

Learning during COVID-19 Pandemic: Online Education Community, based on Discord

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Abstract—Education has been highly affected during the Covid pandemic. From one day to another, from kindergartens to universities, everyone involved in education has struggled to keep it going despite all the difficulties and restrictions. In our department, we coordinate two study programs in Computer Science (bachelor and master level). More than a year ago, we started to use the Discord communication platform to keep in touch in real time with our students and alumni. Our initial goal has been to create a strong ever growing community, in which our students, their former colleagues, and faculty can communicate easily. When the lockdown started, it was obvious that continuing to build and expand this community was the way to go. The last semester and the current one, we have been using Discord enhanced by a set of in-house developed scripts to communicate with the students, to keep going with both lectures and laboratories, according to the schedule, to have both the semester and the graduation exams, and so on. In this paper, we present our approach of continuing education during the pandemic (both requirements and solutions), and the lessons learnt during this experience.

Keywords—Computer Science education; online education community; formal and informal learning; pandemic education

I. INTRODUCTION

Education has been highly affected during the current Covid-19 pandemic. From one day to another, from kindergartens to universities, everyone involved in education, both individually and collectively, has struggled to keep it going despite all the difficulties and restrictions.

In our department, we coordinate two study programs in Computer Science (bachelor and master level). More than a year ago, we started to use the Discord communication platform to keep in touch in real time with both our current students and alumni. Our initial goal has been to create a strong ever growing community, in which our students, their former colleagues, and faculty can communicate easily and, therefore, can truly keep in touch. When the lockdown started, it was obvious for us both that continuing to build and expand this community was the way to go and that using a Discord-based platform for both formal and informal learning could be really useful both for students and faculty.

Discord is a platform specifically built to enhance communication among video game players that started being developed in 2015 [1]. In time, Discord's use has increased in

other areas as well, from study groups to other specific communities (art, hobby, application development, home improvement, and so on). The platform allows its users to communicate via voice, video, and text chat features. They can share various items either through specific community servers, private messages, or group messages. Discord is available on a variety of hardware and software, from desktops and laptops (both PCs and MACs) to mobile devices, and has a very intuitive user interface, which makes it really easy to use by anyone interested. In 2018, they added two more appealing features, i.e. video calling and screen sharing.

There are similar tools that enable online communication, such as Google Classroom and Microsoft Teams, but, in our view, they have major drawbacks. First, all the documents must be stored on their cloud repositories, which raises issues with respect to local accessibility, digital continuity, and copyright. Also, they are CPU-intensive, unlike Discord. Moreover, both systems lack the intuitive features of Discord that are essential in developing a close-knit user community. Furthermore, neither chat or bot functionality is provided in Google Classroom API, while the Microsoft API for developing bots requires using their development framework, which would have been really difficult to integrate with our existing GNU/Linux based educational infrastructure.

Consequently, we have decided to continue developing our Discord-based platform and to enhance its functionality towards the accomplishment of our educational needs by adding a comprehensive set of in-house developed scripts. Thus, the last semester and the current one, we have been using Discord to communicate with the students, to keep going with both classes and laboratories according to the schedule, to have both the semester exams and the graduation ones, and so on. Now we are preparing for our software development team competition to be held also via this Discord-based educational platform. In this paper, we present this approach of continuing education during the pandemic (both requirements and solutions), and the lessons learnt during this experience.

The next section includes the related work, while the third one presents the requirements for and the functionality of our Discord-based platform, along with some insights into its actual implementation. The last section is dedicated to the conclusions and future work.

II. RELATED WORK

In [2], the authors point out that modern distance learning systems, such as Moodle, Blackboard, and Lotus Learning space, are not well suited for use in situations as the current pandemic, mainly because they do not facilitate synchronous communication, especially in cases of limitations with regards to bandwidth and devices being used. First, they identified the most sought after capabilities that software for online education are expected to provide, i.e. keeping low the load on both the local system and the Internet, real-time conferencing, simultaneous displaying of all users' screens, individual or collective consulting, creating visual intuitive user interfaces, and, the servers' administration (including configuring users' rights). Then a comparison of the several communication platforms is provided, along with a survey, taken by 102 teachers and students of Melitopol State Pedagogical University, with regard to the enhancement of communication quality after starting to use Discord, in addition to their distance learning platform. It is worth mentioning that more than 75% of the respondents considered that introduction of Discord has significantly improved the communication in their distance learning, and more than 80% considered that improving the pedagogical capabilities of Discord would be beneficial for education.

In [3], the author presents the experience of using Discord for online tutoring at the University of Alaska Anchorage. Their Computer Science program has hired upper division students as tutors to help students in introductory and lower-division courses for 15 years now. While their focus has been on in-person tutoring, they have also experimented with many forms of online tutoring (IRC, Web chat, Google hangouts, Blackboard Collaborate, and a web-based ticketing system). None of these has been successful. In fall 2017, they started to use Discord by creating channels for each class, and by asking tutors to be available online if they were not busy with an in-person student. When announcing the students about the new system, they found out that a core group already used it for gaming, which contributed to quickly build a critical mass.

While their initial aim was to find a way of delivering online tutoring, once a critical mass of students began using the platform, they started to use it also for socializing, finding study buddies, and other community-building activities. A survey on 56 students is also provided. It shows that 64% of the respondents find tutoring via Discord extremely or very effective, while 73% of them consider using Discord useful for them as students.

Another work tries to assess how a community of gamers can grow both in numbers and culturally by being guided by an ethical tenet (*the creation of a civilized world where honest players thrive and the cruel and corrupt have no power*) [4]. The research focuses on members of the Harbormen gaming community, which have already been using Discord for three years on a consistent daily basis. They had used other voice and text chat applications like Skype, TeamSpeak, Ventrilo, Mumble, and Facebook to communicate with each other, but in comparison to these other services, Discord was deemed the best platform for gamers to communicate, *to assist and inspire others rather than put them down*.

Other related work addresses also online learning during the pandemic, but not specifically using a Discord-based solution. Thus, challenges and opportunities of online learning during the Covid pandemic are approached. The main identified challenges are as follows: pandemic-related anxiety will have negative effects on student academic performance, which also might be affected by racial, economic and resource differences, and the larger parts of instructors were not effectively ready to deliver high-quality instruction remotely [5-11]. One major opportunity is the change in attitude towards the importance of providing online learning from education administrators, teachers, and learners [12].

A very interesting work reflects on the possible problems arising from rushed adoption of commercial digital learning solutions whose design might not always be driven by best pedagogical practices, but by *their business model that leverages user data for profit-making*. The authors also challenge the narrative saying that *education is broken, and it should and can be fixed with technology* and ask almost rhetorically whether educational institutions will reinforce the *capitalist instrumental view of education or promote holistic human growth?* [13].

A comprehensive overview of responses to COVID-19 by higher education across 20 countries is provided in [14]. They have been very diverse from having no response, social isolation on campus, to curriculum redevelopment for online instruction. They show that in developing countries, the low cost solutions were the way to go with online education in order to maximize the number of students attending the classes. They also point out that the focus now should be on online pedagogy and that *never has there been a time for a coordinated, collaborative, and collective global response to the best practice principles for online instruction*. They identify also a real opportunity for shared resources and expertise across the world, to make sure that education of our students can continue during the pandemic.

III. ONLINE EDUCATION COMMUNITY IN CS EDUCATION

A. A bit more about Discord

The Discord platform has support for Windows, macOS, Android, iOS, Linux, and also for common browsers. It competes with Skype, Slack, and TeamSpeak. The ability to seamlessly move between different servers on Discord allows users *to have an active presence and connect with several communities at once*. Any user can create their own server to build a community in, and Discord gives users the power to moderate their own spaces. Additionally, Discord has drawn users to the platform by both being easy to use and having more capabilities than its competitors, which resulted in creation of new online gaming communities [15].

Discord works particularly well on all kinds of hardware and software, *even on low resource ones*. Discord is making constant improvements, taking feedback from its users to further enhance the application [1, 2, 4].

Users can create usernames, upload a profile picture, and link their Discord account to other social media like Facebook, Twitch, Twitter, etc. The platform boasts a total of 250 million users, of which about 14 million use it daily. These users send

about 315 million messages per day. Discord has around 100 million monthly active users with people talking for upwards of 4 hours per day on the platform [1, 4].

B. Discord-based Platform for Online Education Community

In our department, we coordinate two study programs in Computer Science (bachelor and master level). We started using Discord last summer, to replace Slack, in building the online community of our CS students and alumni. There we could make announcements, answer questions, and can keep in touch with each other. Many of students, as game fans, already used Discord, and that contributed to their willingness to participate in the community. Our motto is *Who is not already on Discord, s/he needs to register* ☺ Of course, we do not enforce that. For students who do not want to be involved, we use alternate communication channels.

Since the pandemic started and our country went in full lockdown, the classes had to be moved online from one day to another. With the support of both our head of department and our rector, we have been able to do that in a matter of days, on a Discord-based platform. We started by keeping online classes (according to the schedule), using some of the Discord provided services (voice, screencast, chat), and then created a bot (mainly Python scripts and backend server) to make the connection between the community and our online Web-based platform, on which all the instructional materials are stored.

This bot, called Info-AI, has grown and grown ever since with more and more features being added. We can use it to record the presence of students at any of the activities, to conduct courses, seminars and laboratories, to submit and record assignments, to hold both semester and bachelor/master exams, to carry extra-curricular activities, and so on. Of course, again, nothing is enforced. For example, some teachers use other tools (like Google Meet or Classroom). We also had to use Google Meet to conduct the Bachelor's and Master's final exam, under a regulation from our Ministry of Education and Research, but all the documents, including the theses, have been a priori uploaded, via Discord provided links, on our department's servers. The students can request various information from the bot, such as grades, homework etc.

The main capabilities we sought for in an online platform, able to provide for building an online education community, quickly, in time of crisis, as the current one, are as follows: easy real-time communication, audio and video streaming, screen sharing, multi-platform support, easy registration, building various communities, integration to existing online learning infrastructure, low cost or free, and, the most important for us, protecting the copyright, and providing extensibility with programmable features and automations.

Our existing infrastructure included (1) a Web server with instructional materials used for classes, such as lecture notes, lab and homework assignment, readings, and so on, along with (2) a ownCloud interface (web, mobile, desktop) for file uploads for each teacher, and (3) a back-end with MySQL database for all the users, including teachers and students, and other useful information such as courses descriptions, learning resource repositories, and so on. The architecture of our online

education community platform, built on top of a Discord server, is shown in Fig. 1.

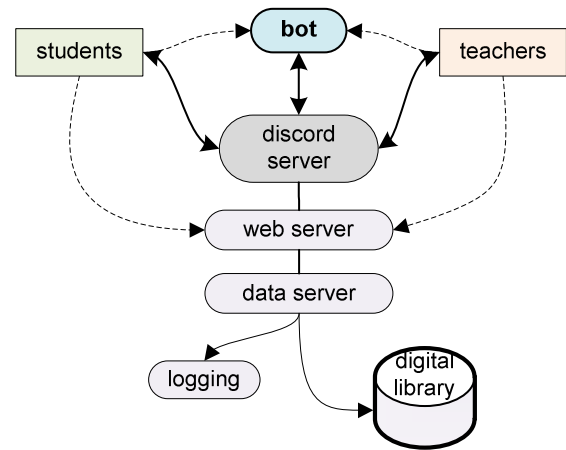


Fig. 1. Architecture of the platform for online education community

A connection to a Discord server, via the bot, has been added to the existing infrastructure. This bot is implemented using the Discord's API that gives access to the outside world at Discord's functionality [16], thus allowing adding features that Discord itself does not provide. The implementation of the bot consists of multiple scripts written in Python and bash (GNU/Linux shell). Events or messages are passed from Discord to this bot via a permanent Websocket connection. The bot can then respond to these events or user messages.

The registered users can upload various files to the data server, via the Web server, by using a link provided by the bot. Thus, the user can make a request for uploading a file to the bot. This file could be a homework assignment, a presentation, a software application, a media demonstration, a project report, and so on. Uploaded files are stored in the file system using a hierarchical structure based on each course name. Using the bot makes it really easy for anyone to upload any file they need with just one click. The registered users have also a unique access point to our data server via the Discord provided OAuth2 service, based on the implementation of the OAuth2 protocol on the web server [17, 18].

Various channels are available on our Discord server, such as general channels (e.g. announcements, data repositories, interesting links, contests, job opportunities, entertainment, corona virus and pandemic), one channel for each discipline/course, one channel for each university year (freshmen, sophomore, final), one for each student group or subgroup, along with several voice channels (multiple for each year, so parallel lectures/seminars/labs can be kept at the same time) (Fig. 2).

For now, the users on our server are as follows: the current 165 students of our BSc and MSc programs in Computer Science, the 21 teachers (including the English one), and 40 alumni from the last university year.

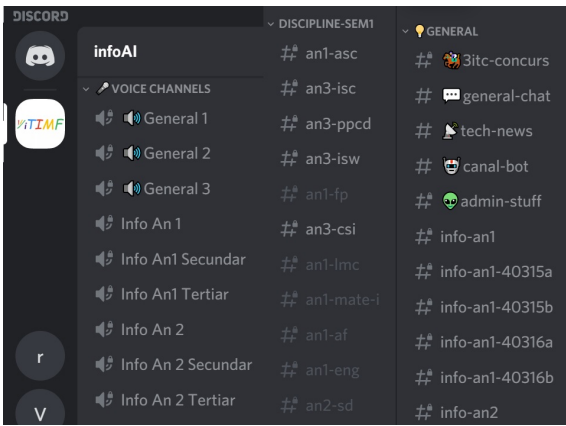
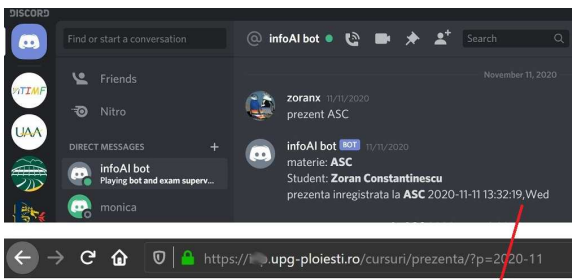


Fig. 2. The created Discord channels

C. Use Scenarios

In this section, we present briefly the main use scenarios.

Attendance tracking - to keep record of whom attends each particular class the bot provides for automatically recording each student's attendance, as it can be seen in Fig. 3. Anyone attending a class, even teachers, has to send the message *present class-name* to the Info-AI bot. Then, the bot will look up the Discord user name, match it with a person in the database, and if both exists and he is enrolled to that particular course, the current date and timestamp will be logged, then the student will be notified about his successful presence.



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perioada [2020-11-11] * 2020.oct * 2020.nov * 2020.dec

data	ora	modul	materie	an	student
2020-11-11 13:21:29	Wed	M4	TAIA	prof	G...
2020-11-11 13:27:36	Wed	M4	ASC	info1	Mo...
2020-11-11 13:28:48	Wed	M4	IA	info3	C...
2020-11-11 13:29:43	Wed	M4	ASC	info1	Ma...
2020-11-11 13:30:46	Wed	M4	ASC	info1	St...
2020-11-11 13:31:35	Wed	M4	LFC	info2	P...
2020-11-11 13:32:08	Wed	M4	ASC	info1	Ma...
2020-11-11 13:32:18	Wed	M4	ASC	info1	So...
2020-11-11 13:32:19	Wed	M4	ASC	prof	Zoran Constantinescu
2020-11-11 13:32:19	Wed	M4	ASC	info1	Ta...
2020-11-11 13:32:21	Wed	M4	ASC	info1	Pa...
2020-11-11 13:32:21	Wed	M4	ASC	info1	V...
2020-11-11 13:32:24	Wed	M4	ASC	info1	Ba...
2020-11-11 13:32:24	Wed	M4	LFC	info2	P...

Fig. 3. Attendance tracking

Online classes – all classes can be held online, via a combination of using a voice or video channel, the chat on each class's channel (where users can exchange text messages or attach different files), sharing of the screen or an application window, as it can be seen in Fig. 4.

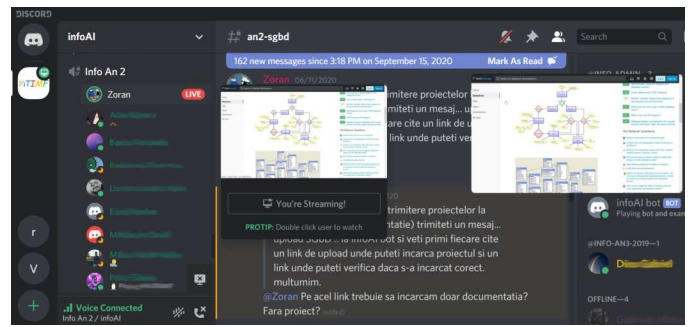


Fig. 4. Online classes

Homework assignments – in order to get an homework assigned, a student needs to send a upload message to the bot specifying the course name and the homework number (first, second, and so on), for example, *upload DAM tema1* (DAM means Development of Mobile Applications and tema1 is the homework1). The bot will look up the student enrolment and if it is valid, it will provide a unique web link for uploading the homework (Fig. 5). Using that link to upload any files will ensure that the bot will associate those files with both the specified course and homework number, and will notify the student about the successful upload.

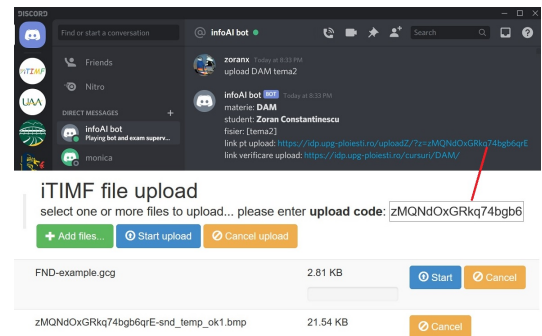


Fig. 5. Homework upload

It is worth mentioning that both the teacher and the teaching assistant can make comments on the homework and give marks (Fig. 6). When the evaluation is complete, the bot will send a notification message to the student, with both the comments and marks.

secrta	student	data	modul	materie	an	student	mark	comment
1	[12M] [Info1] [Info1]	2020-11-11 13:32:19	M4	ASC	info1	Zoran Constantinescu	4	
2	[13M] [Info1] [Info1]	2020-11-11 13:32:19	M4	ASC	info1	Zoran Constantinescu	4	
3	[17M] [Info1] [Info1]	2020-11-11 13:32:19	M4	ASC	info1	Zoran Constantinescu	4	
4	[13M] [Info1] [Info1]	2020-11-11 13:32:19	M4	ASC	info1	Zoran Constantinescu	4	
5	[13M] [Info1] [Info1]	2020-11-11 13:32:19	M4	ASC	info1	Zoran Constantinescu	4	
6	[13M] [Info1] [Info1]	2020-11-11 13:32:19	M4	ASC	info1	Zoran Constantinescu	4	
7	[13M] [Info1] [Info1]	2020-11-11 13:32:19	M4	ASC	info1	Zoran Constantinescu	4	
8	[13M] [Info1] [Info1]	2020-11-11 13:32:19	M4	ASC	info1	Zoran Constantinescu	4	
9	[13M] [Info1] [Info1]	2020-11-11 13:32:19	M4	ASC	info1	Zoran Constantinescu	4	

Fig. 6. Homework evaluation and notification

Taking exams – in case of multiple choice exams, the student sends a request to the bot, that he wants to take that exam (e.g. *examen SO*, which means *exam OS - Operating Systems*). The bot will look up the student, and after verifying that she is enrolled to that course and that the exam's date is now, it will send a personalized link with the exam page and her unique multiple choice form. The student needs to complete the exam by answering the questions in a required time interval (Fig. 7). The final grade is obtained by request to the bot as well (*nota SO* that means *grade at OS*).

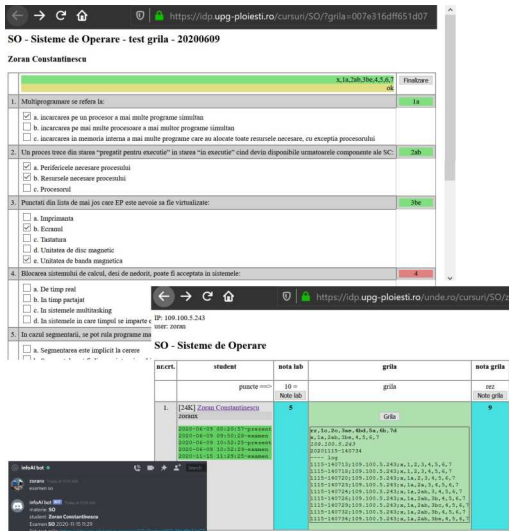


Fig. 7. Multiple choice exam

Bachelor and Master final exams – this year, because of the pandemic, all bachelor and master final exams have been held online, via Google Meet, under a regulation from our Ministry of Education and Research. In order to register for taking these exams, the students have to submit both a file holding specific documents and their thesis. To make things easier for anyone involved, this has been possible also via the Info-AI bot, which provided for uploading all the documents on our department's servers via Discord provided links (Fig. 8). Each member of the examining committee has been able to see all the uploaded files (thesis, presentation, demo, source code etc.), to give comments, and to mark each thesis.

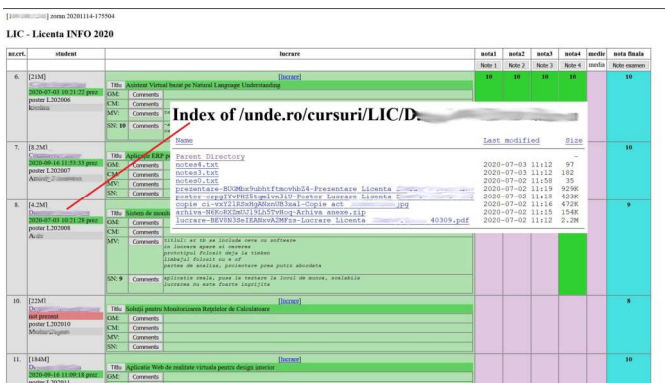


Fig. 8. BSc/MSc exam documents, comments and marks

D. Assessment and Discussion

The main goal when we started to use Discord has been to build a close-knit community of Computer Science students, alumni, and teachers, in which each and everyone of them feels he or she belongs. During their university years, we ask them, quite often, for feedback on the quality of their university study, in particular, and life, in general. We also ask them about their expectations. The most prominent one, for more than 95% of them is to be more involved with each other and with the faculty (this is based on formal feedback based on questionnaires). We see now that since we started using this platform, we are getting there faster and deeper than ever before. The alumni help the students to get jobs in their work places, they answer to their questions related to coding, technology, and “the real world”, in general. The students help each other with study, but also with other community opportunities, or challenges.

The department also benefits hugely from the use of our Discord-base online education platform. The educational process has continued to flow steadily, in spite of the difficulties. Last semester, we have been fully online. This semester, we started with lectures held online, and seminars and laboratories held face to face. In both cases, the day to day work and the transition from one form to the other have been smooth, despite the extra effort involved.

We have not conducted yet any formal feedback gathering, but have asked for informal one both individually and collectively and, as a result, we have learned significant lessons. For example, this year, the freshmen have integrated faster than ever before in our CS community, despite all current Covid-related restrictions. They are delighted that they can see what their more senior colleagues study, what is to be expected in the future, especially now, with so many unknown facts in front of them. They have been particularly active and reached to both their colleagues and faculty when they needed (all kind of) help.

The undergraduate students, on one hand, are generally not happy about not meeting in person for classes. Last semester, the majority of them complained quite a lot about not being able to come to the university and to be together with their colleagues and teachers. They were thrilled this semester, when we started with face to face seminars and laboratories. Now, due to number of cases rising in our university, we are back online with all the activities. On the other hand, the students at Master level are content with having all the classes online, especially because most of them have full time jobs. Even though the pandemic has allowed them to work from home, they are still pleased they do not have to travel back and forth between their homes and the university. Also, they say they are not bothered that much because they are more independent than the students in the Bachelor program.

Of course, not everything is positive and we think more research on how to improve things, pedagogically speaking, is necessary. For instance, when students attend online classes held both via audio channels and chat, they get easily distracted by other household members or pets, which is consistent with the findings in the literature. Also, some believe that because they are online it is easier to multitask –

on our last lecture on Data Structures, held with sophomores, one male student was dusting in parallel with listening to the teacher speaking and answering to questions asked by his colleagues. In our opinion, learning about data structures is hard enough as such, so no distractions are helpful.

Another massive blow was the low number of students being able to take their final Bachelor's exam. We started the Computer Science program in 1992, and our first cohort of students graduated in 1997. The number of students enrolling in the first year varies, but it is consistently between 45 and 65. About half of them are able to graduate on time, at the end of the study years. This year, however, because of these unusual circumstances, only one third of them participated in the exam and all but two successfully finished. Moreover, two top students, the second and the third in this year's class, have finished late their theses, being able to take the final exam only in our fall session (along with few more students). Further, they decided to get a job and not enroll in a master program for now. That also has not happened before. Our top students used to enroll in master programs as soon as they finished with their bachelor one, in our university, or to other university here or abroad.

And all of that has happened in a context in which faculty has gone out of their way to help students having a smooth and effective educational process. They prepared a large variety of extra materials that were especially appropriate for online distance learning, they have made themselves available in many more ways than usual, they answered questions asynchronously to the class, and so on and so forth.

IV. CONCLUSIONS AND FUTURE WORK

On the bright side, our Discord-based online educational platform has worked properly, providing support to keep things going with regard to both instruction and education of our students in Computer Science (Bachelor and Master). It has made things easier, first by providing support for classes, homework, exams, study groups, etc. Secondly, the most important, it helped tremendously by contributing to building a resilient community during hardship. For example, when our first student became infected with the new coronavirus, he let us know immediately after he has got the results, and, consequently, our head of department has been able to move all the activities online for two weeks, just by letting anyone know about it on the platform. Absolutely no one came next day for in-person classes.

On the other hand, there is still a lot of work to do, especially in direction of establishing how to make education better during the pandemic and, of course, after. We need to creatively rethink and reinvent education in order to compensate the major loss our students must endure by not being able to attend classes and other educational activities as usual. This is important both for current online education and for the face to face one, after the pandemic is over.

Therefore, further work is concerned with new pedagogical approaches with regard to instructional design, teaching and learning strategies, contextualization of learning, formal and informal education, and so on. On the software development side, adding new features to the info-AI bot is

needed, so that it becomes able to provide for holding more types of educational activities. A more formal evaluation of this instructional environment is also necessary, because it can help us to improve the educational outcomes of our students, while still in pandemic, but also after, both in formal and informal education.

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