each of the following sections I will state, when relevant, to which student group the discussion applies.

2.1 Open education and inclusiveness in learning

I sincerely believe that education should be as *open* and *inclusive* as possible. Open refers to the idea that the compiled knowledge of society belongs to everyone, and inclusive means that we should actively strive to make this knowledge accessible to everyone, regardless of social status, nationality, gender identity, etc.

Teachers in higher education are in a key position to promote this ideology. I advocate *Open education* by making all my teaching material publicly available and I use open-source software as much as possible, for example when typesetting mathematics, presenting teaching material and for computation. From a practical standpoint, students also benefit from using software which they can continue working with after graduation without worrying about license issues.

Inclusiveness can be promoted in the classroom by a careful use of inclusive language, by making sure that everyone has a voice and to be considerate to those who have special needs. Public outreach also plays an important role for diversity since it allows you to speak to a broader group of audience and to purposefully break down stereotypes.

2.2 Active learning

One of the major difficulties in teaching the large service courses is to engage the students. Research has shown that classroom discussion and active participation increases student learning (see e.g. the survey of Hollander, 2002). A large meta analysis by Freeman et al (2014) on the effect of *Active learning* in STEM, advocates that it should be the preferred teaching practice since it is empirically validated. *Active learning* takes the focus off the teacher and motivates the students to discuss and/or apply the content under consideration, promoting deep learning. I attempt to follow this student-centered principle as closely as possible.

There are three main lines which I use to engage the students in large courses.

1. *Promote discussion and activity in class.* Lectures are given 2x80 minutes per week. Engaging large student groups in the lecture room is a challenge. To meet this I have written interactive course material and experimented with a flipped classroom. My approaches are described in more detail in Section 3.1.

   Problem sessions are given 2x80 minutes per week with the group split in half. These sessions focus on applying the course material to real problems and are well suited for lively discussions.

   Support classes with optional attendance are available 4x80 min every week. Teaching assistants supervise the classes and assist the students in solving homework problems. The classes focus on the students doing the work and are much appreciated by them.

2. *Assignments and assessment.* Students hand in weekly homework exercises. They receive feedback from the teaching assistants without a grade. I emphasize to have the feedback *formative* since that has been shown to raise standards of achievement (Black, P. and Wiliam, 1998; Greenstein, 2010) and I provide the students with examples of what constitutes a good solution. We also attempt to give the feedback quickly in order to maximize its effect. Students are required to hand in a certain number of assignments meeting minimum standards in order to pass the course. In Section 4, I discuss how I would like to use assessment to further engage the students in large courses.

3. *Discussion forums.* Outside the classroom, I encourage students to discuss the material in online forums which are administered by me or the teaching assistants.

To conclude I believe it is vital to inform the students of all the above lines and explain their importance. I write detailed instructions at the start of the course and encourage them regularly to be actively involved.

2.3 Research-oriented teaching

In this section I am primarily referring to mathematics students.

As a teacher in higher education with strong emphasis on research I believe in the importance of introducing students to research and academic practices already at an undergraduate level. The approach to this is highly subject-dependent; some subjects are by nature experimental and research methods are a part of the curriculum. Mathematics is however especially challenging in this regard since it is a very technical subject and it is nearly impossible for an average first year student to understand any details of recent research in the field. The traditional way of teaching undergraduate mathematics emphasizes formality and precision and does not leave much room for looking ahead towards applying the knowledge and advancing the field.

Usually, the undergraduate curriculum does not refer to mathematical research. The impression which the students get may therefore be that mathematics as a field has long been settled. I find it interesting to try to understand how students perceive the role of research in universities in general and specifically in mathematics. In a case study reported by Zamorski (2002) in a UK university, student's impression of research was often associated with "laboratory research" ("men in white coats") and my experience from discussing with colleagues and students is that this is a widespread misunderstanding. In discussions with the students I often get questions such as "is there really anything more to discover in mathematics?"

I try to introduce undergraduate students to research both by discussing recent advances and even by involving them in small projects appropriate to their level. There are various ways to achieve this with different emphasis on the role of the student. I will name some approaches I have taken in Case 2 below.

3 Cases

3.1 Case 1: IT in teaching to encourage Active learning

In the service courses, such as Mathematical analysis II and III, I give lectures to large student groups. The students have very different backgrounds and different reasons for attending the courses and I quickly discovered that it was a great challenge to motivate them to pay attention and to participate during lectures. Due to the importance of *Active learning*, I felt it was not an option to simply dim the lights, turn on the projector and speak from a script. Instead I opted for a more student-centered teaching, seeking ways to include the students in a dialog. I strove to have the lectures as lively as possible and to promote discussion by asking questions to the room. I used graphical representations and examples as much as possible to explain new concepts. The slides I used were however too rigid and limited to allow me to properly get all these ideas across so I wanted to find other ways to present the teaching material. I describe my approach to this in Case 1a below.

Another reason for lack of student participation was that they were often ill-prepared for the classes. It was quite common that they did not purchase the text book, and relied solely on the lecture notes. Their first encounter with the material was in these cases during the lectures which explained their hesitation to take part in discussions or to answer questions. This inspired me to consider the possibility of a flipped classroom. I describe the process in Case 1b below.

Case 1a: Rewriting course material in Edbook

In this section I describe how I use the presentation system Edbook in several large courses and how it relates to my teaching principles concerning *Open education* and *Active learning*. The Edbook system is well suited for typesetting mathematics and allows the user to generate various types of documents such as html, pdf, and e-pub (Magnusson, 2019). The content may be displayed on different platforms such as phones, tablets and computers, and during lectures it is usually presented as a web-page. One of the benefits is that it allows the embedding of objects in the web-page such as videos and computational apps like Sage, Geogebra, Octave and R. In this way it is possible to make the lecture notes interactive and the students can work with new concepts as soon as they are introduced, which encourages *Active learning*. In addition, these apps are open-source and free, which aligns well with my principle of *Open education*. Geogebra is especially suited for educational purposes and a lot of research has gone into studying its benefits in mathematics education (see e.g. a recent review by Tamam and Dasari , 2021). An explicit example of its use in Mathematical analysis III is an applet which allows the user to explore various effects of parameters in a driven damped oscillation. An example page from Edbook demonstrating some of its features is shown in Appendix A.4.

In 2015 I hired two undergraduate students from physics and mathematics to transfer my teaching material in Mathematical analysis II into Edbook and in the following years I did the same for Mathematical analysis III and Mathematical analysis IV (with Valentina GM Puletti). I received a grant from the UI Teaching Fund in 2017, along with Anna Helga Jónsdóttir and Benedikt Steinar Magnússon, on behalf of the Department of Mathematics for the project Notkun upplýsingatækni í stærðfræðikennslu (e. Use of information technology in mathematical teaching). We hired several undergraduate students in the summer 2017. Their projects included continuing the development of Edbook, making apps in Geogebra to embed in the course material and making short teaching videos.

The outcome of this project is a coherent set of teaching material in the mathematics program which is based on the ideology of *Open education*. Today most of the large undergraduate courses in mathematical analysis have been moved to the Edbook system by a joint work with my colleagues at the mathematics department. The full list of courses may be found on the web-page `https://edbook.hi.is`. This effort provides consistency in the presentation of the material and allows teachers of different courses to easily refer to the teaching material of other courses which also encourages the students to look back and revise. The system gives the possibility of flexible presentations of the subject and promotes active and deep learning for the students both during lectures and while they study the notes on their own. The outcome of the project has been measured by discussions with students and with the use of teaching surveys. Students are in general very pleased with the Edbook system and some have told me that they even refer to it later, after completing their mathematics education. This underlines the importance of using an open system which is permanently accessible to the students. Finally, one pleasing aspect of the project is that a selected group of undergraduate students has actively participated in writing and developing the material which has given me an invaluable perspective when developing student-centered teaching methods.

Case 1b: Teaching videos in Mathematical analysis III

In the fall 2020 I recorded 146 short teaching videos in the course Mathematical analysis III. I then used the idea of a flipped classroom instead of traditional lectures with the motive to engage the students. This aligns with my principle of *Active learning*. I presented the results at a conference on university teaching, organized by the Teaching academy of the public universities in Iceland (Stefansson, 2022).

For the past eight years, students in the large service courses have repeatedly approached me and asked whether I could record my lectures. I looked into the possibility, however it was not clear to me what the purpose of this would be. The students wanted to be able to view my lectures at any time, giving them flexibility in attendance, but there was no obvious pedagogical argument for this. On the contrary, if students would stop attending the class I was worried that they would become even less active which was against my principle of engaging the students. At the time, recording facilities in classrooms were in general not good and the idea of streaming my live lectures which I had not prepared for that purpose, using less than ideal equipment, did not tempt me. However, I started wondering whether there was a way to implement recordings of lectures, meeting the students' requests and at the same time encouraging them to be more active, thus not compromising the quality of their education.

I familiarized myself with the idea of a flipped classroom where students would get clear presentation in text and video format on the material before class and then the class itself would be used for reviewing and discussing the material. I read some literature on ideal presentations of teaching videos and was especially intrigued by

Mayer (2008) who presents evidence based principles for the design of multimedia instructions. I also looked for ideas and inspiration in the popular math channels Numberphile and 3BlueOneBrown on Youtube. My conclusion was that rather than recording a traditional lecture, I would aim for making short videos, between 5 and 20 minutes long, focusing on one particular concept, theorem, example etc in each video. This principle is related to the idea of segmenting:

> *"[T]he segmenting principle is that people learn better when a narrated animation is presented in learner-paced segments rather than as a continuous presentation."* (Mayer, 2008)

Segmenting has been shown to have a significant effect on test scores in transfer tests (Mayer, 2008). It takes into account the limited attention span of the students and is a factor in reducing cognitive overload (Thompson et. al. 2021). There is however an ongoing debate on what is the optimal lenght of video segments (Lamontagne et. al. 2021, Thompson et. al. 2021).

All that being said, due to heavy teaching load I was unable to implement my ideas and kept using my traditional on-site methods. However, when the Covid-19 pandemic hit us we were forced to make adjustments and I realized that this would be the correct time to act. I was fortunate that I had given the issue some serious thought beforehand so that I already had a game plan which I could set into motion. At this time, in the fall 2020, I was teaching Mathematical analysis III which I had also taught in 2018 and 2019. I decided to make short videos as explained above. I then embedded the videos in a Canvas page and put them into context by writing explanations around them. The purpose of this was to make it easy for students to navigate the material and to quickly see the context of each video. See Appendix A.5 for an example of a (part of a) page from Canvas. I decided not to write very strict scripts for the videos and aimed to have them lively and somewhat spontaneous. I made sure that I appeared occasionally in the videos in order for the students to get a bit familiar with me. The page with the videos was made available before the scheduled class, and in the class I met the students on Zoom and we discussed the material which they were supposed to have familiarized themselves with.

In some meetings, as in traditional lectures, I ended up doing most of the speaking. However, we often started a really interesting discussion which even lasted way over the scheduled time. This was a completely new experience. In the fall 2021 I taught the course again in the same format and I could reuse the pages and videos from the year before. The difference this time was that the classes were mostly on-site. This worked against awkward silence on Zoom and it was easier to communicate with the students in the classroom.

In order to measure the outcome of this program, I made sure to have constant informal communication with the students. I then encouraged them, as I do in every course, to participate in the online teaching survey, see examples of comments in Appendix A.3. In addition, I interviewed one of the students from 2020 in more detail, see Appendix A.9. The outcomes were very encouraging. The students were extremely happy with the organization of the course. I heard it directly from them in person, from other teachers and even from students who did not attend the course. Many of the comments regarded the segmenting which the students really appreciated. My numerical grade, given by the students in teaching surveys, is shown in Figure 1. It is inspiriting to see that the grade rises in 2020 and even more in 2021 after the big changes were implemented. My grade is above the average, despite the fact that students experience the difficulty, workload and demand in my large courses to be considerably higher than in the average course in the FPS and the SENS, see Appendix A.3.

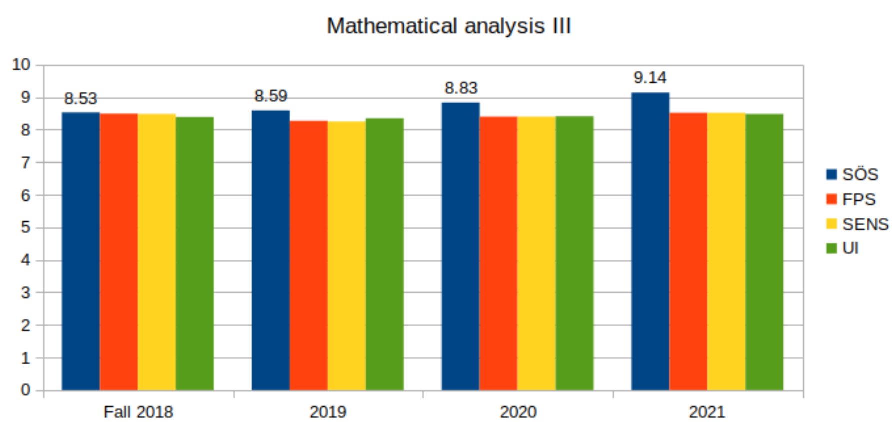


Fig. 1: Numerical grade which the applicant (SÖS) received from students in the teaching survey for Mathematical analysis III. The grade is compared with the average grade of teachers at the Faculty of Physical Sciences (FPS), the School of Engineering and Natural Sciences (SENS) and the University of Iceland (UI). The changes in the course were implemented in 2020.

I also looked at the statistics of the lengths of video segments (Figure 2, left) and measured its effect on the views by students (Figure 2, right). There is a clear trend; the longer the videos, the less they are viewed by the students. This is an evidence of the importance of segmenting and will be used as a reference in the design of future teaching videos. It would be interesting to compare this to data from other teachers and courses.

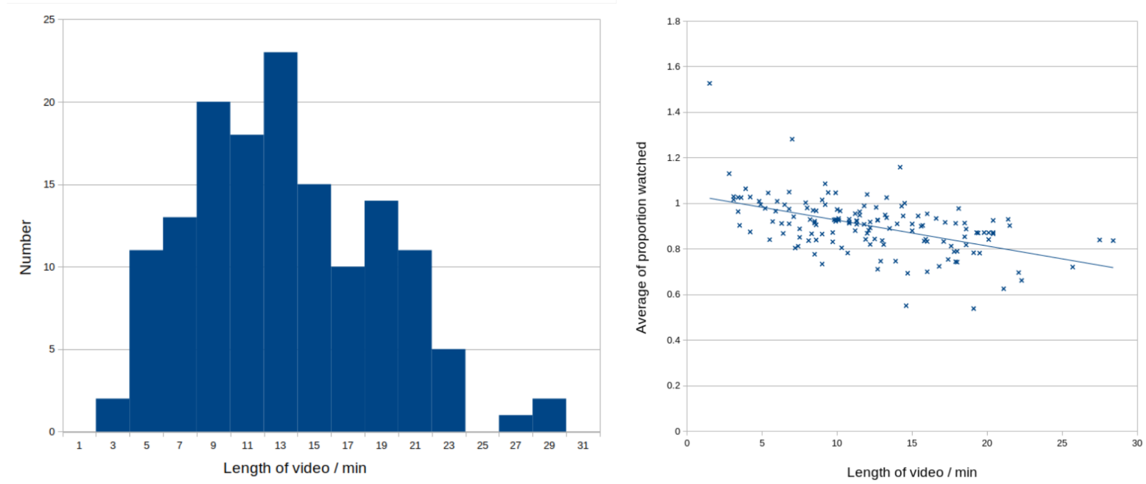


Fig. 2: Left: A histogram showing the number of videos (in 2 min bins) as a function of their lengths. Right: The average of proportion of a video watched (total minutes delivered / (number of unique viewers × length of video)) as a function of its length.

3.2 Case 2: Promoting research in undergraduate studies

In order to address the issues presented in Section 2.3, I have made efforts to include a connection to research in the undergraduate mathematics curriculum which is in line with my principles of *Research-oriented teaching*. I have looked to Healey's model on curriculum design and the link to research to map the research content and role of students (Healey, 2005), see Figure 3. The model has two axes, the horizontal axis measures research content and the vertical axis measures student involvement. Traditionally, undergraduate mathematics mostly belongs to the bottom left part of the model, i.e. is teacher focused and concerns teaching subject content. It is desirable to incorporate all parts of the model into the curriculum, and in particular the student-focused top part, which agrees with my teaching principles of *Active learning*. In Case 2a below I explain how I have used the undergraduate course Mathematical Seminar to achieve this. In Case 2b below I explain how I have attempted to cover the right hand side of the model by supervising students in paid research jobs.

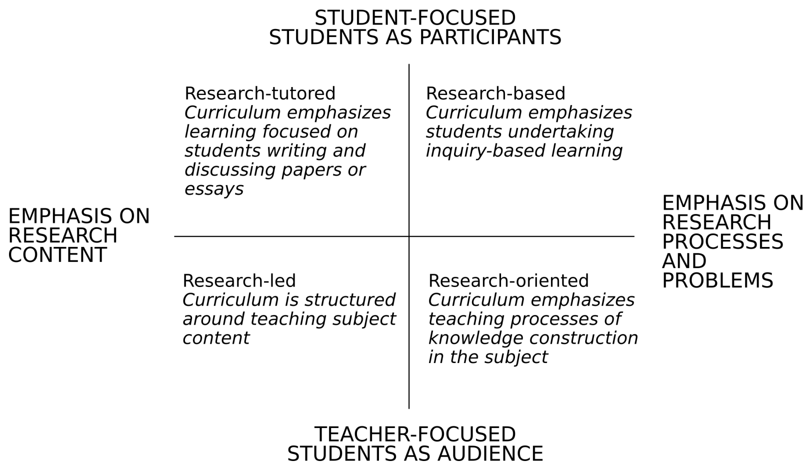
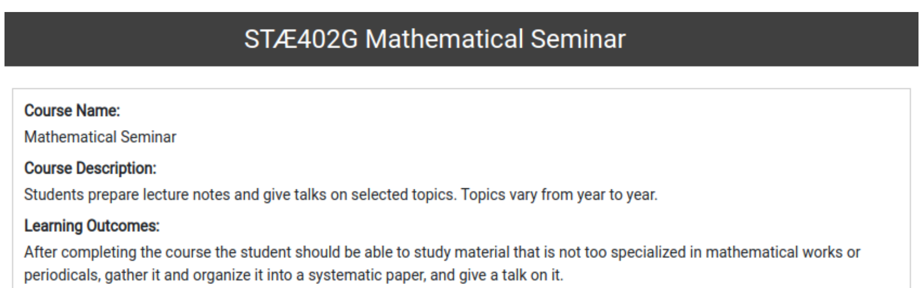


Fig. 3: Healey's model on curriculum design and the link to research.

Case 2a: Restructuring the undergraduate course Mathematical seminar

The course Mathematical seminar is a 4 ECTS course which has been taught in the undergraduate program in mathematics at the UI for decades. The description in the Course Catalog used to be very limited as is demonstrated in Figure 4.



STÆ402G Mathematical Seminar

Course Name:
Mathematical Seminar

Course Description:
Students prepare lecture notes and give talks on selected topics. Topics vary from year to year.

Learning Outcomes:
After completing the course the student should be able to study material that is not too specialized in mathematical works or periodicals, gather it and organize it into a systematic paper, and give a talk on it.

Fig. 4: Description of Mathematical Seminar in the Course Catalog in 2010.

Roughly, the students were supposed to choose some subject of interest, write an essay and give a lecture. Usually, one teacher would manage the course and supervise all the students and the choice of subjects and organization of the course would depend on the teacher. The subject focus was primarily on classical results in mathematics which did not fit into the standard curriculum but it was not at all clear which were the expected learning outcomes.

I managed the course for the first time in Spring 2016 with Benedikt Steinar Magnússon and we had some ideas about redesigning the course and using it to give the students some insight into research practices in mathematics and preparing them for graduate studies. Most courses in the undergraduate program are quite rigid but this one offered a lot of flexibility and so we believed it would be an appropriate venue for our ideas. In our first approach in 2016 we played our plan by ear and soon encountered several problems:

1. Many students did not respect deadlines. In some cases, they had not even started working on their (substantial) essays until the week before deadline. We decided to be flexible but that made the situation even worse.

2. Some students did not know how to structure mathematical text. Their current experience mostly involved writing short solutions to homework problems in well defined packages. This was neither taken into account in the curriculum nor stated as a learning outcome.

3. Not everyone was fluent in the document preparation system LaTeX which is the universal software for typesetting mathematics.

4. The esseys and student lectures were in some cases poorly carried out.

5. Connection with research did not seem to get through to the students.

6. We did not realize how much time the students needed for preparing their projects and whether it reflected the number of credits.

7. We had not done enough preparatory work ourselves before the start of the course and we lacked time to properly oversee the process.

Nonetheless, this experience was very useful and we decided to make an effort to structure the course properly in the following year to address these issues. In the spring 2017, I attended *Course design, assessment and evaluation* as a part of diploma studies for teachers in higher education. Benedikt and I used the opportunity and made the redesign of Mathematical Seminar our main project in the course. A report on the project is in Appendix A.10 and it was presented at Menntakvika (an Icelandic conference on educational research) in October 2017 (Magnusson and Stefansson, 2017). A summary of actions and outcomes are given below and references to the above list of challenges are given where appropriate.

We made three main structural changes. First of all, we decided to collect project descriptions from our colleagues in the mathematics department which were then offered to the students before the start of the course. Each teacher then supervised the students who chose their projects. This had a twofold purpose, firstly to increase the breadth of offered projects and to introduce students to the research fields of the academic staff (addressing item 5) and secondly to reduce the supervision workload on the course managers so that they could focus on managing other parts of the course (addressing item 7).

Secondly, we introduced a work plan for the thesis with four milestones: Hand in first draft to supervisor, hand in second draft to supervisor, hand in almost finished thesis to a fellow student for peer-review, hand in final version. Each milestone had to be finished on time in order to be allowed to continue to the next stage (addressing item 1). In connection with each of these steps we had classes where we discussed how to navigate mathematics literature and journals (addressing item 5), how to structure mathematical text (addressing item 2), how to typeset in LaTeX (addressing item 3), how to provide peer-review and its importance in the publication and verification of research (addressing item 5).

Thirdly, we made the deliverables of the students more visible at the end of the course. We collected together all the essays and printed them in a book which was distributed and then we organized a conference which was advertised to a broader audience where the students then presented their work (addressing item 1 and 4).

We measured the outcome of our new approach in four way, both for the 2016 and the 2017 group: Encouraged the students to answer the standard teaching survey, had informal discussions with the students, interviewed two students, one from each year (see Viðauki við Greinargerð 3 in Appendix A.10), and compared the overall process and deliverables between years.

The student survey did not provide much information. However, from the informal discussions with students and the interviews we got the impression that the 2017 group was happier with the organization of the course. The overall progress and deliverables were much better in the 2017 group, deadlines were respected and the quality of the essays and lectures were much better. The students were very motivated to hand in a good assignment since it would be made public and they were well prepared for the conference day which they seemed to enjoy a lot. After the conference, we had a small celebration with the students and they seemed to really enjoy the social aspect of the program.

In the interviews, we asked the students about workload in order to address item 6. They both felt that the workload was too heavy for a 4 ECTS course. In order to respond to this we used a layout by Baldur Sigurðsson (2011) for estimating workloud which is based on the handbook by Karjalainen and Jutila (2006), see Greinargerð 4 in Appendix A.10. The estimate indicated that the workload was approximately appropriate, however the layout was not adapted to mathematics courses which may partly explain the discrepancy.

Finally, we used our experience from 2017 to completely rewrite the course syllabus, taking into account all of the above (see Viðauki við Greinargerð 5 in Appendix A.10). Since these changes were made the course has been run in the same format with participation of many supervisors, and students are in general very satisfied with the course.

Case 2b: Supervision of research projects for undergraduate students

Undergraduate students in mathematics at the UI are not exposed to much research in their studies. The curriculum does not link to research except in the course Mathematical seminar (see Case 2a) and in some of the courses in statistics and applied mathematics. One reason is that research in pure mathematics requires a lot of preparation, technical proficiency and knowledge of the literature. The bachelor studies prepare students' technical skills but it is usually not until their graduate studies that they get the opportunity to apply them. The downside of that is twofold: 1) How are students supposed to choose graduate studies if they do not know what to expect? 2) The transition from undergraduate studies to graduate studies is substantial and might seem overwhelming.

I have made reference to research in my regular courses, where appropriate, which covers partly the bottom left half in Healy's model (see Figure 3). However, engaging students in doing research requires supervision on an individual basis or in smaller groups. This is partly met in Mathematical seminar and occasional BS projects (which are not mandatory) but there are no other obvious resources to include this in the curriculum. My reaction has been to advertise research assistant positions for undergraduate (or MS) students which they apply to on a competitive basis. Since 2014 I have supervised 5 research assistants, mostly during the summer time.

My research is theoretical and concerns stating and proving mathematical theorems about models in probability theory. It is not realistic to immediately include the students in such technical work so I mainly focus on supervising the students in the following four activities:

1. *Reading.* I supply the students with papers from mathematics journals and assist them in navigating the content. I encourage them to look for references related to these papers and to do their own literature search.

2. *Investigating.* Early on in the process I propose a model to the students and give them the task of investigating its properties using numerical methods. Most students are skilled in programming and solve this part of the project

quickly. This gives them confidence and a sense that they have contributed by discovering something new.

3. *Theorizing.* I involve the students in discussions on how to state and prove theorems about the model. I invite them to make suggestions and give them small, bite-sized problems to work on. I make sure that they still have some numerical projects in parallel so that they can switch between thinking and acting.

4. *Reporting.* I request of the students that they document everything they do. Each project they work on is explained by them in writing and every product, such as computer programs, is documented carefully. At the end of the period I ask them to summarize their work and report their findings in writing.

I have measured the outcome of this program by discussions with the students, by collecting their final reports and by following up on whether they continue towards graduate studies. An interview with one of the students is included in Appendix A.8. My findings are the following: The students are motivated to work hard in their studies to get the opportunity to work on a research project during the summer. All of the students who have worked with me have continued towards graduate studies (MS or PhD). In one case the summer project was a deciding point for the student (see Appendix A.8).

In addition, the program has had important deliverables which include computer programs used in research, reports with ideas, successes and failures, and in one case a research paper which will be submitted jointly with the student to an international peer reviewed mathematics journal (Claesson et. al. 2022).

3.3 Case 3: Development of study programs

The following cases demonstrate the importance of resourcefulness when it comes to developing study programs in a small department. I am very proud of our success in establishing these programs which are in line with my teaching principles concerning *Research-oriented teaching* and *Inclusiveness in learning.*

The first two cases concern the development of graduate study programs in theoretical physics and mathematics at the UI. The problem we were faced with was that there was some demand for MS studies but not necessarily enough to justify running a full program. The MS studies in these fields do not have a long history (roughly 15 years) and have usually been organized on a case by case basis, often involving specially designed reading courses complemented by exchange studies. This is not an ideal service to the students and also involves essentially pro bono work by the supervisors. A short report on the mathematics program is in Appendix A.6 and the physics program is discussed in more detail in Case 3a below.

Furthermore, I took part in organizing a new undergraduate program in applied mathematics at the mathematics department. This program has been a huge success and has almost doubled the student number in undergraduate mathematics. One of the benefits is that there are more options for students who are interested in pursuing mathematical subjects and this has also resulted in a more inclusive learning environment and a more diverse student group. As an example, the gender ratio has become much more even, compared to before when male students were usually in a large majority.

Case 3a: A graduate study program in theoretical physics

The organization of this work is being carried out in collaboration with Jesus Zavala Franco and Valentina Giangreco M Puletti, both at the UI.

Two serious flaws of the MS studies in theoretical physics used to be, perhaps absurdly, not enough teachers and not enough students. In order to provide decent service to those few students who attend the MS studies, and due to our earnest belief that a modern research university should offer such a program, we set out with the mindset "build it and they will come".

Valentina and I serve as representatives on the board of the research institute Nordita (Nordic Institute of Theoretical Physics). Nordita is not an educational institute but we learned that members of the junior academic staff were still interested in teaching. They also needed the experience in order to be more competitive when applying for permanent academic positions.

We advocated to the board that Nordita would organize a program so that their academic staff could teach at Nordic universities and suggested that the UI would participate in a pilot program where this would be implemented. The organization of the program required a lot of coordination and planning at both institutes. We needed to decide on which subfields to focus, secure funding for various expenses, make contracts of commitment with the Nordita staff and more.

Due to the international component of the program we decided to advertise the MS positions internationally and we even managed to compile some funding for scholarships. The flyer which we used to advertise the program is shown in Appendix A.7. The first run of the program started in the fall 2021 and we admitted three MS students. Four assistant professors from Nordita participated in the teaching. They mainly taught from distance on Zoom with occasional visits and on site teaching. In addition they had teaching assistants who were on-site and accessible to the students during the whole course.

Even though the program is run on a very low budget we have not compromised on quality. On the contrary, leading experts in their fields, doing cutting edge research are teaching and supporting the program. The students will furthermore have opportunities to choose supervisors from the Nordita staff, to visit Nordita for graduate schools and conferences and therefore connect with a strong international research network which may benefit them in their further studies. We have also offered 3rd year BS students to participate in some of the MS courses, increasing their options for selective courses and at the same time making better use of resources. This also creates a bridge between the BS and MS studies which is in line with *Research-oriented teaching*.

We have already had meetings with other small Nordic universities in Sweden and Norway which have shown interest in participating and we believe that a wider international cooperation will be crucial in sustaining the program. Recent advancements in online teaching solutions make such a format a reasonable option which will hopefully promote inclusiveness and enable students in smaller communities to pursue MS studies in theoretical physics. The second run of the program is planned to start in the fall 2022 and we look forward to continuing its development.

4 Future teaching development

There are many challenges in teaching which I would like to address in the future. The most important issue in my opinion is to promote *Active learning* in all courses, with special focus on engaging students in large courses . I plan to further develop the teaching videos in Case 1b, both by revising the current videos and by introducing a similar idea in other large courses. The videos are already well received by the students but there is room for improvement in the subsequent discussion classes. The next step will be to improve class discussion and activity in order to exploit the flipped classroom idea to its fullest potential.

Another way to engage students is to use exercises, evaluations and feedback as a motivation. This is already achieved to some extent in the large courses by the weekly assignments which are evaluated by teaching assistants in a formative manner. Unfortunately the feedback is not always very detailed or immediate which may reduce the effectiveness of the assessment. To meet this, I have looked towards software solutions which could provide immediate and consistent feedback to the students. One possibility is to use the educational system tutor-web (`https://tutor-web.net/`), developed by Gunnar Stefánsson at the UI and others, which presents the users with multiple choice questions and provides instant feedback. Multiple choice question in their traditional form are not always suitable for testing and providing feedback on extended calculations or chains of reasoning. There are other systems which take some of these issues into account. Stellan Östlund, at the University of Gothenburg, has lead the development of the system OpenTA (`https://openta-development.github.io/info`) which uses symbolic evaluation of students' solutions and can therefore be used as a step by step guide to mathematical problem solving. Both of these systems are being developed by teachers and tackle many field specific and even course specific hurdles. They are open-source and therefore agree with the principle of *Open education*. I have initiated a discussion with both project leaders and look forward to seeing whether these, or comparable systems, may be adapted to the type of mathematics courses which I teach.

Last but not least, I want to encourage and inspire my collegues at the UI to consider teaching development as an essential role of academics.

References

[1] Black, P. and Wiliam, D. (1998). *Inside the Black Box: Raising Standards Through Classroom Assessments.* Phi Delta Kappan, 80(2), 139–144.

[2] Claesson, A., Dukes, M., Franklin, A. and Stefansson, S. (2022). *Counting tournament score sequences.* Manuscript in preperation.

[3] Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). *Active learning increases student performance in science, engineering, and mathematics.* Proceedings of the National Academy of Sciences, 111(23), 8410-8415.

[4] Greenstein, L. (2010). *What Teachers Really Need to Know About Formative Assessment.* Alexandria, VA: ASCD.

[5] Healey, M. (2005). *Linking research and teaching exploring disciplinary spaces and the role of inquiry-based learning.* In: Barnett, R. (ed.) Reshaping the university: new relationships between research, scholarship and teaching. Maidenhead: McGraw-Hill/Open University Press, 30–42.

[6] Hollander, J.A. (2002). *Learning to discuss: Strategies for improving the quality of class discussion.* Teaching Sociology 30:317–327. `https://doi.org/10.2307/3211480`.

[7] Karjalainen, A.; Alha, K. and Jutila, S. (2006). *Give me time to think. Determining student workload in higher education. A practical guide for teachers and curriculum designers.* Oulu: University of Oulu, Teaching development unit. Sótt af `http://www.oulu.fi/w5w/tyokalut/GET2.pdf`

[8] Lamontagne, C., Sénécal, S., Fredette, M., Labonté-LeMoyne, E., Léger, P.-M. (2021). *The effect of the segmentation of video tutorials on User's training experience and performance.* Computers in Human Behavior Reports, Volume 3, 100071, ISSN 2451-9588, `https://doi.org/10.1016/j.chbr.2021.100071.`

[9] Magnusson, B. (2019). *Introduction to interactive course notes in Edbook.* EDULEARN19 Proceedings, pp. 6301-6306..

[10] Magnusson, B. S. and Stefansson, S. O. (2017, October 6). *Hugað að hæfniviðmiðum* [Conference presentation]. Menntakvika 2017, an annual Icelandic conference on educational research organized by the School of Education at the UI, Reykjavik, Iceland.

[11] Mayer, R. E. (2008). *Applying the science of learning: Evidence-based principles for the design of multimedia instruction.* American psychologist, 63(8), 760.

[12] Sigurðsson, B. (2011). *Mæling náms í ektum – undirstaða gæðastarfs?* Ráðstefnurit Netlu – Menntakvika 2011 Menntavísindasvið Háskóla Íslands. Available at `http://netla.hi.is/menntakvika2011/alm/002.pdf.`

[13] Stefansson, S. O. (2022, May 23): *Kennslumyndbönd í Stærðfræðigreiningu III* [Conference presentation]. Málþing um háskólakennslu, a conference on university teaching, organized by the Teaching academy of the public universites in Iceland, Reykjavik, Iceland.

[14] Tamam, B. and Dasari, D. (2021). *The use of Geogebra software in teaching mathematics.* J. Phys.: Conf. Ser. 1882 012042.

[15] Thompson, P., Xiu, Y., Tsotsoros, J., Robertson, M. (2021). *The Effect of Designing and Segmenting Instructional Video.* Journal of Information Technology Education: Research, Volume 20, 173-200.

[16] Zamorski, B. (2002). *Research-led Teaching and Learning in Higher Education: A case.* Teaching in Higher Education, 7:4, 411-427,`https://doi.org/10.1080/135625102760553919.`

A Appendix

A.1 CV - with emphasis on teaching

Contact Information

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Reference persons:	Sigdís Ágústsdóttir, sigdis@hi.is Hermann Þórisson, hermann@hi.is

A.1.1 Education

- UI: Diploma in Teaching Studies for Higher Education (current).
- UI: Ph. D. in physics, June 2010.
- UI: M. S. in physics, June 2007.
  Exchange student at Niels Bohr Institute, Copenhagen in 2005-2006.
- UI: B. S. in physics, June 2005.
- Matriculation from The Akureyri Junior College in the spring of 2002.

A.1.2 Pedagogical training

- Workshop on how to activate students during lectures, supervised by Margrét Sigrún Sigurðardóttir, associate professor at UI. In Málþing um háskólakennslu, a conference on university teaching, organized by the Teaching academy of the public universites in Iceland, Reykjavik, Iceland, May 23, 2022.
- UI: Diploma in Teaching Studies for Higher Education (current). Have finished 10 ECTS.
- UI: A course and a workshop on supervision of graduate students organized by Miðstöð framhaldsnáms (e. The center of graduate studies) in September 2018.

Course 1: *Reglur og viðmið um doktorsnám* (e. Rules and guidelines concerning graduate studies).
Course 2: *Hlutverk og samskipti leiðbeinanda og doktorsnema* (e. The roles and communication between supervisor and graduate student).

– Active participant in *Kennslukaffi* (e. Coffee meetings on teaching) organized by Kennslumiðstöð at the UI (e. Teaching center).

A.1.3 Work experience (since 2003)

– Professor of Mathematics at the UI. 2019 - present.

– Assistant/associate professor of Mathematics at the UI. 2014 - 2019.

– Post-doc at the University of Uppsala. 2012 - 2014.

– Fellow at the Nordic Institute for Theoretical Physics. 2010 - 2012.

– Teaching assistant at the UI. 2004 - 2010.
See Appendix A.2 for a list of courses.

– Iceland Geosurvey (ÍSOR) summer 2005 and 2006.

– Icelandic Radiation Safety Authority, summer 2003.

Committees and service

– Icelandic representative on the board of NORDITA, Nordic Institute of Theoretical Physics, 2016 - present.

– Member of the board of the Icelandic mathematical society, 2016 - present.

A.1.4 Teaching and supervising experience

I have taught 10 different courses in mathematics since I started my position at the UI in 2014. In 2004–2010, I was a teaching assistant in 6 different courses in physics and mathematics at the UI.

I am currently supervising one PhD student and three MS students and I have been on a thesis committee for one PhD student and one MS student. In addition, I have supervised 14 students in their final projects in the course Mathematical Seminar.

I have supervised 4 students in teaching development projects and 5 students in research projects.

See Appendix A.2 for a complete list of courses and graduate students.

A.1.5 Teaching development and leadership

- Grant from the UI Teaching Fund in 2017 with Anna Helga Jónsdóttir and Benedikt Steinar Magnússon, on behalf of the Department of Mathematics for the project *Notkun upplýsingatækni í stærðfræðikennslu* (e. Use of information technology in mathematical teaching). See Section 3.1 for more details.
- Introduction and pilot testing of the Edbook system in the courses Mathematical analysis II, III and IV, 2016-2018. See Section 3.1 for a detailed account and `https://edbook.hi.is` for more information.
- Member of a pilot group in the introduction of the Canvas system at the UI, spring 2020.
- Introduction of short video recordings and flipped classroom in Mathematical analysis III, 2020 (see Section 3.2)
- A representative of the FPS in the Teaching committee at the SENS, 2020 - current. The committee meets every two weeks during the academic year. Among its tasks is to discuss teaching relates issues and policies within the school and the University and reviewing applications to the UI Teaching fund.

A.1.6 Development of courses and study programs

- A complete overhaul of the course Mathematical seminar, 2017 (see Section 3.1).
- Introduction of the graduate course Weak convergence and stochastic processes, fall 2016.
- Introduction of study lines in the MS program in mathematics at the UI, with Benedikt Steinar Magnússon and Valentina Giangreco M Puletti, 2014. See document in Appendix A.6.
- Introduction of a new line in Applied mathematics in the mathematics department, jointly with colleagues at the department, 2015.

– Development of a joint MS program in theoretical physics between the UI and the Nordic institute of theoretical physics (NORDITA) in Stockholm, with Valentina Giangreco M Puletti and Jesus Zavala Franco, 2020 - current. See Section 3.3 for details and the Program Flyer in Appendix A.7.

A.1.7 Pedagocial research

– Magnusson, B. S. and Stefansson, S. O. (2017, October 6). *Hugað að hæfniviðmiðum* [Conference presentation]. Menntakvika 2017, an annual Icelandic conference on educational research organized by the School of Education at the UI, Reykjavik, Iceland.

– Stefansson, S. O. (2022, May 23): *Kennslumyndbönd í Stærðfræðigreiningu III* [Conference presentation]. Málþing um háskólakennslu, a conference on university teaching, organized by the Teaching academy of the public universites in Iceland, Reykjavik, Iceland.

A.1.8 Mathematical research

I have written 18 research papers in mathematical physics and probability theory. They are either published or in a submission process in international peer reviewed journals. See a complete list at
`https://arxiv.org/search/?searchtype=author&query=Stefansson%2C+S+O`

I have given over 30 research talks including invited talks at international conferences and talks at seminars in universities in Iceland and abroad.

In 2018 I received a 3 year project grant from RANNIS for a project in probability theory titled *Scaling limits of random enriched trees*.

A.1.9 Public outreach

– S. O. Stefansson (2019, June 14). A lecture on knot theory to children in Háskóli unga fólksins (University for young people). Teaching material available on Edbook `http://edbook.hi.is/huf/`. Reykjavik, Iceland.

– S. O. Stefansson. (2018, February 23). A presentation on probability theory to a group of elementary school children in Austurbæjarskóli. A part of a lecture series intended to increase interest of school children in STEM. Reykjavik, Iceland.

- Co-organization of the interdisciplinary seminar Young academics at the University of Iceland. (2015-2018). Monthly seminars with two presentations given by a male and a female from different schools within the University.
- S. O. Stefansson. (2014, October 25). *Graph theory in work and play.* A presentation given to the public in Raunvísindaþing 2014. Reykjavik, Iceland.

A.2 Teaching and supervising experience

Courses taught at the UI as a teaching assistant before 2010

Terms	Course	Type of teaching
Spring 2004	Physics 2V/2R	Lab
Fall 2004	Classical Mechanics	Problem sessions
Fall 2006	Statistical Physics 1	Problem sessions
Spring 2008/2010	Mathematical Analysis IIB	Problem sessions
Fall 2008	Mathematical Analysis IB	Problem sessions
Spring 2010	Mathematical Physics	Problem sessions

Courses taught at the UI after 2014 ($*$ = Jointly with others)

Terms	Course	Nr of students
Fall 2014, 2016	Graph Theory	16, 44
Spring 2015–2018, 2020*	Mathematical Analysis II	217, 209, 211, 199
Spring 2016	Applied Fourier Analysis	26
Spring 2016*–2020*	Mathematical Seminar	Project based
Fall 2016	Weak Convergence and Stochastic Processes	5
Spring 2018*,2020*,2022	Introduction to Measure-Theoretic Probability	21, 20, 19
Fall 2018-2021	Mathematical Analysis III	175, 191, 211, 155
Spring 2019*	Mathematical Analysis IV	55
Spring 2019*	Stochastic Processes	23
Fall 2019	Brownian Motion	5

Supervision at the UI

14 undergraduate students	- Projects in Mathematical Seminar (mini BS)
4 students	- Teaching development projects (see Case 1a in Section 3.1)
5 students	- Research projects (see Case 2b in Section 3.2)
Jóhann Haraldsson	- MS (current)
Guðjón Helgi Auðunsson	- MS (current)
Rafael Vias	- MS (starting in fall 2022)
Daniel Amankwah	- PhD (current)

Committees at the UI

Eyleifur Ingþór Bjarkason	- MS (current)
Hjörtur Björnsson	- PhD (current)

Opponent at defenses

Camille Pagnard	- PhD from Paris Dauphine (2018)
Thomas Lehericy	- PhD from Université Paris-Sud (2019)

A.3 Comments and statistics from teaching surveys

Below are selected quotes from students in teaching surveys regarding my teaching, translated from Icelandic by myself. Original quotes and full access to the results are granted upon request. The first set of quotes regard the teaching videos in Mathematical analysis III, discussed in Case 1b in Section 3.1.

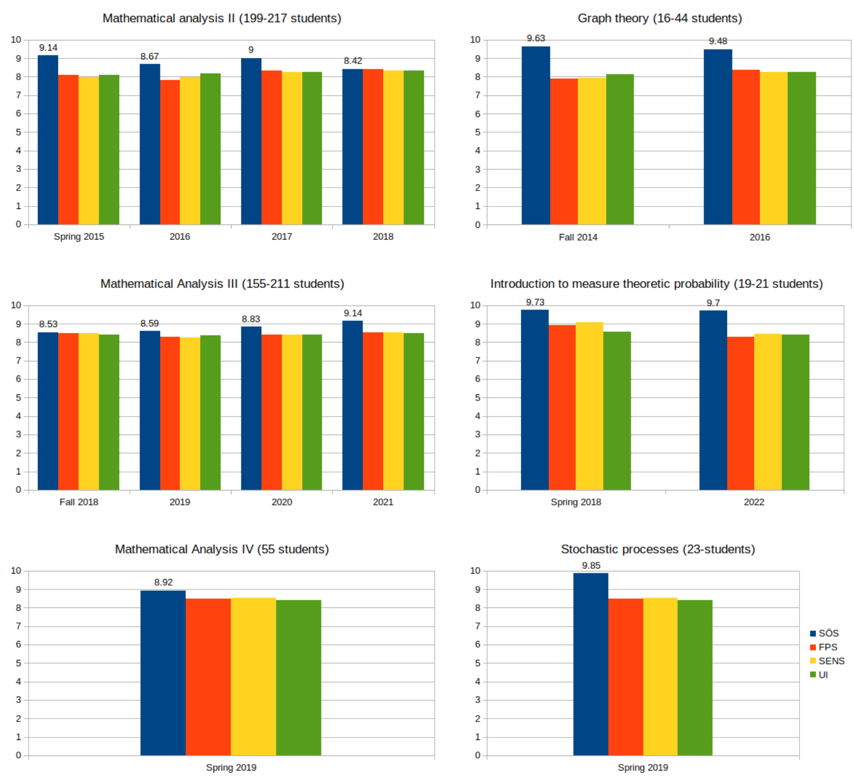
A.3.1 Mathematical Analysis III - Teaching videos

Comments removed in this version.

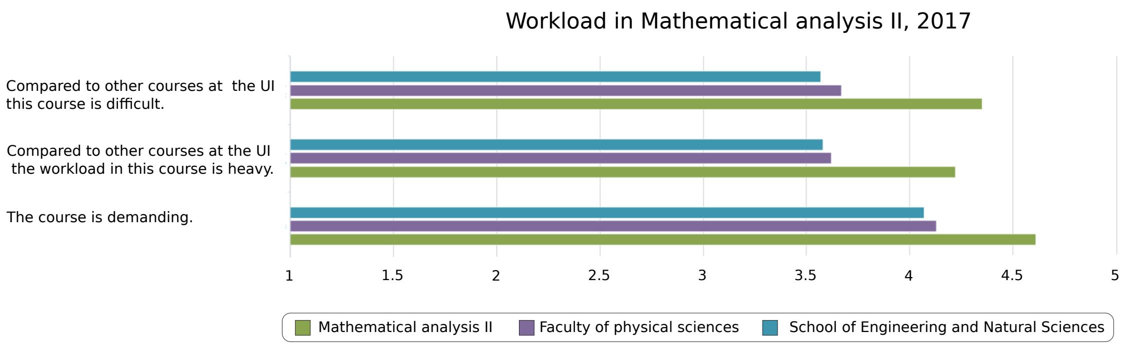
A.3.2 Selected quotes from various courses

Comments removed in this version.

A.3.3 Statistics

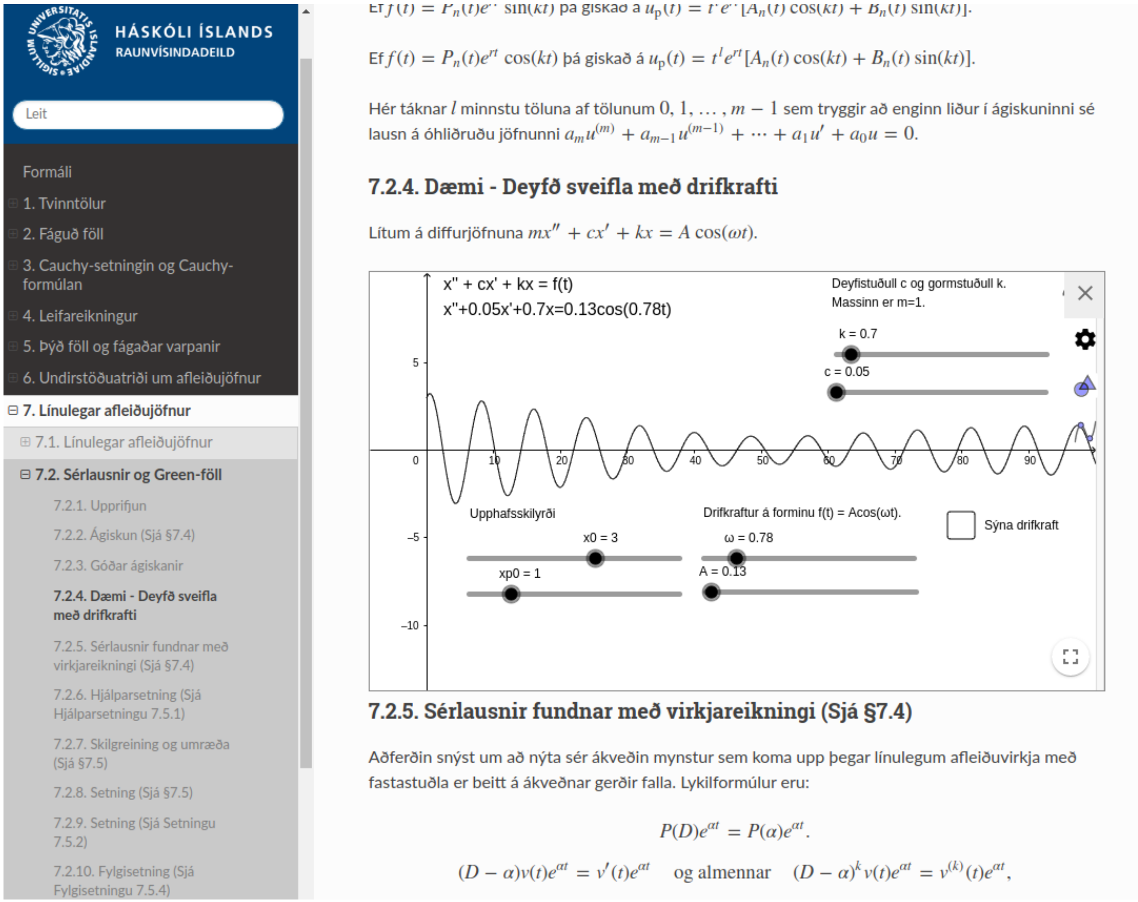


Statistics from teaching surveys (all courses included which had a sufficient number of students). The scores of the applicant ■ SÖS are compared to the scores of the ■ FPS, the ■ SENS and the ■ UI. The left column shows the results from large service courses and the right column shows results for smaller courses mainly aimed at students in mathematics. In all cases, the scores of SÖS exceed the averege scores of the FPS, the SENS and the UI. The scores of SÖS are in general much higher in the smaller mathematics courses which is partly explained by the fact that the student group is more homogeneous and had chosen specifically to learn mathematics whereas the students in the larger courses are more diverse with different reasons and motivations for attending the course.



Another important statistics which is apparent in the large courses is that students find these courses difficult compared to other courses. A typical representative of this is shown in the graph below which illustrates workload in the course Mathematical analysis II, 2017. This is in stark contrast with the result in the smaller courses where the students find them more comparable to other courses.

A.4 Example page from Edbook in Mathematical analysis III



HÁSKÓLI ÍSLANDS
RAUNVÍSINDADEILD

Leit

Formáli
1. Tvinntölur
2. Fáguð föll
3. Cauchy-setningin og Cauchy-formúlan
4. Leifareikningur
5. Þýð föll og fágaðar varpanir
6. Undirstöðuatriði um afleiðujöfnur
7. Línulegar afleiðujöfnur
7.1. Línulegar afleiðujöfnur
7.2. Sérlausnir og Green-föll
7.2.1. Upprifjun
7.2.2. Ágiskun (Sjá §7.4)
7.2.3. Góðar ágiskanir
7.2.4. Dæmi - Deyfð sveifla með drifkrafti
7.2.5. Sérlausnir fundnar með virkjareikningi (Sjá §7.4)
7.2.6. Hjálparsetning (Sjá Hjálparsetningu 7.5.1)
7.2.7. Skilgreining og umræða (Sjá §7.5)
7.2.8. Setning (Sjá §7.5)
7.2.9. Setning (Sjá Setningu 7.5.2)
7.2.10. Fylgisetning (Sjá Fylgisetningu 7.5.4)

Ef $f(t) = P_n(t)e^{rt}\cos(kt)$ þá giskað á $u_p(t) = t^l e^{rt}[A_n(t)\cos(kt) + B_n(t)\sin(kt)]$.

Hér táknar l minnstu töluna af tölunum $0, 1, \dots, m-1$ sem tryggir að enginn liður í ágiskuninni sé lausn á óhliðruðu jöfnunni $a_m u^{(m)} + a_{m-1}u^{(m-1)} + \cdots + a_1 u' + a_0 u = 0$.

7.2.4. Dæmi - Deyfð sveifla með drifkrafti

Lítum á diffurjöfnuna $mx'' + cx' + kx = A\cos(\omega t)$.

7.2.5. Sérlausnir fundnar með virkjareikningi (Sjá §7.4)

Aðferðin snýst um að nýta sér ákveðin mynstur sem koma upp þegar línulegum afleiðuvirkja með fastastuðla er beitt á ákveðnar gerðir falla. Lykilformúlur eru:

$$P(D)e^{\alpha t} = P(\alpha)e^{\alpha t}.$$

$$(D-\alpha)v(t)e^{\alpha t} = v'(t)e^{\alpha t} \quad \text{og almennar} \quad (D-\alpha)^k v(t)e^{\alpha t} = v^{(k)}(t)e^{\alpha t},$$

An example of a part of an Edbook page in Mathematical analysis III which is displayed as a web-page. On the left hand side is a menu which makes navigating very easy. The mathematical formulas on the page are typeset in LaTex which is integrated into the Edbook system (through restructured text). Embedded in the page is a Geogebra applet which allows the reader to visualize a solution to a differential equation describing a driven damped oscillation. The user can change the parameters of the equation directly on the page and see how the solution is affected. A direct link to this example is at https://notendur.hi.is/sigurdur/stae302/Kafli07.html#daemi-deyf-sveifla-me-drifkrafti.

A.5 Example page from Canvas in Mathematical analysis III

Fyrirlestur 19: Samantekt og myndbönd

19. Veldaraðalausnir

Í næstu tveimur fyrirlestrum munum við skoða aðferðir við að leysa óhliðraðar annars stigs línulegar afleiðujöfnur sem ekki nauðsynlega hafa fasta stuðla

$$a_2(x)u'' + a_1(x)u' + a_0(x)u = 0.$$

Lausnaaðferðin gengur út á að gera ráð fyrir að setja megi lausnina fram sem veldaröð

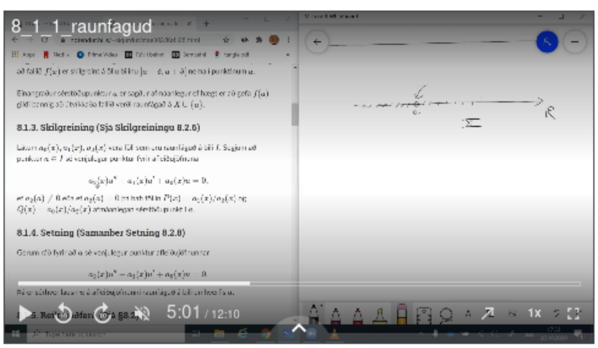
$$u(x) = \sum_{n=0}^{\infty} c_n(x-a)^n$$

þar sem c_n eru óþekktir stuðlar. Síðan er veldaröðinni stungið inn í afleiðujöfnuna. Með því að diffralið fyrir lið og taka saman þær raðir sem koma við sögu fæst formúla fyrir stuðlana c_n sem í sumum tilfellum má leysa. Þannig fæst veldaraðalausn á afleiðujöfnunni.

Veldaraðalausnir eru mjög mikilvægar í ýmsum afleiðujöfnum sem koma við sögu í eðlisfræðilegum verkefnum. Þar má til dæmis nefna Bessel-jöfnuna sem er mikilvæg í t.d. rafsegulfræði og skammtafræði.

Ég byrja á að kynna aðferðina með mjög einföldu dæmi sem við getum reyndar leyst með hefðbundnum aðferðum.

Föll sem setja má fram með samleitnum veldaröðum á bili í kringum punkta í skilgreiningarmenginu kallast **raunfáguð**. Ég fjalla um slík föll í næsta myndbandi.



Nú erum við reiðubúin að skoða almenna reikniaðferð til að finna veldaraðalausn á afleiðujöfnu. Í reikningunum þarf að beita ýmsum aðgerðum á veldaraðir. Við megum til dæmis

- **Diffra lið fyrir lið.** Við megum víxla á diffrun og summutákni í samleitinni veldaröð því veldaröðin er samleitin í jöfnum mæli innan í samleitnibilinu.
- **Leggja saman.** Við leggjum tvær raðir saman lið fyrir lið

An example of a part of a Canvas page in Mathematical analysis III. The videos are short and concise and explanations are written around each video in order to explain their context.

A.6 Development of study lines in the graduate program in mathematics at the UI

Not included in this version.

A.7 Flyer for the joint MS program in theoretical physics between the UI and NORDITA

Not included in this version.

A.8 Interview with a research assistant

Not included in this version.

A.9 Interview with a student from Mathematical analysis III

Not included in this version.

A.10 Restructuring the course Mathematical seminar

The next 30 pages contain a report written by the applicant together with Benedikt Steinar Magnússon in 2017 in *Course design, assessment and evaluation* as a part of diploma studies for teachers in higher education. Our project involved redesigning the undergraduate course Mathematical Seminar as described in Case 2a in Section 3.2.

Report not included in this version.