

Educators' Experiences Online: How COVID-19 Encouraged Pedagogical Change in CS Education

Rune Hjelsvold¹, Shaun S. Nykvist², Madeleine Lorås¹, Abdullah Bahmani¹ and Andreas Krokan²

¹Department of Computer Science, NTNU

²NTNU BETA

Abstract

The COVID-19 lockdown in the spring of 2020 created a unique pedagogical change situation. Educators had to make significant and rapid changes to their teaching approaches, with the time frame being in the magnitude of hours, not weeks or months. At NTNU, a survey was conducted among the educators shortly after the lockdown to study how the educators experienced the change from campus based face-to-face learning to online learning. A total of 56 educators responded to the survey, with 22 of these affiliated with a Computer Science (CS) department. Nearly all the CS educators reported having a positive change experience during this time. More than half of the CS educators reported having prior online teaching experience, while nearly three quarters reported having sufficient or partially sufficient competence needed for the change. In this survey, CS educators highlighted pedagogical challenges as the main challenge. The findings also highlight the fact that some educators found aspects of online teaching to be better than campus based teaching and that CS educators collaborate and exchange pedagogical experience when facing change. Approximately two thirds of the CS educators reported that they consulted a more experienced person or worked closely with colleagues when making the change from a face-to-face mode of delivery to that of an online only mode of delivery. Given the variety of experiences reported and the willingness to collaborate and exchange experience, it can be argued that CS staff and other departments may choose a path of knowledge sharing and communities to support future blended and online teaching opportunities.

1 Introduction

The use of digital technologies and online tools to support both students and educators in online learning environments has become synonymous with transforming learning within Higher Education. This has resulted in a large number of Higher Education Institutions investing in digital technologies and online platforms such as learning management

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systems, to support initiatives associated with blended and online learning. However, while there has been a systematic push for transformation in the Higher Education sector, it can be argued that the move to embrace new technologies and pedagogical approaches has not always been as widespread across the Higher Education sector as many had envisaged. According to Henderson, Selwyn and Aston [6], while digital technologies are clearly evident in the students experience of undergraduate university education, “digital technologies are clearly not transforming the nature of university teaching and learning” (p. 1577). The reasons for this are many and varied, ranging from the barriers for academics to "change" current practices (such as a lack of time, training and incentives [2]) to institutional policies and practices. Online courses do offer flexibility, and when these opportunities have existed, students have embraced the opportunities to participate in online courses. In 2013, over a third of Higher Education students in the US were undertaking some form of online course [1]. However, with an increasing number of online program offerings and the associated increase of students opting into online programs [7][13] there is a growing concern with regards to the pedagogical approaches associated with blended and online learning environments [8] [16] [5].

While many academics have strongly entrenched notions of what constitutes effective teaching and learning in Higher Education and have established pedagogical identities [14], new learning environments call for new or revised pedagogical practices and ways of working. In light of the current COVID-19 pandemic, NTNU, and Norway in general, was thrown into lockdown in March 2020, requiring all educators to transition to fully online teaching in record speed. While the university had already invested in much of the technology needed to support a move to online learning, there was a need for both the students and the academics to change their current teaching and learning practices. It was in this context that the Centre for Excellent IT Education¹ (Excited) at NTNU and NORD University, decided to conduct a study, in the week following the transition to online, to shed some light on the question: “How are the students and educators experiencing the change from campus-based to online learning?” To shed some light on these questions two surveys were developed; one for educators and one for students.

There is a growing number of papers documenting the COVID-19 impact on Higher Education [9] [18] [17] and this study posits itself within this body of growing literature. The main objective of this paper is to analyse the results from the educator survey with an emphasis on the changes made to, and, on the educators’ perceived competence needs and perceived challenges. This analysis may help staff and managers develop plans for the future development of pedagogical practices that are best suited to new learning environments such as online modes of delivery.

2 Research Methodology

The Educator Survey

To obtain a first impression of the new situation immediately after the Covid-19 lockdown, a short and concise questionnaire was designed. The questionnaire contained both qualitative and quantitative questions. The former were mostly open-ended questions in which educators could describe the responses with their own words, while the latter was multi-choice questions where they could select their answer from the possible choices. There were different types of questions in the questionnaire addressing topics such as:

- Experiences and challenges made when transitioning to online teaching.

¹<https://www.ntnu.no/excited>

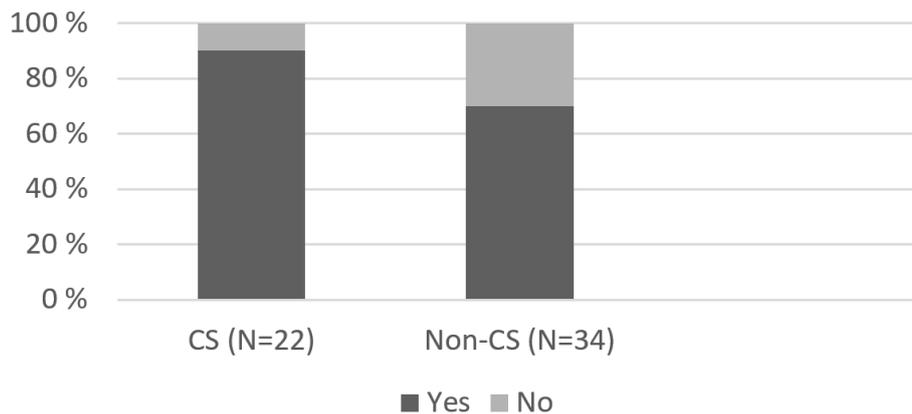


Figure 1: Fraction of educators reporting having a positive experience

- Prior competence and experience in online teaching.
- Pedagogical changes made to adapt to online teaching.
- Tools that were used in the online teaching.

The surveys were distributed on Monday, March 23rd, after one full week of online teaching and learning had been completed. For deployment of the educator survey, the authors used their own departments and collegial networks as the starting point, announcing the survey to all educators of the CS departments and to other colleagues in their academic networks. The survey was subsequently distributed through the faculty intranet. The data used in this study is based on the responses that were submitted prior to Monday, 31st March.

3 Results

In total, there were 56 educators responding to the survey. Among the responses, there were 22 educators affiliated with a CS department. The remaining 34 educators were affiliated with a variety of departments, including social sciences, electronics, mathematics, and teacher education departments. The main results from the survey are presented below.

Perceived Experience

The COVID-19 lockdown undoubtedly caused a lot of stress on educators. The educators reported that they had to work from home without the ability to meet colleagues and students face to face, having to teach in new ways using, to a large degree, unfamiliar technologies, and having to change their teaching plans for the semester - all of this happening abruptly and without much time for planning, implementation or fine-tuning. As shown in Figure 1, the majority of educators (90% of the CS teachers and 70% of the non-CS teachers) still reported having a positive experience when transforming to online teaching due to the lockdown.

Competence Needs

When asked about prior experience, a majority of the educators (59% of CS educators versus 50% of non-CS educators) reported having prior online teaching experience, as shown in Figure 2.

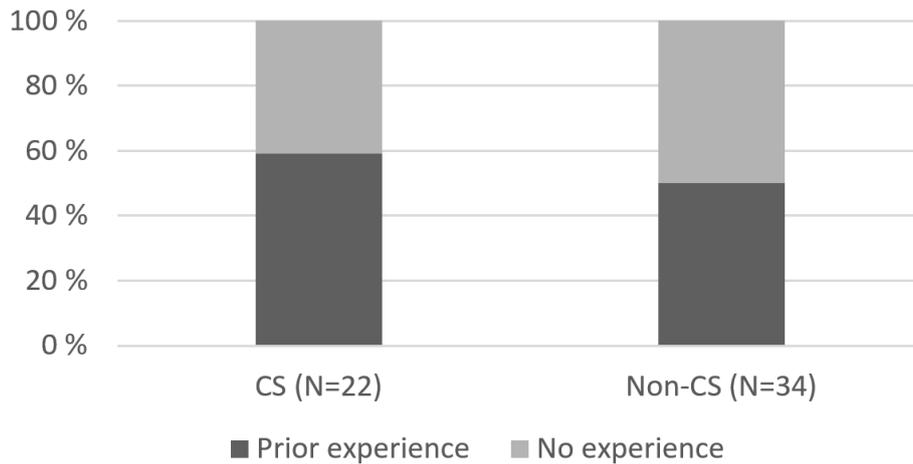


Figure 2: Educators' prior online teaching experience

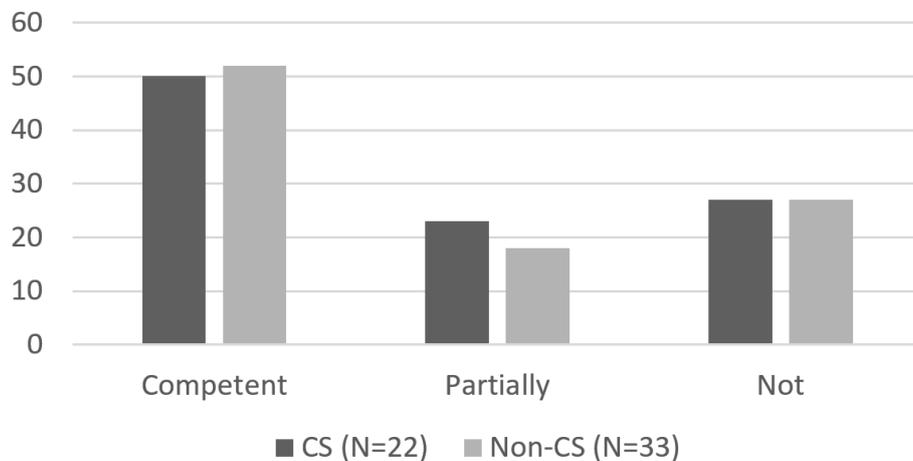


Figure 3: Educators' perceived level of competence

The educators were also asked whether they thought that they had the technical and pedagogical competence required for online teaching. As shown in Figure 3, approximately half of the educators reported having the required competences, around 20% reported feeling partly competent (i.e., either feeling competent technically or pedagogically), and less than 30% reported not feeling competent for online teaching. There were only small differences between the CS and the non-CS educators on this question.

The survey also included a question regarding what types of resources the educators had used when transforming their teaching from a face-to-face mode to an online mode. The choice of response for this question were:

- Using their own ideas
- Using Internet resources
- Consulting an experienced educator
- Working closely with a colleague

Figure 4 shows that a majority of the educators (67% of CS educators versus 59% of the non-CS educators) reported on consulting an experienced educator and/or working closely with a colleague) when transforming their teaching to online.

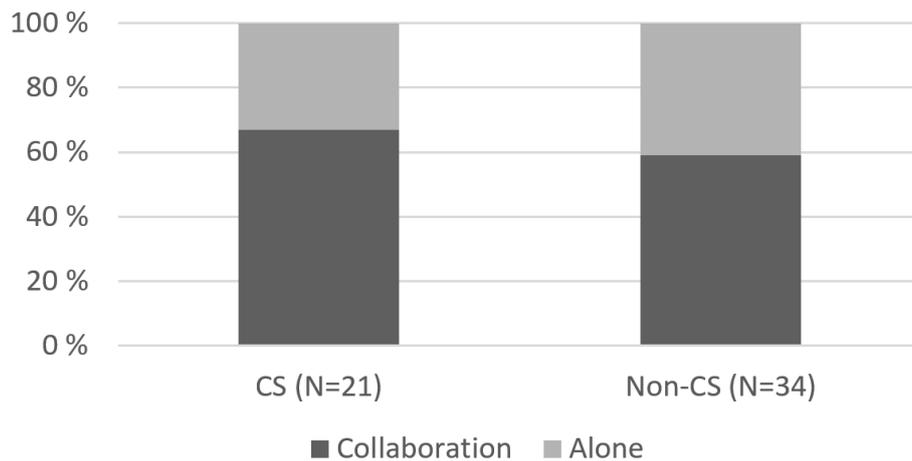


Figure 4: Transforming to online teaching alone or in collaboration with others

Changes to Teaching and Learning

The survey was conducted in both English and Norwegian. The Norwegian responses are translated to English in this section. The original Norwegian quotes are listed in Appendix A.

The survey included one question regarding what changes the educators had made to their teaching when transforming to an online mode of teaching.

Some educators reported on making minimal changes to their teaching when transforming to online, e.g.,

I could mostly teach as before. Surprisingly few changes/improvements were needed to get started. [Norwegian Quote No 1]

Some educators reported on making changes to their teaching so that it would fit better with the new context when transforming to online, e.g.,

Shortening the sessions to maintain both the educator's and the students' attention. [Norwegian Quote No 2]

In some cases, the educators reported on creating new learning spaces for the students but without initiating specific learning activities in these spaces, e.g.,

Created a separate Collaborate "room" for students. The room is open all day; all students are assigned the moderator role. Hence, they may create and manage collaboration groups, etc. all by themselves. Don't know if it will be used, but the option is there. [Norwegian Quote No 3]

There were also educators who adopted new ways to interact with students when transforming to an online only mode of teaching, e.g.,

I am not fully comfortable with the full class lectures, the students interact less in these. However pulls [editor's note: possibly a typo for polls] and use of hand raising to show agreement, works.

A small number of educators reported on changing their teaching completely when transforming to an online only mode of teaching, e.g.,

Two teachers sit down and make coding examples, one takes the lead while the other one takes care to follow up with questions that suits students who take more time to understand things. This lets us create a scenario where the high-end students have well-made examples, while the low-end students still get the extra explanations that help them understand.

Tools

Another question in the survey addressed the use of tools. The educators were asked what digital tools they were using when transforming to an online only mode of teaching. The educators reported on a large number of different tools for content production, content delivery, communication, and interaction.

Some educators stated that they had positive experiences using chat for interacting with students in online lectures, e.g.,

Experiencing that some students ask more questions in the chat than when they are in the classroom. (Non-CS educator) [Norwegian Quote No 4]

and

... there are more questions from the students than in an ordinary lecture. (Non-CS educator) [Norwegian Quote No 5]

Only a small fraction, approximately 20% of the educators, mentioned other tools developed specifically for online interaction, such as Mentimeter, Kahoot, and Padlet.

Positive Experiences

When asked to describe positive experiences they may have had, some educators seemed to be expecting that transforming to online teaching would be much harder than what they experienced, e.g.,

It works better than I feared

and

That the digital solutions (especially BB Collaborate Ultra) were present already. [Norwegian Quote No 6]

Other educators focused on positive experiences related to student interaction, e.g.,

The most positive aspect is that I get closer to the students through chat. ...

and

... Also, it seems like the students have a more positive attitude. ...

Finally, some educators focused on the collegial aspects, e.g.,

... In addition, the faculty at IDI are facing the same problems and sharing experiences and tips.

Challenges Experienced

Several educators mentioned technical issues when being asked what challenges they experienced when transforming to an online only mode of teaching, e.g.,

Some of the students do not have good internet connections, making it problematic to share video/screen. And some students are shy to share their video/screen. Some of the technical solutions have not worked on all platforms

A larger challenge, however, seemed to be related to the increased complexity when transforming to an online only mode of teaching, e.g.,

To test and to get an overview of the services, to choose something that would work well for students and staff. [Norwegian Quote No 7]

Several educators mentioned the lack of physical proximity to the students as a major challenge, e.g.,

I feel, online teaching is very static in the sense that I do not have contact to my audience, no eye contact no visible body language, which may express mutual understanding of the subject to be taught.

Several educators also mentioned problems related to interacting with the students in the online setting, e.g.,

Overall, students are less interactive.

Some educators also mentioned that it is harder to become engaged in their teaching when teaching online, e.g.,

Obviously a physical class is more engaging for the teacher at least. You don't see the students and so you can't get a feeling on how things are going.

4 Discussion

Academic Change

The findings discussed here are based on the data collected from 22 computer science (CS) educators and 34 educators from other faculties, who had to rapidly transitioned from a traditional face-to-face teaching and learning environment to a fully online teaching and learning environment. The results indicate that this experience was largely positive for the educators as they made the transition to online learning and teaching. While the results indicated that there were a number of challenges and fears for educators as they transitioned to an online teaching and learning environment, the educators embraced change and looked for ways to ensure that students continued to learn. This is in contrast to Brownell and Tanner [2], who claim that "changing academic teaching appears to be especially tricky" (p. 339) and in many cases it is "somewhat perplexing" that academics are so resistant to change. However, the explanation for the change here, can perhaps be attributed to the pandemic and a mandate that all academics transition their courses to an online only mode. While the initial results of the study do not fully explore the positive reaction of the academics when moving online, some of these factors may be attributed to the fact that more than 50 % of the educators also felt confident in transitioning to an online environment and believed that they had the pedagogical knowledge to do so.

This confidence is a self-assessed confidence and further exploration of the pedagogical approaches used in the transition to online learning is needed.

The results presented in this paper are comparable to the results reported by Langford and Damsa [9]. In their survey of 172 Norwegian educators, they also found that many educators report on having positive experiences when transitioning to an online only mode of teaching. In a similar context, Tartavulea et al. [17] also reported that in their survey of 114 educators from across Europe, the educators reported the switch to online teaching to have an overall moderately positive impact on the educational process. However, the survey by Watermeyer et al. [18] of 1148 educators working in universities in the UK, is drawing a darker picture of the rapid transition to online teaching due to the COVID-19 lockdown. The UK educators seemed to experience higher levels of stress and seemed to have fewer positive experiences than reported by the other surveys.

The initial findings in this study indicate that support and a shared focus have been key drivers to the positive nature of change reported by academics during the transition from face-to-face to online modes of teaching and learning. There is no doubt that during this process, academics have had to challenge their pedagogical identities as they transitioned to a new way of working. It is in this context that Lugetti [10] claims that "when a person changes they can be understood as taking a new identity" (p.1). In this sense, identity is continually changing in a way that links the past to the future [19] and for many educators this can present conflicting challenges. For this to be a positive, it is important that educators "engage in communities of practice (CoP) to foster teacher change and identity work by developing groups that discuss experiences and tensions about teaching and learning". It is within this sense that the authors advocate the need for collegial competence building.

Collegial Competence Building

As discussed in the results section, more than 60% of the educators reported collaborating with other educators when transitioning to online teaching. Langford and Damsa [9], similarly, found strong signs of collegial competence building in their recent study of academics transitioning to an online only mode of teaching and learning. Neither of these studies asked questions about communities of practice in online teaching. The results, however, suggest that there might be a lack of a larger community for sharing online teaching experiences within the universities; there are large differences in answers when the educators are asked about what changes they made to their teaching and what tools they were using. As shown by Buckley [3] and Kannan Moudgalya et al. [12], knowledge sharing among educators may contribute to an easier transition to online teaching. Therefore, to enable successful change in teaching CS teaching practices, CS education may benefit from focusing on a more structured process for the sharing of knowledge and establishment of online teacher communities that focus on digital pedagogies. However, these communities should be more than just sharing best practice:

Ultimately, innovation in HE is not about 'developing best practice' (which can be backward looking), but empowering better innovators within the context and structure of historical forms. (Salomn [16], p. 231.)

Hence, the strategy should rather be empowering CS educators to be active innovators of CS teaching practices.

Challenges Experienced

The findings in this study also indicate that educators found the lack of student interaction challenging. Similarly, Langford and Damsa [9] found that many educators noted the lack of direct contact with – and feedback from – students as a major challenge. There is, however, a large body of knowledge on the use of digital tools for student interaction in online learning that might be useful for the CS educators to make use of when planning for future online teaching activities. Awareness of the active-constructive-interactive framework proposed by Chi [4] might be beneficial to future work in this area. Likewise, further research related to the active use of online discussions in CS education, e.g., [11] and the use of quizzes and polls in virtual classrooms [15] may also contribute to addressing some of these challenges.

Salmon [16] recommends to initially meet such challenges through small initiatives and projects. The outcome of these should then be reviewed and success should be replicated at the institutional level. The CS departments should therefore, on the one side, promote and support new initiatives and projects in CS education development and, on the other hand, coordinate the efforts in scaling up successful initiatives and projects to a department-wide level.

Limitations

This study was of a particular place and at a particular and extraordinary point in time and the results may not be generalisable to other times and places. As with similar studies, particularly small case studies, there are always issues pertaining to generalisability and scalability.

5 Conclusion

In this study of 22 CS educators, nearly all the CS educators reported having a positive experience when abruptly transitioning to online teaching due to the COVID-19 lockdown. Contrary to prior research on pedagogical change, only a small minority mentioned time being a major obstacle when transitioning to online teaching. More than half of the CS educators reported having prior online teaching experience while 70% reported having sufficient or partially sufficient competence needed for the change. However, the main challenge faced by academics as they moved online was related to that of pedagogy. While many academics expressed confidence in having the skills to "go online", the use of appropriate digital pedagogies, that best met the needs of students, needed further development. The study also shows that some educators find online teaching to be better than campus based teaching in some areas. For example, some educators experienced improved student interaction when using chat based tools to interact with students during (online) lectures. It can therefore be argued that CS educators and departments should focus on developing improved practices for online student interaction.

Furthermore, the survey shows that CS educators collaborate and exchange pedagogical experience when facing change. 65% of the CS educators reported consulting a more experienced person or working closely with colleagues when transitioning to online teaching. Given the variety of experiences reported and given the willingness to collaborate and exchange experience, it can be argued that CS educators and departments may choose a path of knowledge sharing and communities for promoting future pedagogical changes.

As teaching and learning changes to meet the demands of a changing society, there is no doubt that educators will need to embrace "change" and challenge deeply entrenched beliefs of what teaching and learning is. While many universities have already invested in the technologies to support blended and online learning, there needs to be a systematic approach to using and enabling these digital technologies to support teaching and learning. This approach needs to avoid repetitive efforts, while creating a community of learners interested in pursuing learning environments that will support all students, no matter what course they are undertaking.

Future work

The survey was conducted immediately after the COVID-19 lockdown. Since then, the educators have had the time to further advance their transition to online learning and plan for future online learning activities. They have also had the time to exchange their experiences more widely with their colleagues. Furthermore, the current study year is set in a more blended context where some of the teaching takes place on campus as usual, while some teaching also takes place in a blended learning environment or fully online. A follow-up study, and ideally a larger study, would be useful in confirming and possibly extending the results found in this study. It is in this context that this paper suggests the need to focus on continued and improved collegial competence building for continued transitioning to online teaching and to share current knowledge and experiences in online student interaction..

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A Original Norwegian Quotes

In Section 3, Norwegian quotes were translated to English. This appendix lists the Norwegian original of the translated quotes.

- 1. Jeg har stort sett kunnet fortsette undervisningen på tilsvarende måte som før. Overraskende lite som måtte tilpasses/forberedes for å komme i gang.*
- 2. Komprimert undervisningsøkter for å opprettholde konsentrasjon både hos underviser og studentene.*
- 3. Har opprettet et eget Collaborate "rom" for studentene som er åpent døgnet rundt, der alle får rollen som moderatorer. Dermed kan de selv opprette samarbeidsgrupper osv, og styre bruken selv. Vet ikke om det kommer til å bli brukt, men tilbudet er der.*
- 4. Opplever at enkelte studenter stiller flere spørsmål i chat enn i klasserommet.*
- 5. ... det kommer inn mange flere spørsmål enn under en vanlig forelesning*
- 6. At alle digitale løsninger (BB Collaborate Ultra spesielt) var allerede på plass.*
- 7. Å prøve ut og få en oversikt over tjenestene, velge noe som både fungerer bra for studenter og fagstab.*