EDUBOTS

EDUBOTS Case studies

Prepared by Faculty of Organization and Informatics, in collaboration with the consortium partners in the project

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Consortium

The table presented below shows the consortium of the EDUBOTS project.

Table 1. Consortium partners of the EDUBOTS project

DIFFER	P1 – EDTECH FOUNDRY AS
HUBERT	P2 – ANNA & HUBERT LABS AB
UNIVERSITY OF LEEDS	P3 – UNIVERSITY OF LEEDS
foi	P4 – UNIVERSITY OF ZAGREB, FACULTY OF ORGANIZATION AND INFORMATICS
CYENS	P5 – CYENS CENTRE OF EXCELLENCE
UNIVERSIDAD DE GRANADA	P6 – UNIVERSIDAD DE GRANADA

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Introduction

Academic consortium partners describe in this document all of their cases of using Differ, Hubert, and other chat platforms or chatbots in higher education courses in four pilot implementations, namely four different semesters from January 2020 till December 2021. Most interesting cases are extracted and described in more detail in the Best Practices report.

Differ (https://www.differ.chat/) is a chat platform with web, mobile, and desktop clients, aimed at users in the higher education institutions: students to stimulate student collaboration (to connect and chat, find answers, or get help from peers), and educators to boost communication on course level (creation of course communities for their courses and sharing additional information and knowledge with the students). Chatbot BO was integrated into Differ during the project, and it offers functionalities such as pairing up students to facilitate icebreaking, and introductions.

Hubert (https://www.hubert.ai/) is an artificial intelligence-powered chatbot used to automate feedback to educators. It facilitates formative assessment and personalized feedback in the form of a structured interview. Educators set up an evaluation using the provided educational templates with several questions and then share a link with the students who evaluate a course by providing narrative feedback.

Telegram (https://telegram.org/) is a messaging platform, with web, mobile, and desktop clients for all popular operating systems. Telegram also has an open API, allowing anyone to create chatbots with any degree of intelligence.

Case studies document consists of descriptions of courses, educators, course content, students, pedagogical approaches, and ways of implementation from different universities. Project did not promote a single, universal approach which should be applied on all of the courses. Thus, the cases sometimes had large differences and should be analysed primarily from the qualitative perspective.

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1. Case Studies from Pilot 1

Data for Pilot 1 (January 2020 - June 2020) was gathered from course educators who responded to emails and calls from local representatives participating in the Project. All data was entered in the common table from which cases were extracted and described.

1.1. Cyprus Universities

In Pilot 1, CYENS invited educators across different local universities to participate in the pilot, for testing Differ and/or Hubert. Specifically, the educators were provided with short and general descriptions for the potential use of the two chatbots, as given below.

Chatbot 1: Developed to support course evaluation in a formative manner (the Chatbot gathers input from the students in the form of a mini-chat interview with them at different time-points in the semester; a thematic map of the input is shared with the instructor ONLY).

Chatbot 2: Developed to facilitate/support communication between students/learners in a mentor-mentee format.

A total of 10 educators expressed interest to participate in Pilot 1, summing up to a total of 11 different courses (one educator used Hubert in two different courses). Two educators used both Differ and Hubert in their courses (MGA320, POM116), two educators used only Differ in their course (Mihub, EPL121), while the rest of the six educators used Hubert in their course, as part of the informal course evaluation use case scenario (Sociology and pedagogy issues in Physical Education, Planning and instructing exercise for Health and Fitness, CFS428 Taxation, MGA 341, EPL 449 Professional Software Technology Practice, 3d Modelling and Animation II, Social Network Analysis). First, an invitation to join the pilot was shared with CYENS members' professional networks via emails. Second, educators who were interested in participating in the pilot were required to complete a short online form (i.e., Google form, https://form.jotform.com/200351810386448) and provide their contact details. Third, CYENS researchers then proceeded with communicating with the educators via phone or personal emails, for providing more information about the pilot, the potential use of the chatbots in the class, and the data collection processes. Educators who were willing to proceed with the pilot testing of the chatbots in their courses, further received guidelines and instructions on how to set up the chatbots and how to engage their students. One-to-one tutorials and teleconferencing meetings took place, for providing this facilitation. Also, written instructions were also provided on how to use Differ and Hubert. Educators were motivated to test a new technological solution in their class,

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especially a chatbot. Educators aimed to either support mentorship and/or communication processes within their class with the use of Differ, or to provide an alternative and more engaging activity to their students for course evaluation, with the use of Hubert.

Case #1

- **Course name: MGA320:** Design for All (Multimedia and Graphic Arts department)
- **Number of students**: fewer than 50
- **Course description:** Obligatory course. It started in mid-January, took place physically until beginning of March when it turned to be taking place online, due to covid-19. Attending students are third-year students.
- **Description of students' engagement with Differ and Hubert:** Students were onboarded via email. Differ was used for mentorship and communication among students. The exact (onboarding) message is given below:

  > *Hi! Welcome to this Differ community for course MAG320 Design for All at CUT. My name is Olia and I'm the community moderator, on behalf of [NAME OF THE INSTRUCTOR BLINDED]. Don't hesitate to reach out to me if you have any questions. (You can send me a private message).*
  > ***Why should I use Differ?***
  > *- See who's in your course.*
  > *- Chat with your peers without having to share phone numbers and social media accounts.*
  > *Your private conversations stay private!*
  > *(GDPR-compliant & Ad-free)*

  A teaching assistant, a senior student, and an EDUBOTS researcher were onboarded as mentors.
  The only data there is comes from the post-pilot survey, in which the students were asked to indicate the times of using Differ in total. The survey was administered by all participants; thus, there is no data per course. 32 students responded to the survey, out of which 14 students did not ever use Differ and thus, they did not complete the survey. From the rest of the students (n=18), one student used Differ twice, one student used it 11-20 times, and 16 students used it 1-5 times during the semester.
  The students were prompted twice in the semester to use Hubert for course evaluation purposes.
- **Affordances and challenges:** The mentors tried to initiate discussions with the students on a personal level. However, they admitted (unofficially) that the communication and response on the behalf of the students was limited.
  Mentor-student communication: see paragraph above. Also, once teachers set up the community and onboarded students and mentors, they could see very few interactions at the beginning, at least in the open chat space. Teachers do not know whether private messages were exchanged among mentors and students.

Case #2

- **Course name**: POM116 - Statistics (Civil Engineering and Geomatics)
- **Number of students**: 50 to 100

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- **Course description**: Obligatory course. It started in mid-January, took place physically until beginning of March when it turned to be taking place online, due to covid-19. Attending students were first-year students.
- **Description of students' engagement with Differ and Hubert**: Differ was used for mentorship and communication among students. The exact (onboarding) message is given below:

  Hi! Welcome to this Differ community for course POM116 at CUT.
  My name is Olia and I'm the community moderator, on behalf of [NAME OF THE INSTRUCTOR BLINDED].
  Don't hesitate to reach out to me if you have any questions. (You can send me a private message).
  Why should I use Differ?
  - See who's in your course.
  - Chat with your peers without having to share phone numbers and social media accounts.
  Your private conversations stay private!
  (GDPR-compliant & Ad-free)

  Three teaching assistants and an EDUBOTS researcher were onboarded as mentors.
  Mentor-student communication: once the community was set up and onboarded students and mentors, no further interactions could be seen and documented, at least in the open chat space. There is no knowledge whether private messages were exchanged among mentors and students.
  The only data there is comes from the post-pilot survey, in which the students were asked to indicate the times of using Differ in total. The survey was administered by all participants; thus, there is no data per course. 32 students responded to the survey, out of which 14 students did not ever use Differ and thus, they did not complete the survey. From the rest of the students (n=18), one student used Differ twice, one student used it 11-20 times, and 16 students used it 1-5 times during the semester.
  The students were prompted twice in the semester to use Hubert for course evaluation purposes.
- **Affordances and challenges:** The mentors (teaching assistants) were not really active.

Case #3

- **Course name**: CFS428 Taxation (Commerce, Finance & Shipping)
- **Number of students**: fewer than 50
- **Course description**: Obligatory course. It started in mid-January, took place physically until beginning of March when it turned to be taking place online, due to covid-19. Attending students are fourth-year students.
- **Description of students' engagement with Differ/Hubert**: Differ was not used in this course. Just Hubert for course evaluation. The students were prompted twice in the semester to use Hubert for course evaluation purposes.
- **Affordances and challenges:** /

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Case #4

- **Course name**: MGA 341: Internet Application Development II (Multimedia & Graphic Arts)
- **Number of students**: fewer than 50
- **Course description**: Attending students are third-year students.
- **Description of students' engagement with Differ**: Differ was not used in this course. Just Hubert for course evaluation.
  The students were prompted twice in the semester to use Hubert for course evaluation purposes.
- **Affordances and challenges:** /

Case #5

- **Course name**: Social Network Analysis (Social Information Systems department)
- **Number of students**: not provided
- **Course description**: Open University
- **Description of students' engagement with Differ/Hubert**: Differ was not used in this course. Just Hubert for course evaluation. The students were prompted twice in the semester to use Hubert for course evaluation purposes.
- **Affordances and challenges:** /

Case #6

- **Course name**: EPL 449: Professional Software Technology Practice (Computer Science department)
- **Number of students**: fewer than 50
- **Course description**: Attending students are fourth-year students.
- **Description of students' engagement with Differ/Hubert**: Differ was not used in this course. Just Hubert for course evaluation. The students were prompted twice in the semester to use Hubert for course evaluation purposes.
- **Affordances and challenges:** /

Case #7

- **Course name**: 3d Modelling and Animation II (Multimedia & Graphic Arts)
- **Number of students**: fewer than 50
- **Course description**: not provided
- **Description of students' engagement with Differ/Hubert**: Differ was not used in this course. Just Hubert for course evaluation. The students were prompted twice in the semester to use Hubert for course evaluation purposes.
- **Affordances and challenges:** /

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Case #8

- **Course name**: Sociology and pedagogy issues in Physical Education (School of Science, Sports and Exercise Science)
- **Number of students**: fewer than 50
- **Course description**: Obligatory course. It started in mid-January, took place physically until beginning of March when it turned to be taking place online, due to covid-19. Attending students are first-year students.
- **Description of students' engagement with Differ/Hubert**: Differ was not used in this course. Just Hubert for course evaluation. The students were prompted twice in the semester to use Hubert for course evaluation purposes.
- **Affordances and challenges:** /

Case #9

- **Course name**: Planning and instructing exercise for Health and Fitness (School of Science, Sports and Exercise Science)
- **Number of students**: fewer than 50
- **Course description**: Obligatory course. It started in mid-January, took place physically until beginning of March when it turned to be taking place online, due to covid-19. Attending students are second-year students.
- **Description of students' engagement with Differ/Hubert**: Differ was not used in this course. Just Hubert for course evaluation. The students were prompted twice in the semester to use Hubert for course evaluation purposes.
- **Affordances and challenges:** /

Case #10

- **Course name**: EPL121: Digital Systems (Computer Science)
- **Number of students**: more than 100
- **Course description**: Attending students are first-year students.
- **Description of students' engagement with Differ**: Differ was used for mentorship and communication among students. The exact (onboarding) message is given below:

  Hi! Welcome to this Differ community for course EPL121 at UCY. My name is Olia and I'm the community moderator, on behalf of [NAME OF THE INSTRUCTOR BLINDED]. Don't hesitate to reach out to me if you have any questions. (You can send me a private message).
  Why should I use Differ?
  - See who's in your course.
  - Chat with your peers without having to share phone numbers and social media accounts.
  Your private conversations stay private! (GDPR-compliant & Ad-free)
  - Use Differ for course communication with your peers.
  For example, you can ask questions in the #OpenChat and

  8 individuals were proposed by the instructor to be contacted and added as mentors. It is not sure whether all 8 mentors were finally active.

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Mentor-student communication: once the community was set up and onboarded students and mentors, no further interactions could be seen and documented, at least in the open chat space. There is no knowledge whether private messages were exchanged among mentors and students.
The only data there is comes from the post-pilot survey, in which the students were asked to indicate the times of using Differ in total. The survey was administered by all participants; thus, there is no data per course. 32 students responded to the survey, out of which 14 students did not ever use Differ and thus, they did not complete the survey. From the rest of the students (n=18), one student used Differ twice, one student used it 11-20 times, and 16 students used it 1-5 times during the semester.
Hubert was not used in this course. Just Differ.

- **Affordances and challenges:** /

Case #11

- **Course name**: MiHub course
- **Number of students**: 50 - 100
- **Course description**: not provided
- **Description of students' engagement with Differ**: Differ was used for communication among students. The exact (onboarding) message is given below:

  Hi! Welcome to this Differ community for MiHub Limassol. My name is Olia and I'm the community moderator, on behalf of [NAME OF THE INSTRUCTOR BLINDED]. Don't hesitate to reach out to me or [NAME OF THE INSTRUCTOR BLINDED] if you have any questions. (You can send me a private message).
  Why should I use Differ?
  - See who's in your course.
  - Chat with your peers without having to share phone numbers and social media accounts. Your private conversations stay private! (GDPR-compliant & Ad-free)
  - Use Differ for course communication with your

  Differ was used for facilitating the communication among the members of the MiHub, not for mentorship.
  The only data there is comes from the post-pilot survey, in which the students were asked to indicate the times of using Differ in total. The survey was administrated by all participants; thus, there is no data per course. 32 students responded to the survey, out of which 14 students did not ever use Differ and thus, they did not complete the survey. From the rest of the students (n=18), one student used Differ twice, one student used it 11-20 times, and 16 students used it 1-5 times during the semester.
  Hubert was not used in this course. Just Differ.
  Affordances and challenges: /

Summary

Hubert was used in 9 courses, for informal course evaluation. For most of the instructors who used Hubert in their course, the raw data, to which they also had access, was perceived as useful, helping them to identify pros and cons in their teaching. Yet, the content analysis of students'

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responses in Hubert was not perceived as adequately useful to most of the instructors, since the key words used for the content analysis were not meaningful to them. They did acknowledge that, if the bot would be applied in a large-scale class, then perhaps the outputs (Hubert evaluations) would be more meaningful (compared to the experience that they had). Despite these considerations, they all mentioned that they would use Hubert again in the future, as they could see potential in the chatbot to help in course evaluation in this direction. In relation to usability issues of the Hubert platform, one of the instructors mentioned that, even though s/he had received a .pdf with instructions (created by the Hubert Labs team), still it was not clear enough what the instructor should do to retrieve the data and how to interpret the outputs. In addition, the prerequisite to read a pdf with instructions was perceived as time consuming; thus, it was proposed by few of the instructors of creating a short video as a tutorial with clear instructors and guidelines. Also, there was a case in which the instructor reviewed the evaluations in the Hubert platform, but did not save the outputs, and 2-3 weeks later, could not retrieve the outputs and data. The instructor mentions that it would have been useful to be informed about whether and when the data are deleted from the platform. The interviewees proceeded with some recommendations on potential improvements and refinements of Hubert. They all proposed the need for having a new feature, which allows them to add their own questions in the platform (i.e., the questions that the chatbot is using during the conversation with the students). Further, they would like to have full control of Hubert use. That means, the minimum required involvement of the IT staff, the Hubert company, nor any moderator/ researcher to be involved in the process.

Differ was used in four different courses, for the use case scenario of mentorship (i.e., as an additional communication channel between students and mentors). In this scenario, the instructors agreed to create a community for their course within the Differ platform, in which students of the course and mentors could communicate, without the intervention of the instructor. Mentors were assigned as administrators in the community of the class and are allowed to create topics for discussion with the students. Also, members of the community could communicate with each other through private channels. The educators acknowledged during post-pilot interviews that their evaluation was bounded by the fact that they did not actually use Differ; their experience was limited to the technicalities of setting up the community and inviting the students. It was mentioned during the interviews that they would like to have full control of the Differ use. That means, no involvement of the IT stuff, the Differ company, nor any moderator/ researcher to be involved in the process. They also noted that they could not be aware of how many times the students used Differ and they had no access to aggregated data, which is not desirable. Even though the instructors acknowledged the initial purpose of Differ (to bring students and mentors together), still, they found a bit problematic the fact that Differ was promoted as part of the class communication, but the instructor had no access to identify any miscommunication among mentors- students, or among students, in topics related to the course. Last, it was mentioned that, even though Differ is marketed as a chatbot, it functioned more like a chat platform. Considering that the students already use other chat platforms, it was hard to find an added value in the use of Differ. Overall, the added value of Differ was not apparent to them, compared to other available tools and platforms.

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1.2. University of Granada

University of Granada (UGR) used Differ for Pilot 1 and 2, setting up a chat group (community) for all the students in the Informatics and Telecommunication School of Engineering of the Univ. Granada. About the educators, all teachers from the School were invited to participate through different emails in the School of Engineering mailing list. Educators that showed interest were mainly part of the project and used different tutorials and manuals to help them understand the potential of chat groups in Education. Also, descriptions about the use of chatbots were provided. Since the number of interested Educators was limited, most interactions were one-to-one and via teleconferencing.

A few educators finally showed interest but only 3 (already part of the project), started the pilot or helped with it. All of them used Differ and promoted the use among the students using student mentors to encourage other students to use the chat tool. Most students in the School of Engineering are between 18-22, and are mainly from ICT areas: Computer Engineering, Computer Engineering and Economics, Computer Engineering and Mathematics, and Telecommunications. Also, students between 22-23 study their Masters in the School (in Computer Engineering and Telecommunications).

Case #1

- **Course name**: All courses; Computer Engineering and Telecommunications, as well as double majors (with Mathematics and Economics)
- **Number of students**: 1500 for the whole school
- **Course description**: n/a
- **Description of students' engagement with Differ**:
  Students were onboarded via e-mail to institutional student addresses. Initially the intention was to have students using it for several tasks: class swapping, elective class recommendation, collective action for learning quality. However, the pilot was delayed until late May, by which time utility was relative. It could have been used for study groups, but the small number of students that signed up did not allow that.
  Student representatives were told to participate, and introduced in the platform a few days in advance.
  The mentors were already involved in their own careers, as well as other student activities. It was slow and difficult to communicate with them, although they showed good willingness throughout the pilot.
  Communication was mostly student to student. No communication professor-student, scarce communication among students.
- **Affordances and challenges: /**

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Summary

The main finding of this first experience was that large groups for communities such as all the students in a Faculty or a School of Engineering are not particularly useful. The Univ. of Granada already provides a well-supported platform for the communication between the students and their teachers, and also with the administration. Moreover, teachers also support other educational platforms or LMS that are very popular. Both the institutionally-supported platforms and teachers' ad-hoc platforms provide students with tools to communicate with their educators and sometimes, with their peers. On the other hand, students already use other self-organised tools such as WhatsApp and Telegram in order to do that.
Additionally, the delay of the pilot to May (in the middle of the second semester) did not contribute to the adoption by the students since they already were using their self-organised chat groups. At this point, one of the interesting findings was that students preferred to use tools they were familiar with instead of learning new ones.

1.3. University of Leeds

Case #1

- **Course name**: XJCO2121 Data Mining (Leeds-SWJTU Joint School of Engineering)
- **Number of students**: 50 to 100
- **Course description**: 10-credit module, part of 3rd year of BSc Computer Science programme taught at South West Jiatong University campus in Chengdu, China. Teaching activities are lectures and practical coursework assignments
  Students on BSc Computer Science programme taught at South West Jiatong University campus in Chengdu, China; mainly Chinese students age over 19.
- **Description of students' engagement with Differ**:
  One EDUBOTS researcher alone encouraged students to use Differ and Hubert but it was not compulsory. He sent an announcement at start of course (Differ) and near end of course (Hubert) to the class via Blackboard, which also generated email to each student, with URL to joining web-page. Differ was presented as a chat platform for students to meet, e.g. for group work; Hubert was presented as a chatbot to collect student feedback. There were no mentors.
  Students joined Differ and a few used the platform to communicate with other students but most did not, just tried Differ once to see if it might be useful then gave up.
  A small minority of students found Differ "interesting" but most tried it once then gave up. Hubert was used once at the end of the semester.
- **Affordances and challenges:** Leeds-SWJTU Joint School of Engineering requires students and educators to use other chat platforms in learning, and we could not make use of Differ or Hubert mandatory. It was challenging to persuade students to volunteer to trial use of additional platforms.

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Case #2

- **Course name**: COMP5840M Data Mining and Text Analytics (School of Computing)
- **Number of students**: over 100
- **Course description**: 15-credit module, part of MSc Advanced Computer Science and MSc Data Science and Analytics. Teaching activities are lectures plus practical coursework assignments.
  Students on MSc Advanced Computer Science MSc Data Science and Analytics and related MSc programmes; mainly International (non-UK) students aged over 21.
- **Description of students' engagement with Differ**:
  One EDUBOTS researcher alone encouraged students to use Differ and Hubert but it was not compulsory. He sent an announcement at start of course (Differ) and near end of course (Hubert) to the class via Blackboard, which also generated email to each student, with URL to joining web-page. Differ was presented as a chat platform for students to meet, e.g. for group work; Hubert was presented as a chatbot to collect student feedback.
  Students joined Differ and a few used the platform to communicate with other students but most did not, just tried Differ once to see if it might be useful then gave up.
  A small minority of students found Differ "interesting" but most tried it once then gave up.
  Hubert was used once at the end of the semester.
- **Affordances and challenges:** Leeds University IT Service requires students and educators to use other chat platforms in learning, and we could not make use of Differ or Hubert mandatory. It was challenging to persuade students to volunteer to trial use of additional platforms.

Case #3

- **Course name**: COMP2121 Data Mining (School of Computing)
- **Number of students**: over 100
- **Course description**: 10-credit module, part of 2nd year of BSc Computer Science programme. Teaching activities are lectures and practical coursework assignments.
  Students mainly from UK and about 20% International, aged over 19.
- **Description of students' engagement with Differ**:
  One EDUBOTS researcher alone encouraged students to use Differ and Hubert but it was not compulsory. He sent an announcement at the start of course (Differ) and near the end of course (Hubert) to the class via Blackboard, which also generated email to each student, with the URL to join the web-page. Differ was presented as a chat platform for students to meet, e.g. for group work; Hubert was presented as a chatbot to collect student feedback.
  There were no mentors.
  Students joined Differ and a few used the platform to communicate with other students but most did not, just tried Differ once to see if it might be useful then gave up.
  A small minority of students found Differ "interesting" but most tried it once then gave up.
  Hubert was used once at the end of semester.
- **Affordances and challenges:** Leeds University IT Service requires students and educators to use other chat platforms in learning, and we could not make use of Differ or Hubert mandatory. It was challenging to persuade students to volunteer to trial use of additional platforms.

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Summary

In all cases, the Differ communities were created at the level of individual modules with large numbers of students. Students did not make much use of the platform - in general, it appears that they did not recognise any value over the existing communication tools which were set up by the University (e.g. Blackboard, Teams) or had been self-organised by students themselves (e.g. WhatsApp, WeChat). As the courses took place in the second semester of the year, it is likely that the need for social introductions had already been met.
Hubert appears to have been better adopted, with more feedback provided there than through the University's standard feedback mechanisms. Responses from participants suggest that some of this may be due to the novelty of the chatbot platform, particularly as these students' courses and these particular modules touch on chatbots and similar technology.

1.4. University of Zagreb, Faculty of organization and Informatics (FOI)

In the Pilot 1, a total of five courses were involved in using Differ in classes at the University of Zagreb, Faculty of organization and Informatics (FOI). All of the courses were closely connected to informatics studies and were performed at the undergraduate level of study. Educators were introduced with chatbot applications by the members of FOI EDUBOTS team who were predominantly piloting in their courses in the summer semester. Training materials and individual consultations were provided with online meetings or via email. Main motivation for implementing the chatbot solution in courses was to increase the availability of teachers and make communication between students and teachers better due to the Covid-19 pandemic that has paralyzed the world and moved the teaching process to a completely online environment. Hubert was used once at the end of the semester to evaluate course performance.

Case #1

- **Course name:** Text and image processing (Department of Computing and Technology)
- **Number of students:** over 100
- **Course description:** This obligatory course is held during the 2nd semester of a bachelor study programme. The course provides lectures, auditory exercises, and computer exercises. Most of the course activities were held online due to the corona pandemic. Students are mostly undergraduate 1st year students (approx. 19-20 years old) and mostly full-time.
- **Description of students' engagement with Differ and/or Hubert:**
  2 teachers were involved in computer exercises. Teachers served as initiators of communication in Differ, provided guidance in solving the tasks and answers to student questions.
  Invitation was sent by LMS to student e-mails. Joining to Differ was a part of one of the laboratory tasks, though non-obligatory one. Students needed to create their profile and

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introduce themselves with few sentences in respective Differ topic (the name of the student laboratory group). Students needed to suggest a colleague to be a mentor student in Differ or to apply by themselves, and then vote (hit "like"). As a part of a laboratory task, a brief overview of Differ was given emphasizing the benefits: formal and informal communication of teachers and students regarding exercises in public and private channels, private and public conversation with colleagues, creating own chat groups to work on joint projects. A Differ manual in Croatian was created (used in each FOI course) based on the Differ help documentation. Instructors motivated students to take the role of the student mentor in their laboratory groups by offering extra course points for engagement in Differ. Approximately one third of the laboratory groups had one student mentor.

The plan was that Differ will be used during exercises in the computer room (+ virtual office hours once a week), using a mobile application or a web browser, so that students can share their tips and solutions that were not provided during the exercises. That scenario happened only for the several groups in the first usage of Differ and students were actively participating. Soon after, all teaching activities went online due to the corona situation. Teachers then initiated communication in Differ for each of their groups each week by explaining exercises and tasks and gave support to the student groups of other teachers. Communication with student mentors was mostly in a private channel in Differ. Some of the student mentors provided tips and solutions to the problems or initiated communication in their respective group. Myriad of students asked questions regarding particular exercises. More questions arose for the final major laboratory task.

Hubert was used once at the end of the semester, when all teaching activities were finished, and students got points for the majority of their activities, but not the final grade. Hubert was used to evaluate the course, not the teacher's performance.

- **Affordances and challenges:** Despite invitation in course LMS, several ones in Differ and extra course points, students in many groups didn't want to engage as student mentors. Thus, teachers acted as the initiators of the communication in all groups.

  Despite a lot of engagement of the teachers to motivate the communication, there were no responses in some laboratory groups, just one-way communication. Since communication in Differ was less formal than in official channels (LMS, email), teachers perceived that communication with the students was more frequent than in previous years.

Case #2

- **Course name:** Computer-Mediated Communication (Department of organization)
- **Number of students:** less than 50
- **Course description:** Elective course held in FOI's distance study center. It was held extensively in 5 weeks – 3 weeks of lectures and 2 weeks of computer exercises. 3 weeks of the course activities were held online due to COVID-19 outbreak.

  Attending students are undergraduate 2nd year students (approx. 20-21 years old), mostly part-time students. It is a distance course that lasts intensively for 5 weeks.
- **Description of students' engagement with Differ and/or Hubert:** 1 teacher was involved in communication with students via Differ. Students were introduced to Differ on first class. Joining Differ was a part of the laboratory task.

  Differ was used for communicating mostly with the teacher about lab exercises – it was used extensively before the exam. Community for the course was created. Students were given the Differ manual. Because of the specific way of conducting the course, there were no student mentors.

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On the first computer exercises (just before closing the University due to COVID- 19) students were introduced to Differ. Differ helped to communicate with students during lock-down (teacher-to student) and completely replaced e-mail communication. Communication via Differ was much faster and informal and students were not shy to ask all kinds of questions. Teacher initiated communication, but as the course lasted for only 5 weeks, students continued to ask questions after the course ended because the exam was 1,5 months later.
Students were active in communication until they had finished all the activities on course. After that they had a final oral exam, but stopped using Differ. Communication was less formal, the teacher felt connected to students more than ever. Differ helped very much to solve various problems and give additional explanations about exercises, ways of conducting exams, or ways of scoring the test.
Hubert was used once at the end of the semester, when all teaching activities were finished, and students got points for the majority of their activities, but not the final grade. Hubert was used to evaluate the course, not the teacher's performance.

- **Affordances and challenges:** It was hard to find and engage students from previous year because most of them are part-time students who are working.

Case #3

- **Course name:** Business Informatics
- **Number of students:** more than 100
- **Course description:** Obligatory course held during 2nd semester. The course provides lectures and computer exercises. Most of the course activities were held online due to the corona pandemic. Attending students are undergraduate 1st year students (approx. 19-20 years old), mostly full-time.
- **Description of students' engagement with Differ and/or Hubert:** Invitation to join Differ was sent by LMS to students' emails. Brief overview of Differ was given emphasizing the benefits: formal and informal communication of teachers and students regarding exercises in public and private channels, private and public conversation with colleagues, creating own chat groups to work on joint project. A Differ manual in Croatian was created (used in each FOI course) based on the Differ help documentation.
  Half of the groups had student mentors. Students did not get any extra points for mentoring.
  There was no interest in virtual consultations in constant terms. Teachers continued to use Differ groups for additional communication (along with standard Moodle forums) - as reminders of upcoming deadlines for tasks to be done.
  Students who wanted any form of virtual consultation did so through chat rather than public channels, so individual chat was far more used for consultative purposes.
  There were few messages per week in groups. There were more questions through individual chat.
  Hubert was used once at the end of semester.
- **Affordances and challenges:** Students recognized mentoring as extra work which they were not willing to take**.**

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Case #4

- **Course name:** Software engineering
- **Number of students:** more than 100
- **Course description:** Software engineering is a course held in the third year of FOI's undergraduate study programme which has two study programme orientations. The course is obligatory for students of Information Systems study programme, and elective for students of Business systems study programme. The course provides lectures and computer exercises.
  Undergraduate 3rd year students, mostly full-time. They had no or only a scarce knowledge on Software Engineering before enrolling in the course.
- **Description of students' engagement with Differ and/or Hubert:** Students were invited during the first lectures and latter invitation and links were sent through LMS Moodle.
  The overview and benefits of using Differ were presented to students during the first lectures. The participation in Differ groups was not obligatory. For those who participated, teachers created a Differ manual. Student demonstrator (1 student who already passed the course) was also a mentor on Differ.
  The model of communication was developed in accordance with our teaching model. Thus, teachers included:
  a) Teacher to student communication through formal topic for Announcements. This topic was closed for chat.
  b) Student or mentor to student communication through specific topics that were created for each topic the students have been preparing for their partial exams. The chat was very lively in these groups.
  c) Student to teacher communication through specific topics prepared specifically for
  purpose of asking questions or having open chat related to the course.
  d) Student to student communication in private teams/groups/topics that were created by students.
  The general opinion is that a formal yet direct and easy channel of communication that was introduced to the course was a positive side of this "experiment". Due to the specifics of the course, the students were motivated and engaged in discussions in different groups. However, due to high expectations of such tools, the feedback from students and teachers on user experience for using the tool was not very good.
  Hubert was used once at the end of semester.
- **Affordances and challenges:** Teachers didn't face any problems, although the role of mentors was minor in the Differ setup. The focus was on student to student and student to teacher communication.

Case #5

- **Course name:** Multimedia Systems
- **Number of students:** less than 50
- **Course description:** Elective course in vocational study program held in one distance study centre during 6th semester. It was held extensively in 6 weeks - 3 weeks of lectures and 3 weeks of computer exercises. 3 weeks of the course activities were held online due to COVID-19 outbreak. Attending students are undergraduate 3rd year students (from 21 to 40+ years old), mostly part-time students.

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- **Description of students' engagement with Differ and/or Hubert:** 1 teacher involved in communication with students via Differ. Students were invited during the first computer lab exercise and info about onboarding to Differ was available on course homepage in LMS Moodle.
  A brief overview of Differ was given emphasizing the benefits: formal and informal communication of teachers and students in public and private channels regarding computer exercises and course projects; private and public conversation with colleagues, creating own chat groups to work on joint project. A Differ manual in Croatian was created (used in each FOI course) based on the Differ help documentation. The group was small and most of the students are part-time students who are working, so teachers did not seek to find student mentors.
  Community was structured to have topics like Open chat; Questions to teachers; Project; and several topics related to topics of computer labs. The latter one was used the least. Teachers encouraged communication with the students in the Open chat from time to time, and students posted several questions to teachers in the Questions topic. Teacher did not know if communication among the students occurred in private channels.
  Hubert was used once at the end of the semester, when all teaching activities were finished Hubert was used to evaluate the course, not the teacher's performance.
- **Affordances and challenges:** Altogether, frequency of communication was low. The teacher was not involved on a regular basis. However, some of the questions that students usually send by email were sent (and answered) in Differ.

Summary

The pilot round 1 on FOI's courses showed that chatbot application Differ is flexible to be implemented in various course scenarios. **Main affordances** of Differ use are described in the following paragraph. Although all subjects are IT based, the method of implementation and the complexity of the subject are different, but Differ has enabled teachers who have not yet encountered this form of communication to successfully implement it in groups with a large number of students. Some of those scenarios in project-based courses included the important role of student mentor, and more frequent use of virtual hours/consultations (*Announcements functionality)* and discussions (*Topic functionality)* by the teachers. In general communities were created in line with teachers' needs, so some of them were created on class level and included all of the enrolled students, but others chose strategies for smaller groups based on laboratory/seminar or project groups. Use of Differ increased the level of informal communication on student-to-student and student-teacher level related to academic and course activities.The general teacher's impression is that he helped maintain better social relationships during the lockdown.

On the other hand, the use of Differ has brought with it some **challenges.** First, communication in communities was very dependent on teacher involvement and regular encouragement of discussions. As the semester progressed, communication became one-way regardless of the effort from the teacher. Although it was interesting to them at the beginning, the students used other common communication platforms in parallel with Differ. In the first pilot we notice that the role of student mentor is not popular because it requires additional engagement of students of previous generations for which he is expected to be paid as a student's job.

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2. Case Studies from Pilot 2

Data for Pilot 2 (September 2020 - January 2021) was gathered through the questionnaire which Project partners distributed to course educators who participated in the piloting. This was an easier way of gathering information when compared to the approach applied for the Pilot 1.

2.1. Cyprus Universities

In Pilot 2, CYENS invited educators across different local universities to participate in the pilot, for testing Differ and/or Hubert. First, an invitation to join the pilot was shared with CYENS members' professional networks via emails. In contrast to Pilot 1, in this Pilot 2 educators were particularly introduced to the use of two specific scenarios for Differ testing (Course community and Frequently asked Questions (FAQs) and Informal peer-to-peer community), and for the same specific scenario for Hubert testing (course evaluation). For the two scenarios in Differ, more detailed descriptions were provided, in an effort to help the educators to understand and value the use of those use cases in their class.

1) *Course community and Frequently asked Questions (FAQs)*

Create a course community for academic purposes, in which your students can communicate with you, and mentors/teaching assistants of the course. Organize FAQs related to administration of the course (e.g., deadlines, submissions) and content related topics (e.g., on core concepts of the course).

2) *Informal peer-to-peer community*

Create an informal online community in which your students can chat to each other for topics related to your course and open community topics around their hobbies/interests. Promote inclusion and social interaction among all students, especially for students who do not use other social media platforms for connecting to their peers.

Educators who were interested in participating in the pilot were required to complete a short online form (i.e., Google form, https://forms.gle/9LpzvLKRuiWp4AKFA) and provide their contact details. A total of 7 educators initially expressed interest to participate in Pilot 2. CYENS researchers then proceeded with communicating with the educators via phone or personal emails, for providing more information about the pilot, the potential use of the chatbots in the class, and the data collection processes. Educators who were willing to proceed with the pilot testing of the chatbots

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in their courses, further received guidelines and instructions on how to set up the chatbots and how to engage their students. One-to-one tutorials and teleconferencing meetings took place, for providing this facilitation. Also, written instructions were also provided on how to use Differ and Hubert. Educators were motivated to test a new technological solution in their class, especially a chatbot. Educators aimed to either support mentorship and/or communication processes within their class with the use of Differ, or to provide an alternative and more engaging activity to their students for course evaluation and self-reflection, with the use of Hubert. From the total of 7 educators who initially expressed interest to participate in Pilot 2, 4 educators finally participated in the pilot, summing up to a total of 4 different courses. Specifically, Differ was used in 4 different courses (MGA640, CIS324, IST 783, MiHub) and Hubert in two different courses (MGA640, MiHub).

Case #1

- **Course name**: MGA 460 Research Methods in Multimedia and Graphic Arts (Multimedia and Graphic Arts Department)
- **Number of students**: fewer than 50
- **Course description**: The course is provided to students studying at Year 3+ of their bachelor's degree studies. Typically lectures on the various research methodologies together with hands-on work on building a research proposal and delivering the proposed project in the form of a small-scale research study conducted in groups are offered through the course. Specifically, the course aims to introduce students to the research process and to provide the necessary skills to design and implement small-scale research projects in the fields of multimedia and graphic arts. The course includes topics such as planning of research work, theoretical framework, research questions, literature review, APA reference system, selection of research methodology (quantitative and qualitative research), research tools (observation, interview and focus groups, questionnaires) and basic analysis of qualitative and quantitative data. Within the course students will prepare and present small-scale research projects, which include all stages of research.
- **Description of students' engagement with Differ**: The teacher directed the students to create informal peer-to-peer student communities, after being invited via email to join Differ with the use of an application. Primary focus of Differ use on the course was the creation of informal peer-to-peer student communities, to get introduced to other students (ice-breaking), and for communication purposes among students.
- **Affordances and challenges**: Main affordance of the Differ use is that students had an online community for their peer-to-peer communication for the purposes of the module within a safe environment. Challenges were primarily seen in students who are not willing to try out something new because they already use different communication tools. They were overloaded with everything online due to the COVID-19 situation. Even though students were invited to join the course community on Differ, none of them ever referred to the use of this tool. The use of Differ had no added value in comparison to the use of other chat tools. The teacher spoke unofficially to two students who confirmed that they

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did not use it much because they did not see added value over Facebook chat or other chat tools.

Case #2

- **Course name**: MGA 460 Research Methods in Multimedia and Graphic Arts (Multimedia and Graphic Arts Department)
- **Number of students**: fewer than 50
- **Course description**: The course is provided to students studying at Year 3+ of their bachelor's degree studies. Typically lectures on the various research methodologies together with hands-on work on building a research proposal and delivering the proposed project in the form of a small-scale research study conducted in groups are offered through the course. Specifically, the course aims to introduce students to the research process and to provide the necessary skills to design and implement small-scale research projects in the fields of multimedia and graphic arts. The course includes topics such as planning of research work, theoretical framework, research questions, literature review, APA reference system, selection of research methodology (quantitative and qualitative research), research tools (observation, interview and focus groups, questionnaires) and basic analysis of qualitative and quantitative data. Within the course students will prepare and present small-scale research projects, which include all stages of research.
- **Description of students' engagement with Hubert**: The teacher created a new evaluation in Hubert.ai using the template provided for course evaluation. Then. The teacher shared the generated link to students, who interact with Hubert by clicking on that link. Hubert posed the predefined (by the chosen template) questions to students, with a degree of smart interactions in the sense that Hubert could react positively or negatively to students' responses. Then, the teacher should be able to see the evaluation results, with students' responses, on her dashboard, having access to the raw data (i.e., the actual conversation of each student with Hubert), but also to a thematic analysis of students' responses. Concluding, Hubert was used in the course for course evaluation at the end of the semester.
- **Affordances and challenges**: Hubert was used by the students for course evaluation. Main affordances of the Hubert use: (i) easy process for the teacher to set up an evaluation; (ii) easy way to invite students in interacting with Hubert, by sharing a link; (iii) interactive and fun way for students to evaluate the course, in an anonymous way and through a short interaction with Hubert. Challenges faced in this course: Hubert data were then lost from the platform and the teacher did not manage to have access to the results, but only once. HUB (P2) did not manage to resolve the issue and provide the data to the teacher.

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Case #3

- **Course name**: CIS324 Data Journalism (Communication and Internet Studies Department)
- **Number of students**: fewer than 50
- **Course description**: The course is provided to students studying at Year 3+ of their bachelor's degree studies. The course introduced theories, best practises and tools that apply to Data Journalism with lectures, discussions, and workshops. First 6 weeks face to face lectures, next 7 weeks remotely. Specifically, the course is an introduction to the production of journalism using data. Students will explore ways to obtain data, to use tools to analyse it and learn how to deploy it in their work. The course emphasizes the development of a mindset, which is not confined to the development of skills to analyse and edit data for journalistic purposes; it also focuses on the general idea regarding the role and use of data in order to attain transparency in public communication.
- **Description of students' engagement with Differ**: The teacher created an online community for the course, using BO, and invited students to join via email. Primary focus of Differ use on the course was the teacher-students and student-student communication through Differ, but also for announcements related to the course, and Q&A. No mentors were involved.
- **Affordances and challenges**: Students persisted in using emails to communicate with the instructor/teacher. According to the teacher's responses in the survey, he believes that the use of Differ had no impact on students' learning and on the proportion of students successfully completing the course this year. Students were not interested in using Differ and were inactive despite the teacher's efforts to engage them in communication. The teacher explained that students are used to other means for contacting or communicating with either their teacher (i.e., usually via emails, other platforms provided by the university) or their peers (i.e., usually through social media platforms, such as Facebook). Also, according to the teacher, the usage of Differ did not encourage his social participation in the course with the students and did not improve his teaching experience in the course. Despite this experience, the teacher was willing to try using Differ in other courses.

Case #4

- **Course name**: IST 783 Press, Education and Spiritual Movement in Cyprus [Τύπος, Εκπαίδευση και Πνευματική Κίνηση στην Κύπρο] (Department of History and Archaeology)
- **Number of students**: fewer than 50
- **Course description**: The course is provided to master students. It was a seminar-type course consisting of lectures by the educator, students' presentations, videos, study of archives and discussions.
- **Description of students' engagement with Differ**: The teacher created an online community for the course, using BO, and invited students to join via email. Primary focus

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of Differ use on the course were the FAQs created by the teacher, but also the teacher-students and student-student communication through Differ, its use for announcements related to the course, and Q&A. No mentors were involved.

- **Affordances and challenges**: According to the teacher's responses in the survey, she believes that the use of Differ had no impact on students' learning and on the proportion of students successfully completing the course this year. In fact, even though the teacher created a lot of FAQs in the community, only one student accessed Differ, despite the teacher's efforts to engage the students with the community and her reminders provided to them to use Differ. The teacher claimed that due to the small number of students in this course, any issues of queries from the side of students were mostly solved on a 1-to-1 basis. She claimed that perhaps in larger classes, the use of Differ for FAQs could be more useful. In addition, according to the teacher's feedback, it was a bit time consuming creating the FAQs with the use of BO. The added value would be having a smart chatbot actually answering to FAQs, and not having the teacher writing the possible and frequently asked question and the corresponding answer, just like one could more easily do by providing this information on a webpage.

Case #5

- **Course name**: Language course for migrants (Mihub Information Center via the Cyprus University of Technology 2020-2021).
- **Number of students**: 50 to 100
- **Course description**: Help and support is provided to migrants from Non-European Countries in order to adjust to the local society, including familiarizing themselves with the local language.
- **Description of students' engagement with Differ**: The facilitator created an online community for Mihub, using BO, and invited Mihub members to join via email. Primary focus of Differ use on the course were the FAQs created by the facilitator, but also the facilitator-members and member-to-member communication through Differ, its use for announcements related to the topics of interest to migrants, and Q&A (ask questions to your community).
- **Affordances and challenges**: Mihub members were interested in using Differ and the facilitator claimed that the online community helped its members to interact with people having the same needs and sharing similar concerns with them. Main affordance was that due to the COVID-19 pandemic and the mitigation measures (i.e., lockdown), the online community in Differ offered a safe environment for communication and exchange of information, when the circumstances did not allow face-to-face interactions. The facilitator claimed that he frequently used the FAQs feature, and it was useful for the Mihub members to find answers to those commonly asked questions. Also, the facilitator had the opportunity to make other postings and announcements in the open chat space, and many members of the community communicated with him via private messages. Differ was used

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on an everyday basis by the facilitator and the community members. The facilitator claimed that he would continue using Differ, even after the end of Pilot 2.

Summary

Hubert was used in two courses, for informal course evaluation. Hubert was used by the students for course evaluation. The main advantages of the use of Hubert in these two courses, as reported by the two educators, include the ease of use e.g., to set up an evaluation, to invite students to interact with Hubert. Also, Hubert was positively evaluated as being an interactive and fun way for students to evaluate their course, in an anonymous and not time-consuming way. Educators still faced some challenges while using Hubert. First, in the case of one educator, the Hubert data were lost from the platform very shortly, thus prohibiting the educator to revisit the data and make use of them for course improvement. Another challenge which also appeared in Pilot 1, was the fact that content analysis of students' responses in Hubert was not perceived as adequately useful to the two educators, since the key words used for the content analysis were not meaningful to them.

Differ was used in four different courses. Educators who used Differ in their class tried to explore both scenarios proposed to them. Specifically, the "informal peer-to-peer student community" scenario was tested in one course (MGA640), while the "Course community and Frequently asked Questions (FAQs)" scenario was tested in three different courses (CIS324, IST 783, MiHub). As reported by the educators, the main affordance of the Differ use is that the students had an online community for their peer-to-peer communication for course related matters within a safe environment. Challenges were primarily seen in students who are not willing to try out something new because they already use different communication tools. They were overloaded with everything online due to the COVID-19 situation. Educators felt that the use of Differ had no added value in comparison to the use of other chat tools which were available in the market, while students persisted in using emails or other means of communication to communicate with their educators. Furthermore, one of the educators who used the FAQs scenario, reported that even though s/he created a lot of FAQs in the community, only one student accessed Differ, despite his/her efforts to engage the students with the community. That particular educator claimed that due to the small number of students in this course, any issues of queries from the side of students were mostly solved on a 1-to-1 basis. It was concluded that perhaps in larger classes, the use of Differ for FAQs could be more useful. In addition, according to the educators' feedback, it was a bit time consuming creating the FAQs with the use of BO. The added value would be having a smart chatbot actually answering to FAQs, and not having the teacher writing the possible and frequently asked question and the corresponding answer, just like one could more easily do by providing this information on a webpage.

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2.2. University of Granada

Several educators attended a webinar about the use of Differ organized by EDUBOTS consortium (in September 2020). We advertised the webinar in the webpage of the International Projects, Networks and Agreements Office from UGR, as well as through the email lists of the ETSIIT center. They were interested in the technology and wanted to learn about the possibilities of Differ for education.

In this second pilot every participant teacher must create his/her own Differ Community around their subject and invite the students to join it and use this software (including chatbot BO).

Case #1

- **Course name**: Fundamentos de Redes (Fundamentals of Networking)
- **Number of students**: 50 to 100
- **Course description**: It is provided to students at their third year in bachelor's degree studies. The course presents the fundamentals of Computer Networks, including the conceptual OSI model of networks layers, IP protocol, TCP and UDP, network security, and network services (SNMP, HTTP, DNS). It is one of the mandatory subjects they must complete in their degree. The teaching dynamics are based on lectures in the classroom, practical parts in the laboratory, and students' public work presentations to their partners. However, due to the COVID-19 pandemic situation, this subject was taught completely online, i.e. through virtual sessions in Google Meet.
- **Description of students' engagement with Differ and/or Hubert**:The teacher created an online community in Differ (named "Fundamentos de Redes"), with the help of BO. Students were invited to join the community via internal message (in the official Moodle platform of the University of Granada) and e-mail. This was not mandatory to participate in this community, so just 23 students joined it. The main use of Differ was as a tool to communicate with the teacher regarding any question about the subject. Moreover, the students could use it as a breaking-ice utility for contact with other partners. The teacher made public announcements in the Differ community and some students used it to ask some questions about the course agenda or doubts about the contents.
- **Affordances and challenges**: Some of the students used Differ mainly for interaction with the teacher. Teacher also communicated with some students through direct chats and posted weekly announcements related to the subject. The fact that Differ was a complementary and non-required tool for the course (given the UGR restrictions on the use of non-official applications) made that only 25% of students joined the community. Moreover, they used the application mostly for communication, so it had no real impact on their academic performance (according to the teacher's opinion). Moreover, the teacher didn't perceive Differ as a very relevant tool to facilitate his teaching nor the subject organization, as it didn't increase his connection with students, nor his social participation in the course. It also didn't help to additionally share his knowledge with students and the utilities that BO could offer were not very relevant for him. However, he argued he would

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like to use it in a better way in a new course. Maybe using the Q&A or FAQ (with the help of BO).
He said that some of the utilities are not needed or not attractive for his students, such as the ice-breaking, and also that language barrier is another important factor in Spain.

Summary

Finally, just one of the teachers used Differ in this Pilot. The rest of the attendants to the webinar didn't consider it as useful or they argue that it will imply additional work in the subjects that probably won't be worth the time spent in preparing it. Thus, they didn't see enough advantages in the use of Differ. Moreover, some of them were concerned regarding the use of a non-official tool in classes, i.e. not provided nor supported by the University.

The educator who used Differ (one of the participants in the project) created a community of his subject and joined more than 20 students. He used some of the features of Differ, but mainly announcements and communication features.

The students used Differ and interacted with BO, but not as much as it was expected. According to their feedback, they didn't see utility in BO's options, and some of them couldn't deal with the language barrier (Differ and BO just worked in English). Thus, they finally used the community just as an alternative communication tool with the teacher.

2.3. University of Leeds

Case #1

- **Course name**: PhD programme (School of Computing)
- **Number of students**: over 100
- **Course description**: Pilot 1 had indicated challenges in use of Differ and Hubert by educators in teaching a course; so instead we piloted use of Differ as a platform to encourage university student belonging and community in a broader student group: PhD students in the School of Computing, mainly International (non-UK) students age over 21.
- **Description of students' engagement with Differ**:
  One EDUBOTS researcher encouraged Computing PhD students to use Differ but it was not compulsory. He sent announcements to the cohort via email to each student, with URL to joining web-page. Differ was presented as a chat platform for students to meet, to encourage PhD student belonging and community.
  Some students joined Differ and a few used Differ to communicate with other student(s) but most did not, just tried Differ once to see if it might be useful then gave up.
- **Affordances and challenges:** Leeds University IT Service requires PhD students and supervisors to use other chat platforms in online communication, and we could not make

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use of Differ mandatory. It was challenging to persuade students to volunteer trial use of this additional platform.

Case #2

- **Course name**: Mature student community (Lifelong Learning Centre)
- **Number of students**: over 100: 3650+ students were invited; c300 joined (less than 10%)
- **Course description**: Pilot 1 had indicated challenges in use of Differ and Hubert by educators in teaching a course; so instead we piloted use of Differ as a platform to encourage university student belonging and community in a broader student group: "mature students", older students who may feel isolated in classes of mainly younger students. The Lifelong Learning Centre provides support and advice for mature students in all disciplines across the university, mainly UK students age 21 to over 60
- **Description of students' engagement with Differ**:
  Lifelong Learning Centre professional service staff encouraged mature students supported by LLC to use Differ but it was not compulsory. They sent announcements to the cohort via email, with URL to joining web-page. Differ was presented as a chat platform for students to meet, to encourage LLC student belonging and community. Many students joined Differ and a significant minority used Differ to communicate with other student(s).
- **Affordances and challenges:** Leeds University IT Service requires all students and staff to use other chat platforms in online communication, and we could not make use of Differ mandatory. It was challenging to persuade students to volunteer trial use of this additional platform; however, a minority liked the platform and continued to use it. The methods and results were presented in "Online Chat and Chatbots to Enhance Mature Student Engagement in Higher Education" submitted to International Journal of Lifelong Education; and "EDUBOTS: chatbots for university student belonging and community" submitted to Student Education Conference, 6-7 Jan 2022, Leeds University.

2.4. University of Zagreb, Faculty of organization and Informatics (FOI)

In the second pilot round a total of three courses were involved. All of the teachers who implemented the Differ were from the FOI EDUBOTS team. Even though all of the teachers from the faculty were informed about the Differ though presentations, email invitations and additional instruction/ training materials, they were not motivated to participate in the extra activity that could be potentially time consuming in the time of great the era of great uncertainty of the way of teaching due to the situation with COVID-19. Teachers decided to reduce the workload and stick to what worked well last semester. The **main difference between Pilot 1 and Pilot 2** on FOI dominantly stems from this - the perceived fear and distrust of teachers from trying out new technical solutions / applications that could help them achieve better communication with students. In Pilot 2 were involved only educators from EDUBOTS FOI team who participated already in the first pilot. Hubert was used once at the end of the semester.

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Case #1

- **Course name:** Business Communication
- **Number of students:** over 100
- **Course description:** The course is held in the 1st year of bachelor's studies. Teaching activities were fully online except the first and the third week when seminars were held face to face. Goal of the Business Communication course is to teach and prepare students for various forms of business interactions like presentations, negotiation, sales, written communication, and writing CV-s. Students were mostly 18-19 years old full-time students.
- **Description of students' engagement with Differ and/or Hubert:** Teachers on the course used chatbot Bo within Differ to create the community. Primary focus of Differ use on the course was to get introduced to other students (ice-breaking), ask questions to the community, and creation of the community for students. Differ helped students to connect with their peers especially for team-work presentation tasks, but also with student mentors who helped them in preparation for presentation. Students often used Differ before exams to ask the teacher some additional questions, or after the exam. In the cases when they failed the test, Differ was a good tool to encourage them for further learning and explain how to fix bad results later in the semester. They often feel happy and relieved because they have quick information that helps them a lot to stay motivated for the course. Differ helped teachers get closer to students which was very meaningful since lectures were almost fully online. Student-mentors used Differ to prepare students for their projects, group and peer-to-peer-communication.
- **Affordances and challenges:** Main affordance is that communication was faster, informal, but yet academic appropriate. Challenges were primarily seen in students who are not willing to try out something new because they already use different communication tools. They were overloaded with everything online due to the COVID-19 situation.

Case #2

- **Course name:** Multimedia Systems
- **Number of students:** less than 50
- **Course description:** The course is held in the 3rd year of bachelor's studies. Teaching activities are provided as lectures and laboratory exercises. Most of them were held online, synchronously using the videoconferencing system BigBlueButton. Learning materials and tasks were provided by LMS Moodle. Students were mostly full-time students, interested in the subject since this is a non-obligatory course held in the 5th semester. Some of them had previous knowledge in media editing and website design.
- **Description of students' engagement with Differ and/or Hubert**: An educator encouraged communication in Differ at the second lab exercises, by asking the students to briefly introduce themselves in the Differ course community (where are they from, what are their hobbies). Then encouraged them to ask questions when they need help with lab tasks or have questions regarding the course project or an exam. Students usually asked questions regarding their tasks and the educator responded as soon as possible, usually

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sooner than s/he would respond to the email. Students were polite in Differ and sometimes used emojis instead of a reply. Students that were delayed in their tasks, also asked for explanations and extensions of the task in Differ. They would probably not ask that via mail or LMS forum, thus might not finish the task within a reasonable extended time.

- **Affordances and challenges**: Communication was more vivid when the educator was engaged. If a few days passed without the educator's answer, none of the students will try to provide the answer, although s/he might know the answer. A community was not used for knowledge dissemination between the students, at least not in the formal channels. The educator is not aware if students created their own study groups/communities in Differ.

Case #3

- **Course name:** Intelligent Systems
- **Number of students**: 50 to 100
- **Course description**: The course is held in the 2nd year of master's studies. Teaching activities are provided as lectures and laboratory exercises. Most of them were held online using the videoconferencing system BigBlueButton. Course is taught as project based and project activities accounted for 50% of points at the course. Learning materials and tasks were provided by LMS Moodle. Students were mostly full-time students, interested in the subject since this is a non-obligatory course. Most of the students did not have any previous knowledge about machine learning and intelligent systems.
- **Description of students' engagement with Differ**: Teacher on the course used chatbot Bo within Differ to create the community. Teacher constantly tried to stimulate students by starting topics and encouraging them to ask questions about lab tasks, course project activities or an exam. Students usually asked questions regarding their tasks and the teacher responded as soon as possible, usually sooner than she would respond to the email. Students were satisfied with that approach and more informal communication.
- **Affordances and challenges**: Communication between students and teacher was faster. Challenges are recognized in students which were overwhelmed with different communication tools and were not keen to use Differ. Furthermore, Differ community was not used for knowledge dissemination between the students.

Summary

In the second pilot round students **were overwhelmed with one additional communication tool** and did not see long term benefits of its usage. Because of that they didn't use the chatbot application as it was expected.

Nevertheless, Differ proved to be a **good solution for large student** groups in the first year of undergraduate study. New students on the faculty had more questions about the course organization, exams and final grades so it was faster to communicate with them through Differ.

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Despite limitations in usage that arise from less motivated students for new applications, Differ as a chatbot platform showed that it is a good tool for different course strategies but vividness of community is very dependent on course teacher engagement.

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3. Case Studies from Pilot 3

Data for Pilot 3 (February 2021 - June 2022) was also gathered with the questionnaire, which Project partners distributed to course educators who participated in the piloting.

3.1. Cyprus Universities

In Pilot 3, CYENS followed a similar strategy, as in the previous two pilots. CYENS invited educators across different local universities to participate in the pilot, for testing Differ and/or Hubert. Two different invitations to join the pilot were shared with CYENS members' professional networks via emails. The first invitation concerned the use of Differ, while the second one the use of Hubert. Within the first invitation, improvements and new features added in the Differ chat were particularly stressed within the invitation email, as well as an introduction to BO, the social chatbot, that was a new addition in the Differ environment. The exact description that was incorporated in the invitation email follows.

> *"We are reaching out to the Universities of Cyprus for volunteer-instructors to BO, our chatbot in the 3rd pilot during the Spring academic semester 2021. Improvements and new features have been applied since our previous pilots.*
> *BO is a social chatbot integrated within Differ, a chat tool (https://www.differ.chat/) which can offer support in building learning communities, initiating peer interaction and collaboration.*
> *If you teach any courses this semester, we would like to hear from you!*
> *If you are interested, please fill in the form below. We will contact you with more details (you can opt-out any time)."*

Educators who were interested in participating in the Differ-BO pilot were required to complete a short online form (i.e., Google form, https://forms.gle/HCmmJ4tqtoyjehn3A) and provide their contact details. A total of 5 educators initially expressed interest to participate in Pilot 3 for testing Differ.

Within the second invitation concerning the advertisement of Hubert, the two different scenarios (course evaluation, self-reflection) were explicitly introduced in brief. The exact description that was incorporated in the invitation email follows.

> *"We are reaching out to the Universities of Cyprus for volunteer-instructors to test Hubert, a chatbot in the 3rd pilot during the Spring academic semester 2021.*

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Hubert is a chatbot (https://hubert.ai/) which can interact via short conversation with the students, promoting students' self-reflection (scenario 1) and informal course evaluation (scenario 2) in a formative manner at different time-points in the semester. A thematic map of the input is accessible to the instructor only.
If you teach any courses this semester, we would like to hear from you!
If you are interested, please fill in the form below. We will contact you with more details (you can opt-out any time)."

Educators who were interested in participating in the Hubert pilot were required to complete a short online form (i.e., Google form, https://forms.gle/PYeg5XZ42zKU56E5A) and provide their contact details. A total of 4 educators initially expressed interest to participate in Pilot 3 for testing Differ.

CYENS researchers then proceeded with communicating with the educators via phone or personal emails, for providing more information about the pilot, the potential use of the chatbots in the class, and the data collection processes. Two different emails were sent to people interested in using Differ and Hubert. The content of those emails is provided below.

"Dear colleagues,
Thank you for your interest in participating in our pilot.
There are 3 steps that you need to follow in order to get access to Differ and BO.
BO= chatbot
Differ = chat tool within which BO is activated
1. Register in the EDUBOTS Cyprus Community, by following the link: https://dif.re/cyprus
2. Provide your phone number for receiving a code which will allow you to sign up.
3. Download the application (mobile or desktop), and sign in.
Upon completing the aforementioned 3 steps, then you will be required to create your own community within Differ in order to be able to use the chatbot with your students.
You can then use the chatbot with one or more of the following scenarios.
Scenario 1: Ice-breaking activities.
Scenario 2: Create Frequently Asked Questions (FAQs).
Scenario 3: Split students into groups.
Detailed instructions on how to set up your community and proceed with the scenarios are provided here: [Link to instructions].
Please, do not hesitate to contact us in case of questions (o.tsivitanidou@cyens.org.cy)."

"Dear colleagues,
Thank you for your interest in participating in our pilot for testing the Hubert chatbot (https://hubert.ai).
You can use the chatbot with one or more of the following scenarios.
Scenario 1: Promoting self-reflection
Scenario 2: Informal course evaluation
A brief description of the steps you need to follow:
- *Create your Hubert account here: https://hubert.ai/signup*
- *Create your evaluations (scenario1/ scenario 2/ or both)*
- *For each scenario there are specific templates to use*
- *Generate a link and share it with your students*

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- *By pressing the link, the students start a short (<1 min) conversation with Hubert*
- *You can then have access to students' responses via https://hubert.ai/evaluations*
- *All of the above steps are described in the guide file attached.*

For further detailed descriptions of the two scenarios and their added value are provided here: [Link to descriptions].
Please, do not hesitate to contact us in case of questions (o.tsivitanidou@cyens.org.cy)."

Further to the above-mentioned instructions, educators received a set of manuals with guidelines for the use of Differ and Hubert.

Specifically, for the use of Differ, the following open document was shared with all educators, so as to guide them during the application of different scenarios (ice breaking activity, FAQs, split students into groups). Link to the document: EDUBOTS Pilot Phase 3 – Instructions for Differ. Likewise, for the use of Hubert, the following open document was shared with all educators, so as to guide them during the application of different scenarios (informal course evaluation, students' self-reflection). Link to the document: EDUBOTS Pilot Phase 3 – Instructions for Hubert.

From the total of educators who initially expressed interest to participate in Pilot 3, 4 educators finally participated in the pilot, summing up to a total of 7 different courses and 11 different use cases (two educators used Differ/ Hubert in more than one courses and for more than one use cases). Specifically, Hubert was used in one course (LCE670) by one educator, in two different courses (EDU610DL, EDU585DL) by another educator, and in one course (MGA320) by a third educator. Differ was used in one course (MG320) for the creation of three different learning communities that served different objectives and in two additional courses (MGA460, MGA461) by the same educator. Finally, Differ was used in a third community of learners (Mihub) by the forth educator.

Case #1

- **Course name:** Greek for Academic Purposes (LCE670) at the Language centre of the Cyprus University of Technology
- **Number of students**: less than 50
- **Course description**: Four-hour course, six credits, free choice. This course is specially designed mainly for third year and fourth-year students, who are invited to become familiar with the academic way of thinking and writing for the production of written and oral speech at the academic level, as well as for the completion of their dissertation. In this course, students have the opportunity to develop a wide range of skills so that they can comprehend demanding, lengthy texts, recognize implied meanings and develop clear, well-structured, detailed texts on complex topics, demonstrating controlled use. organizational forms, linkages, and cohesion mechanisms. In addition, students become familiar with the stages of the scientific way of thinking (parts of a scientific dissertation, creation of bibliography, citation system / bibliographic references, etc.). The program is based on student-centred teaching methods, as well as on the autonomous learning of students. The use of new technologies (Computer Assisted Language Learning) is an

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integral part of the learning process, so that students can fully develop language and other skills. Source: https://www.cut.ac.cy/faculties/languagecentre/module-descriptions/greek/?languageId=1

- **Description of students' engagement with Hubert**: The teacher used Hubert at the end of the academic semester for course evaluation. She created a new evaluation in Hubert.ai using the template provided for course evaluation. Then the teacher shared the generated link to students, who interact with Hubert by clicking on that link. Hubert posed the predefined (by the chosen template) questions to students, with a degree of smart interactions in the sense that Hubert could react positively or negatively to students' responses. Then, the teacher reviewed the evaluation results, with students' responses, on her dashboard, having access to the raw data (i.e., the actual conversation of each student with Hubert), but also to a thematic analysis of students' responses. Concluding, Hubert was used in the course for course evaluation at the end of the semester.
- **Affordances and challenges**: Hubert was used by the students for course evaluation. Main affordances of the Hubert use: (i) easy process for the teacher to set up an evaluation; (ii) easy way to invite students in interacting with Hubert, by sharing a link; (iii) interactive and fun way for students to evaluate the course, in an anonymous way and through a short interaction with Hubert. Challenges faced in this course: The teacher was not completely satisfied with the thematic analysis of students' responses provided by the Hubert Evaluation Dashboard.

Case #2

- **Course name**: EDUG610-DL: Measurement and Assessment in Education, at the University of Nicosia
- **Number of students**: less than 50
- **Course description**: The course aims to help students to deepen the concepts and theories of measurement and evaluation as they are applied in the field of education, and to help them understand how they are used for evaluation purposes. Through the course, students acquire the necessary tools and knowledge, so that they can improve their practice in assessment issues with the goal of improving their teaching and learning.
- **Description of students' engagement with Hubert**: The teacher used Hubert 5 times during the semester, specifically: (i) once at the beginning of the semester for students' self-reflection, (ii) twice during the middle of the semester for self-reflection and course evaluation, and (iii) twice at the end of the semester for self-reflection and course evaluation. The links to those evaluations are provided below. For the self-reflection use case, the first interaction took place at the beginning of the semester aiming to assess students' expectations of the course. The second interaction took place in the middle of the semester, aiming to ensure that students are motivated, are on track, and whether they have any questions on certain topics, while the third interaction took place at the end of the semester, for evaluating students' self-perceived accomplishment of their learning goals. For the informal course evaluation use case, all interactions aim to the course

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evaluation. Through short, interactive dialogues with a chatbot, the students had the opportunity to provide informal feedback to their educator on their course. This feedback could be used by the educator for improving the applied teaching practices and approaches. Two templates were used for this use case. The first template was used during the academic semester and the second template, in the middle and at the end of the semester. The items were essentially the same, it was just the wording that slightly differed in the two templates. The teacher created each one of the five evaluations separately in Hubert.ai using the templates provided for course evaluation and students' self-reflection. Then the teacher shared the generated link with the students, via a Learning Management Platform (Moodle). Then, the students could interact with Hubert by clicking on that link. Hubert posed the predefined (by the chosen template) questions to students, with a degree of smart interactions in the sense that Hubert could react positively or negatively to students' responses. Then, the teacher reviewed the evaluation results, with students' responses, on her dashboard, having access to the raw data (i.e., the actual conversation of each student with Hubert), but also to a thematic analysis of students' responses.

- ➢ Beginning of the semester
  - EDUG-610DL Self-reflection Beginning
  - https://www.hubert.ai/feedback/602265cbfcbbdf001736727
- ➢ Middle of the semester
  - EDUG-610DL Self-reflection Middle
  - https://www.hubert.ai/feedback/605072d6ed347600118cfa3c
  - EDUG-610DL Course Evaluation Middle
  - https://www.hubert.ai/feedback/605072fded347600118cfa3d
- ➢ End of the semester
  - EDUG-610DL Self-reflection End
  - https://www.hubert.ai/feedback/607eb51ba778690011335ce4
  - EDUG-610DL Course Evaluation End
  - https://www.hubert.ai/feedback/607eb545a778690011335ce5

- **Affordances and challenges**: Hubert was used by the students for self-reflection and course evaluation. Main affordances of the Hubert use: (i) easy process for the teacher to set up an evaluation; (ii) easy way to invite students in interacting with Hubert, by sharing a link; (iii) interactive and fun way for students to evaluate the course, in an anonymous way and through a short interaction with Hubert, (iv) an alternative way for students to self-reflect on their previous knowledge of the course topic (at the beginning of the semester), on what they have learned and what are the main challenges they still face in the course, during the semester and at the end of the semester, respectively, (v) possibility for the teacher to see and review raw data and easy access to them. In fact, reviewing the raw data was useful for the teacher to identify the preferences and dislikes of students in relation to the delivery of the course, but also to get insights into students' misunderstandings or gaps in relation to the course content. Challenges faced in this course: (i) the teacher was not completely satisfied with the thematic analysis of students' responses provided by the Hubert Evaluation Dashboard. For instance, some responses

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were clustered as having a negative connotation and were included in the negative aspects of the course evaluation, were those responses occurred from students' negative answers to the question "Do you want to add something more?"

Case #3

- **Course name**: EDUC-587DL: History and Philosophical aspects of the Natural Sciences
- **Number of students**: less than 50
- **Course description**: The course attempts a mapping of the field of history and philosophy of science. Starting with a general overview of the history of science and the so-called "scientific method", we focus on the history of evolutionary thought, the historical relationship between science and religion, while we also consider what separates science from the non-scientific fields. We study science as a culture and a product of invention. As far as the philosophy of science is concerned, we are concerned with the issues of scientific explanation, realism, and the nature of theories. The section also includes the philosophy of physics, medicine, and social sciences, as well as specific examples of theories from the field of physics and their historical and philosophical implications.
- **Description of students' engagement with Hubert**: The teacher used Hubert 5 times during the semester, specifically: (i) once at the beginning of the semester for students' self-reflection, (ii) twice during the middle of the semester for self-reflection and course evaluation, and (iii) twice at the end of the semester for self-reflection and course evaluation. The links to those evaluations are provided below. For the self-reflection use case, the first interaction took place at the beginning of the semester aiming to assess students' expectations of the course. The second interaction took place in the middle of the semester, aiming to ensure that students are motivated, are on track, and whether they have any questions on certain topics, while the third interaction took place at the end of the semester, for evaluating students' self-perceived accomplishment of their learning goals. For the informal course evaluation use case, all interactions aim to the course evaluation. Through short, interactive dialogues with a chatbot, the students had the opportunity to provide informal feedback to their educator on their course. This feedback could be used by the educator for improving the applied teaching practices and approaches. Two templates were used for this use case. The first template was used during the academic semester, the second template, at the end. The items were essentially the same, it was just the wording that slightly differed in the two templates. The teacher created each one of the five evaluations separately in Hubert.ai using the templates provided for course evaluation and students' self-reflection. Then the teacher shared the generated link with the students, via a Learning Management Platform (Moodle). Then, the students could interact with Hubert by clicking on that link. Hubert posed the predefined (by the chosen template) questions to students, with a degree of smart interactions in the sense that Hubert could react positively or negatively to students' responses. Then, the teacher reviewed the evaluation results, with students' responses,

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on her dashboard, having access to the raw data (i.e., the actual conversation of each student with Hubert), but also to a thematic analysis of students' responses.

- ➢ Beginning of the semester
  - EDUC-587DL Self-reflection Beginning
  - https://www.hubert.ai/feedback/60210fe27022ae0011f1c0ee
- ➢ Middle of the semester
  - EDUC-587DL Self-reflection Middle
  - https://www.hubert.ai/feedback/605071b0ed347600118cfa39
  - EDUC-587DL Course Evaluation Middle
  - https://www.hubert.ai/feedback/60507270ed347600118cfa3a
- ➢ End of the semester
  - EDUC-587DL Self-reflection End
  - https://www.hubert.ai/feedback/607eb49fa778690011335ce2
  - EDUC-587DL Course Evaluation End
  - https://www.hubert.ai/feedback/607eb4e2a778690011335ce3

- **Affordances and challenges**: Hubert was used by the students for self-reflection and course evaluation. Main affordances of the Hubert use: (i) easy process for the teacher to set up an evaluation; (ii) easy way to invite students in interacting with Hubert, by sharing a link; (iii) interactive and fun way for students to evaluate the course, in an anonymous way and through a short interaction with Hubert, (iv) an alternative way for students to self-reflect on their previous knowledge of the course topic (at the beginning of the semester), on what they have learned and what are the main challenges they still face in the course, during the semester and at the end of the semester, respectively, (v) possibility for the teacher to see and review raw data and easy access to them. In fact, reviewing the raw data was useful for the teacher to identify the preferences and dislikes of students in relation to the delivery of the course, but also to get insights into students' misunderstandings or gaps in relation to the course content. Challenges faced in this course: (i) the fact that the Hubert-student interaction was taking place in the English language, hampered some students to initiate the conversation with Hubert, as they were not confident with the language, (ii) the teacher was not completely satisfied with the thematic analysis of students' responses provided by the Hubert Evaluation Dashboard. For instance, some responses were clustered as having a negative connotation and were included in the negative aspects of the course evaluation, were those responses occurred from students' negative answers to the question "Do you want to add something more?"

Case #4

- **Course name**: MGA 320 'Design for all' (Multimedia and Graphic Arts Department)
- **Number of students**: fewer than 50
- **Course description**: The aim of the course 'Design for all' is to present to the students' topics related to information technology, communications and accessibility, accessible

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content, accessible entry and exit of computer systems, new procedures, principles and examples of accessible human-computer interaction, as well as methods and techniques design of accessible anthropocentric systems. In this course students will have the opportunity to develop a wide range of topics related to concepts, necessity, general principles, and design guidelines for all. Also, the aim of the course 'Design for All' is to examine issues of ethics, legal restrictions and directions, business trends, standards and good practices, in relation to the global reality. Finally, the course provides accessibility system design exercises and experiences related to accessibility.

- **Description of students' engagement with Hubert**: Hubert was used for course evaluation and self-reflection, in the middle and end of the semester. The teacher's assistant created new evaluations in Hubert.ai using the template provided for course evaluation. The teacher assistant shared the generated link to students, who interact with Hubert by clicking on that link. Hubert posed the predefined (by the chosen template) questions to students, with a degree of smart interactions in the sense that Hubert could react positively or negatively to students' responses. Then, the teacher assistant and the instructor could be able to see the evaluation results, with students' responses, on her dashboard, having access to the raw data (i.e., the actual conversation of each student with Hubert), but also to a thematic analysis of students' responses. The links to those evaluations are provided below.

    - Middle of the semester
        - MGA320 Self-reflection Middle
        - https://www.hubert.ai/feedback/60533c9084ccc4001173d183
        - MGA320 Course Evaluation Middle
        - https://www.hubert.ai/feedback/60533d6f84ccc4001173d184

- **Affordances and challenges**: Hubert was used by the students for self-reflection and course evaluation. Main affordances and challenges of the Hubert use are the same as in Case#3.

Case #5

- **Course name**: MGA 320 'Design for all' (Multimedia and Graphic Arts Department)
- **Number of students**: fewer than 50
- **Course description**: The aim of the course 'Design for all' is to present to the students, topics related to information technology, communications and accessibility, accessible content, accessible entry and exit of computer systems, new procedures, principles, and examples of accessible human-computer interaction, as well as methods and techniques design of accessible anthropocentric systems. In this course students will have the opportunity to develop a wide range of topics related to concepts, necessity, general principles, and design guidelines for all. Also, the aim of the course 'Design for All' is to examine issues of ethics, legal restrictions and directions, business trends, standards, and

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good practices, in relation to the global reality. Finally, the course provides accessibility system design exercises and experiences related to accessibility.

- **Description of students' engagement with Differ**: The teaching assistant created a community for the course, in which students were invited via a link. Differ was used as the main informal communication tool in the course and for Q&A on course related topics, including administrative matters. The MGA320 community was created and used for general discussions of the whole class. Two additional communities were created for this class (see cases 6 and 7).

  ➢ MGA320 Link:
  ➢https://join.differ.chat/community/ddc734d8-d3a7-471e-9941-eaffe56893ce/ZPGNVQ

- **Affordances and challenges**: Main affordance of the Differ use is that students had an online community for their peer-to-peer communication for the purposes of the course within a safe environment. In Pilot 3, MGA320 students participated more actively in the community and interacted among them and with the teaching assistant in the open chat and with private messages. One factor that might have affected this observation is the fact that other communication tools or social media channels were excluded/ prohibited for use during the semester in the particular course. It is not clear whether the use of Differ, and/or BO had an impact on students' learning.

Case #6

- **Course name**: MGA 320 'Design for all' (Multimedia and Graphic Arts Department)
- **Number of students**: fewer than 50
- **Course description**: The aim of the course 'Design for all' is to present to the students, topics related to information technology, communications and accessibility, accessible content, accessible entry and exit of computer systems, new procedures, principles, and examples of accessible human-computer interaction, as well as methods and techniques design of accessible anthropocentric systems. In this course students will have the opportunity to develop a wide range of topics related to concepts, necessity, general principles, and design guidelines for all. Also, the aim of the course 'Design for All' is to examine issues of ethics, legal restrictions and directions, business trends, standards, and good practices, in relation to the global reality. Finally, the course provides accessibility system design exercises and experiences related to accessibility.
- **Description of students' engagement with Differ**: The teaching assistant created a second community for this course, named, MGA320 – POLIMESA (multimedia) in which students were invited via a link. Differ was used as the main informal communication tool in the course and for Q&A on course related topics, especially for multimedia, including administrative matters. The MGA320 – POLIMESA community was created and used for specific discussions in the multimedia direction of the program.

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➢ MGA320 - POLIMESA Link:

- https://join.differ.chat/community/7bf3c0f3-3086-4abf-98bd-1eff5b57ffa2/KJCWBT

- **Affordances and challenges**: Main affordance of the Differ use is that students had an online community for their peer-to-peer communication for the purposes of the course within a safe environment. In Pilot 3, MGA320 students participated more actively in the community and interacted among them and with the teaching assistant in the open chat and with private messages. One factor that might have affected this observation is the fact that other communication tools or social media channels were excluded/ prohibited for use during the semester in the particular course. It is not clear whether the use of Differ, and/or BO had an impact on students' learning.

Case #7

- **Course name**: MGA 320 'Design for all' (Multimedia and Graphic Arts Department)
- **Number of students**: fewer than 50
- **Course description**: The aim of the course 'Design for all' is to present to the students, topics related to information technology, communications and accessibility, accessible content, accessible entry and exit of computer systems, new procedures, principles, and examples of accessible human-computer interaction, as well as methods and techniques design of accessible anthropocentric systems. In this course students will have the opportunity to develop a wide range of topics related to concepts, necessity, general principles, and design guidelines for all. Also, the aim of the course 'Design for All' is to examine issues of ethics, legal restrictions and directions, business trends, standards, and good practices, in relation to the global reality. Finally, the course provides accessibility system design exercises and experiences related to accessibility.
- **Description of students' engagement with Differ**: The teaching assistant created a third community for the course, named MGA320 – GRAPHIKES (graphics), in which students were invited via a link. Differ was used as the main informal communication tool in the course and for Q&A on course related topics, especially anything related to graphics, including administrative matters. The MGA320 – GRAPHIKES community was created and used for specific discussions in the graphic arts direction of the program.

➢ MGA320 – GRAPHIKES Link:

- https://join.differ.chat/community/cc9c340e-1e76-495d-97b2-946f0144e67b/VPOULT

- **Affordances and challenges**: Main affordance of the Differ use is that students had an online community for their peer-to-peer communication for the purposes of the course within a safe environment. In Pilot 3, MGA320 students participated more actively in the

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community and interacted among them and with the teaching assistant in the open chat and with private messages. One factor that might have affected this observation is the fact that other communication tools or social media channels were excluded/ prohibited for use during the semester in the particular course. It is not clear whether the use of Differ, and/or BO had an impact on students' learning.

Case #8

- **Course name**: MGA 320 'Design for all' (Multimedia and Graphic Arts Department)
- **Number of students**: fewer than 50
- **Course description**: The aim of the course 'Design for all' is to present to the students, topics related to information technology, communications and accessibility, accessible content, accessible entry and exit of computer systems, new procedures, principles, and examples of accessible human-computer interaction, as well as methods and techniques design of accessible anthropocentric systems. In this course students will have the opportunity to develop a wide range of topics related to concepts, necessity, general principles, and design guidelines for all. Also, the aim of the course 'Design for All' is to examine issues of ethics, legal restrictions and directions, business trends, standards, and good practices, in relation to the global reality. Finally, the course provides accessibility system design exercises and experiences related to accessibility. As part of the students' obligations in the course, they were assigned with a team project that they had to deliver by the end of the semester. The "TEAM PROJECT" aimed to let students design for Migrants and Refugees in order to have a better implementation to their local communities. They had designed 8 different prototypes and were presented to real users in cooperation with MiHuB. It was a team project as students created teams of 4 and were assigned roles
- **Description of students' engagement with Hubert**: The teaching assistant created a self-reflection evaluation in Hubert.ai, for allowing students to reflect on their work during the implementation of this team project, that was assigned to them as part of the MGA320 course. The teaching assistant created the evaluation in Hubert.ai using the appropriate template provided for students' self-reflection. Then he shared the generated link with the students, via an email. Then, the students could interact with Hubert by clicking on that link. Hubert posed the predefined (by the chosen template) questions to students, with a degree of smart interactions in the sense that Hubert could react positively or negatively to students' responses. Then, the teaching assistant reviewed the evaluation results, shared those also with the main instructor of the course, having access to the raw data (i.e., the actual conversation of each student with Hubert), but also to a thematic analysis of students' responses.

    - ➢ The links to this evaluation is provided below.
        - https://www.hubert.ai/feedback/6023d045cf9cbf00112f69c5

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- **Affordances and challenges**: Hubert was used by the students for self-reflection and course evaluation. Main affordances and challenges of the Hubert use are the same as in Case#3.

Case #9

- **Course name**: MGA461 - Bachelors' Thesis
- **Number of students**: fewer than 50
- **Course description**: The course aims at allowing students to complete their Bachelors' theses in multimedia and graphic arts. The aim of the course is to allow the students to gain experience in carrying out independent research work. The thesis is done under the supervision of a member of the Department. The evaluation is based on two axes: 1. written thesis and completion of all associated deliverables and 2. oral presentation of the work. More information: https://www.cut.ac.cy/studies/bachelor/bachelor-programmes/module-description/?languageId=1&contentId=110254
- **Description of students' engagement with Differ**: The instructor created a community for this course, in which 4year students were invited via a link. The aim of this community was primarily for students to discuss with the instructor and other peers their BA thesis progress. Differ was used as the main informal communication tool in this course.

  ➢ The links to this community is provided below:

  https://join.differ.chat/community/d3cd4d66-025b-4c72-afcd-73ca942bb79f/IYWGKI

- **Affordances and challenges**: Main affordance of the Differ use is that students had an online community for their peer-to-peer communication with colleagues but also with their instructor, for getting feedback for their BA thesis, exchange ideas and discuss any matters of interest. Students participated actively in the community and interacted among them and with the instructor in the open chat and with private messages. It is not clear whether the use of Differ, and/or BO had an impact on students' learning.

Case #10

- **Course name**: MGA 460 Research Methods in Multimedia and Graphic Arts (Multimedia and Graphic Arts Department)
- **Number of students**: fewer than 50
- **Course description**: The course is provided to students studying at Year 3+ of their bachelor's degree studies. Typically lectures on the various research methodologies together with hands on work on building a research proposal and delivering the proposed project in the form of a small-scale research study conducted in groups are offered through

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the course. Specifically, the course aims to introduce students to the research process and to provide the necessary skills to design and implement small-scale research projects in the fields of multimedia and graphic arts. The course includes topics such as planning of research work, theoretical framework, research questions, literature review, APA reference system, selection of research methodology (quantitative and qualitative research), research tools (observation, interview and focus groups, questionnaires) and basic analysis of qualitative and quantitative data. Within the course students will prepare and present small-scale research projects, which include all stages of research.

- **Description of students' engagement with Differ**: The teacher directed the students to create informal peer-to-peer student communities, after being invited via email to join Differ with the use of an application. Primary focus of Differ use on the course was the creation of informal peer-to-peer student communities, to get introduced to other students (ice-breaking), and for communication purposes among students.

    - ➢ The links to this community is provided below:

        - ■ https://join.differ.chat/community/eebd3851-81f3-4177-8458-adebea567bfc/CAZAEZ

- **Affordances and challenges**: Main affordance of the Differ use is that students had an online community for their peer-to-peer communication for the purposes of the module within a safe environment. Challenges were primarily seen in students who are not willing to try out something new because they already use different communication tools. They were overloaded with everything online due to the COVID-19 situation. Even though students were invited to join the course community on Differ, none of them ever referred to the use of this tool. The use of Differ had no added value in comparison to the use of other chat tools. The teacher spoke unofficially to two students who confirmed that they did not use it much because they did not see added value over Facebook chat or other chat tools.

Case #11

- **Course name**: Language course for migrants (Mihub Information Center via the Cyprus University of Technology 2020-2021).
- **Number of students**: 50 to 100
- **Course description**: Help and support is provided to Migrant from Non-European Countries in order to adjust to the local society, including familiarizing themselves with the local language.
- **Description of students' engagement with Differ**: The facilitator created an online community for Mihub, using BO, and invited Mihub members to join via email. Primary focus of Differ use on the course were the FAQs created by the facilitator, but also the facilitator-members and member-to-member communication through Differ, its use for

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announcements related to the topics of interest to migrants, and Q&A (ask questions to your community).

- ➢ The link to this community is provided below:
  - https://join.differ.chat/community/f1e15a29-c48a-4105-a65b-5de1f989cd06/ISJLGG

- **Affordances and challenges**: Mihub members were interested in using Differ and the facilitator claimed that the online community helped its members to interact with people having the same needs and sharing similar concerns with them. Main affordance was that due to the COVID-19 pandemic and the mitigation measures (i.e., lockdown), the online community in Differ offered a safe environment for communication and exchange of information, when the circumstances did not allow face-to-face interactions. The facilitator claimed that he frequently used the FAQs feature, and it was useful for the Mihub members to find answers to those commonly asked questions. Also, the facilitator had the opportunity to make other postings and announcements in the open chat space, and many members of the community communicated with him via private messages. Differ was used on an everyday basis by the facilitator and the community members. The facilitator claimed that he would continue using Differ, also in pilot 4.

Summary

Despite the fact that only four educators participated in this pilot, we managed to use Differ and Hubert in multiple courses and in different use cases. In contrast to Pilot 2, Hubert was used not only for informal course evaluation, but also for students' self-reflection, with the use of a new template of questions that was constructed. However, the main affordance and main challenges of using Hubert in Pilot 3 resembled the ones acknowledged by the educators in pilot 2. One of the main benefits of using Hubert in the class was the interactivity and fun way of collecting information for course evaluation from the students. Hubert was also valued for its use as a reflective tool. One of the main challenges that remained was the quality of the thematic analysis that Hubert performs based on students' actual responses. No improvements were reported from the one pilot to the other. With regards to Differ, it was observed that in Pilot 3 the students were more engaged and participated more actively in the community discussions, as compared to pilot 2. This can be attributed to the fact that within the courses that Differ was piloted this time, other communication tools or social media channels were excluded/ prohibited for use during the semester. Overall, Differ was successfully piloted particularly in one of the courses (Mihub) that was dedicated to migrants for language learning. As already reported above, Mihub members were interested in using Differ and the facilitator claimed that the online community helped its members to interact with people having the same needs and sharing similar concerns with them. Main affordance was that due to the COVID-19 pandemic and the mitigation measures (i.e., lockdown), the online community in Differ offered a safe environment for communication and exchange of information, when the circumstances did not allow face-to-face interactions. The

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facilitator claimed that he frequently used the FAQs feature, and it was useful for the Mihub members to find answers to those commonly asked questions. Also, the facilitator had the opportunity to make other postings and announcements in the open chat space, and many members of the community communicated with him via private messages. Differ was used on an everyday basis by the facilitator and the community members. The facilitator claimed that he would continue using Differ, also in pilot 4.

3.2. University of Granada

In Pilot 3, UGR started developing their course chats in Differ, as done for the previous pilots. UGR invited different professors at our university and was specially distributed around colleagues in the School of Informatics (mainly for the Computer Science and Telecommunication Engineering educators). In all these cases, the proposal was to use Differ as a tool to communicate with our students in a synchronous way. The communication was done via email and informal talks in our seminar sessions.

In our emails, we included information about the goals of the EDUBOTS project, the link to the project web, and instructions on how to join the tool and how to use it. A few educators initially expressed interest about the project and/or the tool. However, only one educator outside the project joined for this pilot. Also, UGR team promoted the cMOOC learning community via different emails and were informed about the final conference at the end of the project, in case they were interested in the topic or on accessing tutorial and hands-on information about the tools. Due to the lack of interest, during this pilot, we started using some of the most common tools already in use to communicate amongst students: Telegram.

For this pilot, three educators finally participated, summing up to a total of 5 different courses (3 of them used Differ and the rest used Telegram). No significant differences were evident between pilots 1,2 and Pilot 3 in relation to the strategy that was followed to recruit participants.

Case #1

- **Course name**: High-Performance Architectures for Computer Vision - Master in Big Data and Computer Engineering
- **Number of students**: *A) less than 50*
- **Course description**: The course aims at teaching students different acceleration platforms such as FPGAs and GPUs for their use in Computer Vision processing, within the master in Big Data and Computer Engineering. All students are 23 or older and most of them have part-time jobs in the field. Their background is mostly Computer Engineering or Telecommunications. The evaluation of the course is done via a final presentation of a project on Computer Vision, that must evaluate different computing architectures and qualities such as throughput, memory utilization, frame rate, accuracy of their solution,

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robustness, etc. More information on the course (Spanish): https://masteres.ugr.es/datcom/docencia/plan-estudios/guia-docente/M51/56/3/14

- **Description of students' engagement with Differ**: The instructor created a community for this course. Students were invited to join via a link. The aim was for the students to have synchronous communication with the educator and with the other students in the course. Differ was used in the course as an additional communication tool (since students use an LMS for the course materials, evaluations, etc). Additionally, the educator in this course elaborated information of interest about the course such as responses to FAQs about the course, the tool suites to be used in the practical labs, the evaluation of the course, etc.

    ➢ The links to this community is provided below: https://join.differ.chat/community/07c34181-2a1a-4735-ac0a-8f7a62dcf680/QRGRPC

- **Affordances and challenges**: The main affordance was that students had an additional tool for synchronous communication with their teacher and with the other students. From the teacher's perspective, students also had the possibility to find the answers to frequently asked questions within the Differ community. This means the teacher did not need additional time to respond to these repetitive questions and could focus on the educational process. However, students did not actively participate in the chat or asked many questions to their teacher or their peers. It seems most of them already were part of an informal chat group with all the other students and therefore, did not find it interesting using a new tool to do the same thing.

Case #2

- **Course name**: Server's engineering
- **Number of students**: *A) less than 50*
- **Course description**: The practical aspects of the course cover server administration and basic hardening, studying aspects like storage configurations, service installation and configuration, monitorization and benchmarking. Bachelor degree.
- **Description of students' engagement with Differ**: The professor during the class invited the students to join the chat. There were alert bots for reminders and FAQs.
- **Affordances and challenges**: Students barely used the chat due to the fact that communication by traditional channels was fluent (regular classes, emails and LMS messaging).

Case #3

- **Course name**: Secured servers

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- **Number of students**: *A) less than 50*
- **Course description**: Introduction to Cybersecurity with practical exercises. Master degree.
- **Description of students' engagement with Differ**: The professor messaged students providing the link to the group
- **Affordances and challenges**: For this case the participation in the chat has been slightly higher as students have shared some news related to the course. The professor also has created a new group for alumni where, once the course is finished, other students from previous years can share their experience and news about the course. The alert bot was not of great help as the communication in class was quite fluid and most questions were discussed during lecture time.

Case #4

- **Course name**: Master Thesis
- **Number of students:** B) 50 to 100
- **Course description**: Students have to develop a Master Thesis to obtain the certification, as a coordinator for the master programme, the coordinator has to inform every student of their responsibilities, deadlines, procedures despite the work being carried out under the supervision of, at least, one professor.
- **Description of students' engagement with Differ:** The first day of classes the coordinator provided a link to the group:
- **Affordances and challenges**: In this case, the experience of the group in Telegram has been quite successful from the point of view of both students and professor. As there are a lot of students, it is quite agile to organise polls and broadcast job offers (in a separate group). Students feel free to ask questions related to the master thesis and other aspects of the organization of the program. The bot for the FAQs and the alert bot have been used (although interactions of the first one are recommended to be done privately).

Case #5

- **Course name**: Transmisión de Datos y Redes de Computadores (Data Transmission and Computer Networks)
- **Number of students**: *B)* 50 to 100
- **Course description**: Advanced concepts about networks at the bottom levels of the OSI Layer Model (Network and Link layers). Corporate networks fundamentals. Bachelor degree.
- **Description of students' engagement with Differ**: On the presentation day, the professor explained Differ possibilities, showed the link and offered the students the possibility of joining the community for the subject (named "TDRC - GII"). The aim was to use Differ as a tool to communicate with the students in a synchronous way. However,

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there was the possibility of using it as a breaking ice tool for those students who want to use this feature of BO chatbot.

- **Affordances and challenges**: The participation in this community was less than in previous applications of the same professor (just 16 students joined the community). It was only used for announcements and general messages from the professor to the students, they didn't even use it for synchronous communication with the teacher or public messaging with their peers. The management of the subject was conducted using the official LMS at UGR.

Summary

Results from pilot 1-2 already showed that it was very hard to encourage students to use or join new tools for communication with their peers or their teachers. One of the first findings from our previous experience in pilot 1-2 was that *large groups for communities such as all the students in a Faculty or a School of Engineering are not particularly useful*. The Univ. of Granada already provides institutional platforms for student-to-student, student-to-teachers and student-to-administration communication. Furthermore, teachers also use their own LMS and some of them are very popular among students (e.g SWAD: A free-software, educational, online tool for managing courses and students, https://swad.ugr.es/es).

Building on this experience, communities for this pilot were set up for smaller groups (less than 50 students) and with a very specific purpose. In this case, for different courses of the Master in Big Data and Computer Engineering and for a course in Telecommunication Engineering. The main objective was to provide students with a tool for rapid interaction with their teachers and to confront ideas with their peers. Also, teachers were offered a tool to alleviate the time they need to dedicate to respond to very frequent questions about the dynamics of their courses, the evaluation, or administrative tasks. Reducing the burden of this point was positively valued by the educators that could find extra time to be focused on their students and their learning process.

3.3. University of Leeds

For Pilot 3 at University of Leeds Differ and Hubert were used with taught module classes, but with larger student numbers. The Educators were members of the Leeds EDUBOTS research team, so did not need to be recruited or invited. No training materials were required, as the EDUBOTS research team did not require additional training in use of Differ and Hubert. Our motivation and aim were to include chatbots like Differ and Hubert as part of teaching and learning in data mining and text analytics, as well as wanting to trial the chatbots as part of the EDUBOTS research project. This differs from Pilot 2, where Differ users were not Computing students learning about chatbots. Differ and Hubert were offered to students on 3 courses: Computing MSc module COMP5840 Data Mining and Text Analytics, class size 237; Computing undergraduate module COMP2121 Data Mining, class size 172; and Computing undergraduate

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module XJCO2121 Data Mining, taught remotely to 74 students at the Leeds-SWJTU Joint School campus in Chengdu, China. Here we provide only one course from Pilot 3, the largest class size, 237 Computing MSc students; the other 2 courses were similar but with smaller class sizes and undergraduates rather than postgraduates.

Case #1

- **Course name**: OMP5840 Data Mining and Text Analytics
- **Number of students**: over 100 (237)
- **Course description**: 15-credit module taught over 11 weeks to computing students in MSc Advanced Computer Science and MSc Data Science and Analytics postgraduate programmes.
- **Description of students' engagement with Differ and/or Hubert**: The course included natural language processing and text analytics applications, with chatbots cited as an example use case; students were invited to try Differ and Hubert as additional background study.
- **Affordances and challenges**: Leeds University IT Service requires students and staff to use other platforms in online communication and issues its own course evaluation surveys. Hence, we were unable to make the use of Differ or Hubert mandatory as part of a taught module class, or to include Differ and Hubert use in coursework for credit; and it was challenging to persuade students to volunteer to trial the use of optional platforms. A handful of students agreed to try Differ and Hubert, but their qualitative evaluation feedback was that they preferred the standard Leeds IT platforms for chat discussion and student feedback.

Summary

Overall opinion of educators participating in Pilot: The Leeds EDUBOTS research team had the additional challenge that Differ and Hubert would be competing with existing mandatory systems at Leeds University for student interaction and student feedback. We have advocated to senior management to trial alternative IT solutions for these IT functions, and Leeds University IT service has agreed to consider some alternative systems for student-educator interaction and for eliciting student feedback; but not necessarily Differ and/or Hubert.

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3.4. University of Zagreb, Faculty of Organization and Informatics (FOI)

In the third Pilot at the Faculty of Organization and Informatics, in total 5 courses were involved in Differ. As most of the teachers had previous experience with Differ, additional one-on-one instructions were provided to other teachers who used Differ for the first time. Overall, teachers were not so interested in using new technological solutions because of the well-established ICT solutions that have experience with or are part of the Learning Management System. The motivation of others to use Differ was a positive experience from previous pilots and the fact that they recognized the chatbot application as useful for communication and connecting with students in teaching activities.

If we look at the **differences in Pilot 2 and 3,** we have noticed the reluctance of teachers to come up with new technological solutions. We assume that there has been a saturation of the various tools used in online teaching and they have stayed with those with whom they already have good experiences and do not require much extra effort and time to use.

Case #1

- **Course name**: Managerial Communication and Leadership
- **Number of students**: 50 to 100
- **Course description**: Managerial Communication and Leadership is an elective course on the first year of graduate studies of Economics of Entrepreneurship. Students are very interested in this course and a great number of them enrol in it
- The aim of the course is to improve the knowledge and skills related to communication between leaders and managers in business organizations, and in relation to other employees at different levels, groups and teams, as well as representatives of other business organizations. Getting acquainted with communication processes in organizations, as well as processes related to communication in small groups and teams, communication in motivation and leadership, in decision-making, as well as during change management and crisis situations. Preparation for more effective analysis and research of communication processes in business organizations, as well as for the design of communication strategies related to internal and external organizational communication. (Source: https://nastava.foi.hr/course/76562/2018-2019) . Students were divided in 2 groups of approximately 30 students. In first 10 weeks students worked individually/in pairs or in small groups on exercises related to teamwork, creativity, decision making etc. and had to submit their homework weekly. Last 4 weeks of the course were devoted to their presentation of distinguished leaders. It **is important to emphasise that classes during the summer semester took place exclusively online due to the Covid-19 pandemic.**

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- **Description of students' engagement with Differ and Hubert**:
  Students were invited to join the **Differ** community via Moodle system and detailed instructions were provided in the first weeks of semester in laboratory online groups. Text-instructions were available the whole semester in LMS. Role of educator was to 1) inform the students about upcoming activities (exams, deadlines, teaching methods and tasks); 2) encourage conversations about weekly activities on seminars 3) To encourage students to give feedback about colleagues' presentations on seminars 4) to make community a vivid academic society due to lack of face to face lectures.
  Students accepted Differ in the beginning of the semester very well, 53 of them (from 58 total) on-boarded. Teacher initiated the conversations, but students freely asked questions and new conversations about topics. They actively used Differ, and most of them as a mobile application from the result of the Pilot 3 survey.
  Usage of Hubert: Evaluation of course was conducted at the end of the semester, but only 2 students had a conversation with Hubert.
- **Affordances and challenges**:
  Affordances: Students recognized **Differ** as a channel of communication that improves the availability of teachers and adds a new value to their learning process because they can share their opinions and comment on their presentations in real time. Students accepted it very well since they were very motivated for the course, and found it useful and applicable for the workplace. It can be concluded that usage of Differ was successful because students experienced something new that was not time or technically demanding (more interesting for non-IT students) and it help them to solve seminar tasks. From a teacher's perspective, since the students were motivated and used Differ regularly during and after the classes and could be described as a useful medium to make closer connections among students, but also students and teachers. Also, it was a communication platform on which issues could be solved immediately and efficiently. Because of COVID-19, Differ was the medium to make closer connections among students, but also students and teachers.
  Challenges: Main challenges stem from the decline in student motivation for how the semester was coming to an end and all obligations were resolved. Also, one challenge was the dependencies of initiating discussions and topics from the teacher's side.

Case #2

- **Course name**: **Computer mediated Communication**
- **Number of students**: 50 to 100
- **Course description**: Computer mediated Communication course is an elective course at Undergraduate Vocational Study Programme Information Technology in Business Application in Varaždin. The course enables the acquisition of knowledge, skills and specific competencies from various areas of Internet use in business and private communication at the level of individuals, groups or teams, as well as in mass communication via the Internet. It also provides the necessary knowledge of communication and psychology to more successfully present information on the Internet

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and design products and services based on communication with users via the Internet. During the practical exercises from the course, students get to know and master the work with a large number of online communication tools and web 2.0 applications such as e-portfolio, wiki system, blog, Google drive tools, online surveys, applications for mental maps and block diagrams, etc. (Source: https://nastava.foi.hr/course/50958/2019-2020/VZ). Practical skills students gained in laboratory lecturers and the main task was to do scientific research projects in small groups (2-3 members) related to course topics. It is important to emphasize that classes during the summer semester took place exclusively online due to the Covid-19 pandemic.

- **Description of students' engagement with Differ:** Students were invited to join the **Differ** community via Moodle system and detailed instructions were provided in the first weeks of semester in laboratory online groups. Text-instructions were available the whole semester in LMS. Role of educator was to 1) inform the students about upcoming activities (exams, deadlines, teaching methods and tasks); 2) Encourage conversation about research topics and to make social presence better because of Covid-19.
  Communication was encouraged on a weekly basis by teachers, but unfortunately it was one-way and students did not have many questions or feedback. Due to this, and the small number of involved and active users in the course, **the evaluation of the use of Differ was not conducted due to the low interest of students**. Data on the use of Differ (desktop or mobile version) is also not known.
  Hubert's case evaluation was also not conducted due to the simultaneous conduction of the University Teacher Evaluation Survey.
- **Affordances and challenges**: As the teacher was only initiator of conversations in Differ and students didn't use application to communicate related to course activities, main **challenge/ the assumption** is that they used already existing communication channels for communication and received enough information on a weekly basis about teaching activities in synchronous online lessons.
  Also, since this group are **computer science students, they like to use advanced communication applications** that are closer to their profession and consider this an additional burden **that does not create additional value for the learning process**. Also, the s**tudents have known each other since before** and that is why it was not interesting for them to use Differ and Bo as a way to gain new contacts and friendships. No affordances detected in this case.

Case #3

- **Course name**: Data Mining
- **Number of students**: less than 50
- **Course description**: The course is elective in the summer semester of the 3rd year of the Bachelor's Degree at the university undergraduate study Economics of Entrepreneurship. The goal of the course is that students: acquire quality knowledge to understand and apply knowledge discovery in data in economics; getting acquainted with the basic principles of

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knowledge discovery in data; introduction to techniques and algorithms; learning basic data discovery skills through tools and examples; and understanding of typical application examples. Teaching activities consist of the lectures and practical laboratory exercises. Students were mostly full-time, interested in the course topics since the course is elective.

- **Description of students' engagement with Differ**: Differ was introduced in the course as a part of a computer exercise. Students got the guidelines uploaded on the learning management system on how to join the community and use the app. An educator created in Differ topics for discussions with the students. Differ was used to further explain course announcements in LMS if needed. Students were actively participating in the discussions, mostly to get the answer to some exercise related problem or administrative questions. Most of the students used private messaging to directly ask the educator without other students seeing the message.
- **Affordances and challenges**: Motivate students to use Differ since they already used many applications.

Case #4

- **Course name**: Multimedia and web in business
- **Number of students**: less than 50
- **Course description**: The course is elective in the summer semester of the 1st year of the Master's Degree at the university graduate study Economics of Entrepreneurship. The goal of the course is that students acquire 1) knowledge of the principles and specifics of media editing for business purposes, 2) acquire basic knowledge of web technologies and elements of web design and development of business websites, and 3) acquire knowledge of methods, techniques and skills with the content management system to develop business website from the perspective of the client. Teaching activities consist of the lectures and practical laboratory exercises. Students were mostly full-time, interested in the course topics since the course is elective, but without much technological background. They had some previous experience of image editing, but mostly using mobile apps, and only a few used desktop applications. Some of them tried video editing. Previous knowledge on web technologies and web design principles was low.
- **Description of students' engagement with Differ**: Differ was introduced later in the course as a part of a computer exercise. Students got the guidelines uploaded on the learning management system on how to join the community and use the app. Over 90% of the students onboard the Differ. An educator created in Differ various topics for discussions with the students, related to the course structure (lectures, exercises, open chat). Also, Differ was used to further explain course announcements in LMS if needed. Students were actively participating in the discussions, mostly to get the answer to some exercise related problem or administrative questions (e.g will the lecture be recorded and available later in LMS, and similar). Some students used private messaging to directly ask the educator without other students seeing the message.

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- **Description of students' engagement with Hubert**: Hubert was used once in the last week of the semester to informally evaluate the course. The setup of the evaluation was straightforward. Response rate was low (only 7 responses or conversations were received) since the students already knew its course grade and did not bother to participate in additional activities.
- **Affordances and challenges**: The educator used Differ in three courses. In the courses in which she was an active Differ participant, sending messages, asking questions, the students were more active in using the Differ community. In the course where the educator was marginally active, there wasn't any activity from the students. However, Differ made communication faster and easier in cases when the educator didn't have to check records about some student.

Case #5

- **Course name**: Knowledge Management
- **Number of students**: more than 100
- **Course description**: The aim of this elective course is to enable students to understand the theory, practice, tools and techniques for Knowledge management. Within the course, students will learn and be able to apply methods of analysis and evaluation of KM solutions and master and apply methods of semantic modelling and reasoning about knowledge in knowledge management. Also, students will understand the role of knowledge management in organisations, which could help them achieve a successful career. (Description of the course available on: link) During the semester, students were divided into teams of 3 to do the practical task. Overall, 53 student teams were formed. Each team had a project task to do.
- **Description of students' engagement with Differ**: Differ was used only in laboratory groups. Differ was used as the primary communication channel that was used to form teams. In Differ each week new tasks and course materials were available. The teacher was in each student team/group. Teacher had a controlled view of what each team was working on. Most of the students used Differ in the team actively, but some of them did not use it. Hubert was not used in the course.
- **Affordances and challenges with Differ**: Several affordances were mentioned: a sense of social presence of teachers during online classes, better connections and better communication with students and organising course materials for each team. Another advantage is faster resolution of student inquiries, and students were also inclined to ask questions related to the project and teaching activities. Differ was found as a good alternative communication platform when all University services were down for almost all day. Course teacher mentioned that there was no such a need to check mail and she was able to respond very quickly to each team individually. The teacher has the impression that students find it difficult to accept new technologies.

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Summary

For the subjects who participated in the Pilot 3, the following similarities were observed: the previous positive experience of the teacher with the use of Differ is the main determinant for its reuse on the subjects. Differ proved to be a great and fast way to communicate with teachers and made it easier for teachers to work. The main challenges of (not) using Differ stem from students' lack of interest in new applications and sticking to existing solutions. According to their reduced activity in Differ and Hubert, we can say that they are oversaturated with different solutions used in online teaching.

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4. Case Studies from Pilot 4

Data for Pilot 4 (September 2021 - January 2022) was gathered through the questionnaire, as in the previous pilots, which Project partners distributed to course educators who participated in the piloting.

4.1. Cyprus Universities

In Pilot 4, CYENS followed a similar strategy, as in the previous pilots. CYENS invited educators across different local universities to participate in the pilot, for testing Differ and/or Hubert. In this pilot, one single invitation was sent to CYENS members' professional networks via emails. The exact description that was incorporated in the invitation email follows.

> *"Dear colleagues,*
>
> *The CYENS Research Centre of Excellence is involved in an EU Erasmus+ project on Educational Chatbots (EDUBOTS - Best practices of pedagogical chatbots in higher education, https://www.EDUBOTS.eu/).*
>
> *We are reaching out to the Universities of Cyprus for volunteer-instructors to use (i) BO, a chatbot integrated within a chat tool, Differ (https://www.differ.chat/) and/or (ii) Hubert (https://hubert.ai/), in the 4th pilot during the Fall academic semester 2021.*
>
> *BO is a social chatbot integrated within Differ chat tool that can offer support in building learning communities, initiating peer interaction and collaboration.*
>
> *Hubert is a stand-alone chatbot, which can be used for course evaluation and/or students' self-reflection.*
>
> *If you teach any courses this semester, we would like to hear from you!*
>
> *If you are interested, please fill in the form below. We will contact you with more details (you can opt-out any time).*
>
> *https://forms.gle/AcxFJaRnSDixsmHV8*
> *Thanks in advance!"*

Educators who were interested in participating in the pilot were required to complete a short online form (i.e., Google form, *https://forms.gle/AcxFJaRnSDixsmHV8*) and provide their contact details.

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A total of 5 educators initially expressed interest to participate in Pilot 4 for testing Differ or Hubert, out of which 4 finally participated in the pilot.

CYENS researchers then proceeded with communicating with the educators via phone or personal emails, for providing more information about the pilot, the potential use of the chatbots in the class, and the data collection processes. Emails with particular instructions on how to start using the two chatbots were also sent. The content of these two emails is provided below (one email with instructions on how to start using Differ-BO and a second email with instructions on how to start using Hubert). In addition, educators were prompted this time to join the cMOOC community.

> *"Dear colleagues,*
>
> *Thank you for your interest in participating in our pilot.*
>
> ***There are 3 steps that you need to follow in order to get access to Differ and BO.***
>
> ***BO= chatbot***
>
> ***Differ = chat tool within which BO is activated***
>
> *1. Register in the EDUBOTS Cyprus Community, by following the link: https://dif.re/cyprus*
>
> *2. Provide your phone number for receiving a code which will allow you to sign up.*
>
> *3. Download the application (mobile or desktop), and sign in.*
>
> *Upon completing the aforementioned 3 steps, you will be required to create your own community within Differ in order to be able to use the chatbot with your students.*
>
> *You can then use the chatbot with one or more of the following scenarios.*
>
> *Scenario 1: Ice-breaking activities.*
>
> *Scenario 2: Create Frequently Asked Questions (FAQs).*
>
> *Scenario 3: Split students into groups.*
>
> *Detailed instructions on how to set up your community and proceed with the scenarios are provided here: [Link to instructions].*
>
> *In addition, if you wish, you may join our cMOOC on Eduflow -- a collaborative learning platform, in which you may connect with a community of educators around chatbots in education. Create an Eduflow account and connect with the community members, learn, and develop new digital skills. Join here: https://app.eduflow.com/join/FJXN2X.*

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Please, do not hesitate to contact us in case of questions (o.tsivitanidou@cyens.org.cy).”

“Dear colleagues,

Thank you for your interest in participating in our pilot for testing the Hubert chatbot (https://hubert.ai).

You can use the chatbot with one or more of the following scenarios.

Scenario 1: Promoting self-reflection

Scenario 2: Informal course evaluation

A brief description of the steps you need to follow:

- *Create your Hubert account here: https://hubert.ai/signup*
- *Create your evaluations (scenario1/ scenario 2/ or both)*
- *For each scenario there are specific templates to use*
- *Generate a link and share it with your students*
- *By pressing the link, the students start a short (<1 min) conversation with Hubert*
- *You can then have access to students’ responses via https://hubert.ai/evaluations*
- *All of the above steps are described in the guide file attached.*

For further detailed descriptions of the two scenarios and their added value are provided here: [Link to descriptions].

In addition, if you wish, you may join our cMOOC on Eduflow -- a collaborative learning platform, in which you may connect with a community of educators around chatbots in education. Create an Eduflow account and connect with the community members, learn, and develop new digital skills. Join here: https://app.eduflow.com/join/FJXN2X

Please, do not hesitate to contact us in case of questions (o.tsivitanidou@cyens.org.cy).”

Further to the above mentioned instructions, educators received a set of manuals with guidelines for the use of Differ and Hubert.

Specifically, for the use of Differ, the following open document was shared with all educators, so as to guide them during the application of different scenarios (ice breaking activity, FAQs, split students into groups). Link to the document: EDUBOTS Pilot Phase 3 – Instructions for Differ. Likewise, for the use of Hubert, the following open document was shared with all educators, so

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as to guide them during the application of different scenarios (informal course evaluation, students' self-reflection). Link to the document: EDUBOTS Pilot Phase 3 – Instructions for Hubert.

Four educators finally participated in the pilot, summing up to a total of 6 different courses (one educator used Differ and Hubert in two courses and another educator used Hubert in two courses). Specifically, Hubert was used in five courses (EDUC-585DL, LCE512, LCE668, MGA320, MGA460) while Differ was used in three different courses (MGA320, MGA460, MiHub 2021). Concluding, no particular differences were evident between Pilot 3 and 4 in relation to the strategy that was followed to recruit participants.

Case #1

- **Course name**: EDUC-585DL: Current Trends in the Teaching of Mathematics and Science
- **Number of students**: Less than 50
- **Course description**:The aim of the course is to bring students in a first contact with modern research in Mathematics Education and Science Education. The course examines selected areas of research in both areas. Students to develop: Basic thinking and scientific method skills, personal philosophies for learning and teaching mathematics and science, basic research skills related to the teaching of mathematics and science, to develop knowledge for modern learning theories and didactic approaches in Natural Sciences and Mathematics, to develop argumentation skills, to be informed about didactic approaches related to the nature of science and mathematics, to plan didactic activities through the prism of research findings in cognitive psychology and didactics of Science and Mathematics, to gain knowledge and develop skills which will be the basis for the creation of personal philosophies of teaching and learning for Science and Mathematics.
- **Description of students' engagement with Hubert**: The teacher used Hubert in the middle of the academic semester as part of a series of activities dedicated to assessment in science teaching. As part of this activities, Hubert was introduced to the students as an example of technological tools that can be used in the class with students for self-reflection on their learning progress and for an active engagement of students. The teacher in this case created a new evaluation in Hubert.ai using the template provided for students' self-reflection. Then the teacher shared the generated link with the students via the Moodle platform and as part of students' weekly assignments. All the students in the class interacted with Hubert by clicking on that link. Hubert posed the predefined (by the chosen template) questions to students, with a degree of smart interactions in the sense that Hubert could react positively or negatively to students' responses. Then, the teacher reviewed the evaluation results, with students' responses, on her dashboard, having access to the raw data (i.e., the actual conversation of each student with Hubert), but also to a thematic analysis of students' responses. Concluding, Hubert was used in this course for self-reflection and as an example of technological tools that can be used by the students themselves in their own classes.

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- **Affordances and challenges**: Since the activity was obligatory for the students, as part of their weekly assignments, all students in the cohort interacted with Hubert, thus providing a good pool of responses for the teacher. Also, it was a good opportunity for the students to experience a technological tool that can be used in their own classes with their own students. Main affordances reported in the previous pilots, such as (i) easy process for the teacher to set up an evaluation; (ii) easy way to invite students in interacting with Hubert, by sharing a link are still applicable in this case as well. There was only one challenge, which was also reported previously: the fact that the teacher was not completely satisfied with the thematic analysis of students' responses provided by the Hubert Evaluation Dashboard.

Case #2

- **Course name**: LCE512 - Second Language Instructional Technology
- **Number of students**: less than 50
- **Course description**: The aim of this module is to set students on track to becoming autonomous lifelong learners in the field of second language instructional technology (SliT). To achieve this goal, students will be provided with a broad perspective of SLIT: where it has come from, where it is now, and its likely future directions. Students will get practical experience using multimedia-editing tools (text, audio, graphics, video) in the preparation of their assignments. Using Internet search engines, they will discover what the primary professional resources of the field are and how to access them. They will explore and evaluate different types of computer-assisted language learning activity types: tutorials, tools, simulations, games, and communication. In so doing, they will get hands-on experience using applications designed to foster specific language skill areas, cultural knowledge and communicative competence. As part of the collaborative assignments upon which the course is based, students will develop their practical competence in the use of social networking sites and computer-mediated-communication applications: discussion forums, chats, wikis, and blogs. They will likewise learn to use various computer-based tools as language teaching applications. At the end of the course, through the e-portfolio that they produce, students will possess an extensive summary of what they have learned and created in the course for their future reference in the MA in CALL programme and ongoing professional development.
- **Description of students' engagement with Hubert**: Students were invited to use Hubert as a means for course evaluation and reflection. Their feedback was in general positive (even in cases that the use was not mandatory they enjoyed using it). Students were invited to the app with a link (copied link from the Hubert website).
- **Affordances and challenges**: The instructor reported that she enjoyed using Huber for receiving anonymous course evaluation at regular intervals. Students provided ideas and insights that helped her improve the course.

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Case #3

- **Course name**: LCE668 (Greek for Academic purposes for Communication and Internet Studies
- **Number of students**: less than 50
- **Course description**: The course is designed to meet the needs of the students in the CIS deparments in terms of academic writing. In this course students will have the opportunity to develop a wide range of skills: understand demanding texts (such as academic papers) and produce well-structured texts that meet the requirements of the specific department.
- **Description of students' engagement with Hubert**: *Students engaged with Huber at the end of the course and as they were pressed for time did not engage with it as I expected. Students were given the link (copied from the Hubert Website).*
- **Affordances and challenges**: Although the tool is very useful, in this course it has not been fully exploited. Students noted that the fact that they had to write in English was challenging, as well as the time pressure for final exams.

Case #4

- **Course name**: MGA320 Designing for All
- **Number of students**: less than 50
- **Course description**: The aim of the course 'Design for all' is to introduce students to issues related to information technology, communications and accessibility, accessible content, accessible entry and exit of computer systems, new procedures, principles and examples of accessible human-computer interaction, and method design of accessible anthropocentric systems.

  https://www.cut.ac.cy/studies/bachelor/bachelor-programmes/module-description/?contentId=110229

- **Description of students' engagement with Differ and Hubert**: Differ was used as the main communication tool in the class. The use of the tool Differ was important in the course process. Especially during the coronation epidemic, Differ was the main communication tool used among the instructor and the students. No other communication tools were used in this course. It was also a notification area for the course as well as the process of defining the groups as it was done from there. Hubert was also used for course evaluation. Hubert was very important as the instructor used it to receive feedback on the value of the course no matter how good the teaching methodology was. That tool gave feedback to the instructor during the lesson but also at the end.
- **Affordances and challenges**: It was hard at the beginning for students to get familiar with Differ but during the semester they found the interface and the whole procedure very useful.

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Case #5

- **Course name**: ❖ MGA460 (Research Methodology in Multimedia and Graphic Arts)
- **Number of students**: less than 50
- **Course description**: The aim of the course is to introduce students to the research process and provide the necessary bases and skills for the design and implementation of small-scale research projects in the fields of multimedia and graphic arts. The course includes topics such as research project scheduling, theoretical background, research questions, literature review, APA reporting system, design and selection of research methodology (quantitative and qualitative research), research tools (observation, interview and focus groups, questionnaires) and basic qualitative analysis and quantitative data. During the course students will prepare and present a small research project, which includes all stages of research. https://www.cut.ac.cy/studies/bachelor/bachelor-programmes/module-description/?contentId=110253
- **Description of students' engagement with Differ and Hubert**: Differ was used as the main communication tool also in this class. Differ was very useful for direct communication with students during the semester. An alternative channel which was very helpful and useful. As part of students' obligations in the course was the delivery of a project in groups. The peer groups for the project of the semester were categorised by the specific feature of Differ (split students into groups). Hubert was also used for course evaluation. Hubert was very important as the instructors used it to receive feedback on the value of the course no matter how good their teaching methodology was. That tool gave feedback to us during the semester but also at the end.
- **Affordances and challenges**: Students were familiar with both tools (Differ and Hubert) as they had used them in a previous course during Pilot 3 so they didn't find any challenges.

Case #6

- **Course name**: Language course for migrants (Mihub Information Center via the Cyprus University of Technology 2020-2021).
- **Number of students**: 50 to 100
- **Course description**: Help and support is provided to Migrant from Non-European Countries in order to adjust to the local society, including familiarizing themselves with the local language.
- **Description of students' engagement with Differ**: The facilitator created an online community for Mihub, using BO, and invited Mihub members to join via email. Primary focus of Differ use on the course were the FAQs created by the facilitator, but also the facilitator-members and member-to-member communication through Differ, its use for announcements related to the topics of interest to migrants, and Q&A (ask questions to your community).

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- **Affordances and challenges**: Affordances of the Differ use in this community are the same as reported in previous pilots. Mihub members were interested in using Differ and the facilitator claimed that the online community helped its members to interact with people having the same needs and sharing similar concerns with them. Main affordance was that due to the COVID-19 pandemic and the mitigation measures (i.e., lockdown), the online community in Differ offered a safe environment for communication and exchange of information, when the circumstances did not allow face-to-face interactions. The facilitator claimed that he frequently used the FAQs feature, and it was useful for the Mihub members to find answers to those commonly asked questions. Also, the facilitator had the opportunity to make other postings and announcements in the open chat space, and many members of the community communicated with him via private messages. Differ was used on an everyday basis by the facilitator and the community members. No challenges were reported in this use case.

Summary

As already stated in the introductory section, four educators participated in the Pilot 4, summing up to a total of 6 different courses (one educator used Differ and Hubert in two courses and another educator used Hubert in two courses). Specifically, Hubert was used in five courses (EDUC-585DL, LCE512, LCE668, MGA320, MGA460) for two scenarios: self-reflection and course evaluation, while Differ was used in three different courses (MGA320, MGA460, MiHub 2021) as a communication tool for the course. In relation to observed commonalities in the courses, educators who used Hubert in their class reported that they enjoyed using Hubert, it was an easy process to set up a new evaluation and students' responses, especially for the course evaluation scenario, were useful to the educators for making improvements in their course. Yet, one educator reported that s/he was not completely satisfied with the thematic analysis of students' responses provided by the Hubert Evaluation Dashboard, yet reviewing the raw data for transcripts was still insightful. Another educator also reported as a challenge the unavailability of Greek as a language for the interactions which were taking place between the students and the chatbot. Last, in relation to the use of Differ, educators reported that students who were already familiar with the chat tool (as part of their participation in previous pilots), could more easily get engaged and use the tool, in comparison to students who used Differ for the first time.

4.2. University of Granada

In Pilot 4, UGR started developing their course chats in Differ again, as done for the previous pilots. However, even during Pilot 3, some of the members of the UGR team decided to start using other tools in order to encourage students using the chatbots, given the poor results in previous pilots in terms of enrolment. This is the reason some of the courses in this section were performed using Differ but most of them used Telegram. Anyway, UGR still invited educators at our university and specially for the School of Informatics (mainly for the Computer Science and

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Telecommunication Engineering educators, but also educators for the masters in Computer Science and Technology and the education master). The communication was done via email and informal talks in our seminar sessions.

In our emails, we included information about the goals of the EDUBOTS project, the link to the project web, and instructions on how to join the tool and how to use it, following the same strategy that we already used in our previous pilots. Since the end of the project was approaching, we reiterated in our attempt to promote EDUBOTS by joining the cMOOC learning community via different emails and were informed about the final conference at the end of the project, in case they were interested in the topic or on accessing tutorials and hands-on information about the tools. As seen, no significant differences were evident between Pilot 3 and Pilot 4 regarding the strategy to recruit new participants.

For this pilot, we are presenting 4 different courses (1 of them used Differ and the other 3 used Telegram).

Case #1

- **Course name**: Integrated Electronic Systems - Master in Telecommunication Engineering
- **Number of students**: *A) less than 50*
- **Course description**: The course aims at teaching students how to do hardware programming with MPSoCs (multiprocessor system on chip) within the Master in Telecommunication Engineering. Students are 23-24 years old and their background is Telecommunication Engineering. This master is mandatory to certify their studies as Engineers in Telecommunications in Spain. The evaluation of this course has two parts: 80% is achieved by the development of a project that involves different hardware architectures and the application of hardware programming principles taught in this course, 20% is evaluated via short practical exercises done during the first part of the course in the lab. More information on the course (Spanish):

  https://masteres.ugr.es/ingenieria-telecomunicacion/docencia/plan-estudios

- **Description of students' engagement with Differ**: The teacher created a community for this course in Differ. Students were invited to join via a link, using the university mailing list and the communication provided by the LMS tool. The community was created with the objective of providing students with fast communication with their teacher. Also, students were encouraged to use the different communication channels to interact between them. Differ was used in the course as an additional communication tool (since students were already using an LMS for the course materials, evaluations, and other administrative tasks). Also, the teacher elaborated responses to FAQs about the course, the hardware programming framework to be used in the labs, the evaluation of the course, etc.

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➢ The links to this community is provided below:

https://join.differ.chat/community/41c982cb-e585-4738-b61e-6aefa93b97ff/RHTLDT

- **Affordances and challenges**: The positive side was that students have an additional synchronous channel for their communication with their teacher and with other students. Also, the teacher had a tool to respond to FAQs, relieving him/her from the burden of responding to the questions again and again. However, students did not engage much with the platform. Despite the countless efforts inviting students to use the new tool, only a few of them actually registered and there were very few interactions during the course. In fact, only a few of them (less than 30%) replied to the questionnaire about the use of Differ and Bo.

Case #2

- **Course name**: Embedded Systems and HW-SW Codesign - Master in Big Data and Computer Engineering
- **Number of students**: *A) less than 50*
- **Course description**: The course aims at teaching students how to do hardware programming with MPSoCs (multiprocessor system on chip) and accelerate computationally demanding processing within the Master in Big Data and Computer Engineering. Students are 23-24 years old and their background is Telecommunication Engineering/Computer Engineering/Computer Science. Most students have part-time jobs in the field. The evaluation of this course is done via short practical exercises during the practical labs using different acceleration platforms. More information on the course (Spanish):

  https://masteres.ugr.es/datcom/docencia/plan-estudios/guia-docente/M51/56/3/5

- **Description of students' engagement with Telegram**: The teacher created a chat group for this course in Telegram. Students were invited to join via a link, using the university mailing list and the communication provided by the LMS tool used in the course (SWAD). The chat group was created with the objective of providing students with fast communication with their teacher, and the potential of including different bots that could help students with their learning process. Also, students were invited to use the group to interact between them and help others with their questions about the subject or share links of interest. Apart from that, the teacher in this course integrated different chatbots: a) for reminding students about submission deadlines for their exercises or projects; b) for moderating the chat group; c) a bot developed by the teacher for automatically responding to FAQs (@faq_secodis_bot, freely available in Telegram); d) built-in polls to ask students their opinions and preferences along the course.

  ➢ The link to join this Telegram chat group is provided below:

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https://t.me/+5PP16h1awNhjMzVk

- **Affordances and challenges**: The experience with Telegram in this case was exactly the opposite to the previous case. Students did engage the chat group and interact with each other and with the teacher, continuously asking questions about the subject and about the evaluation. Moreover, they also use the chat group to help other students with their questions and issues during the development of their projects, sharing with others screenshots of their errors and offering links to solve some known bugs of their developments. From the teacher's perspective, the tool was greatly appreciated and shown in the questionnaire (specific questionnaires for the use of Telegram were developed for students and educators). The chat group helped with responding to FAQs but also contributed to the collaborative work between students, helping them to learn by explaining.

Case #3

- **Course name**: Electronic Digital Systems - Telecommunication Engineering
- **Number of students**: *B) 50 to 100*
- **Course description**: The course aims at teaching third year Telecommunication Engineers how to program in VHDL, a hardware programming language for reprogrammable hardware platforms (Field programmable gate arrays). The evaluation of this course includes an exam at the end of the semester for the theory and another one for practical experiments. This is 50% of the final grade, the other 50% is achieved by building a project along the course. More information on the course (Spanish):

  https://grados.ugr.es/telecomunicacion/pages/infoacademica/guias_docentes/comunes/tecnologa-electrnica/sistemas-electrnicos-digitales?lang=en

- **Description of students' engagement with Telegram**: The teacher created a chat group for this course in Telegram. Students were invited to join via a link, using the university mailing list. Students were informed that joining was not mandatory and that all the information in the chat would be sent via the university mailing list as well (this is mandatory due to the University policies about the use of tools other than the one provided by the University). The chat group was created with the objective of providing students with synchronous communication with their teacher and to help other students with their problems. Also, one-to-one communication with the teacher was available when required by the students (specially, when the problem regards their evaluations). Apart from this, the teacher also integrated other chatbots for reminding students about submission deadlines and built-in polls to ask students for their opinion.

  ➢ The link to join this Telegram chat group is provided below:

  https://t.me/+HDwky1yzck9jMTlk

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- **Affordances and challenges**: In this case, the use of Telegram did encourage students to join and interact with each other although the engagement was approximately 40% of the total number of students in the course. Regardless of this fact, students did participate and interact with the teacher and with their partners through the chat group. The activity especially spiked by the evaluation time and when submission deadlines approached. From the teacher's perspective, the tool was not as useful as expected. Due to the low engagement (lower than 50%), the work of answering FAQs was still needed. On the other hand, synchronous communications with larger groups are sometimes very demanding. This calls for the planning and elaboration of specific rules for the chat group to allow for time to carefully respond to the different questions (e.g. asking students not to post questions after 9 pm or during the weekends/holidays). In any case, the chat group helped with responding to FAQs and fostered collaboration between students.

Case #4

- **Course name**: Fundamentos de Redes (Fundamentals of Networking)
- **Number of students**: 50 to 100
- **Course description**: It is provided to students at their third year in bachelor's degree studies in Computer Sciences. The course presents the fundamentals of Computer Networks, including the conceptual OSI model of networks layers, IP protocol, TCP and UDP, network security, and network services (SNMP, HTTP, DNS). It is one of the mandatory subjects they must complete in their degree. The teaching dynamics are based on lectures in the classroom, practical parts in the laboratory, and students' public work presentations to their partners.
- **Description of students' engagement with Telegram**: The teacher created a chat group for this course in Telegram. It was presented in the first session of the course. Students were invited to join via a link, also using the internal messages system of the official LMS at UGR. Joining the group was not mandatory for them, since all the information in the chat would be also published in the LMS forums or mailing lists (this is required by the University). The chat allows the students to have synchronous communication between them and also with their teacher. In addition to the chat, the teacher added some Telegram bots into the group, such as alarms or reminders to students for submitting a task, important announcements, live polls related with the subject development, and an own-created FAQ bot ("NoMenteroBot FR") including the main topics that worries students in every subject, mainly focused on the evaluation.
- **Affordances and challenges**: The use of Telegram was very successful, given that almost all the students joined the group (56 out of 62). More than half of them participated actively in the chats, whereas almost all of them used the bots (mainly the FAQ one when the exams period was approaching). There were some rules set in the group, such as respecting working hours and working days for posing questions to the teacher, and just use the chat for course-related topics. Students interacted with the teacher, asking questions about any theoretical topic or about the subject development. They also spoke with their peers, asking doubts which were solved by other students. Almost all of them

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submitted their tasks on time and the teacher was not overwhelmed with the same questions several times. Thus, we consider this tool as very useful from the students perspective, but also for the teacher.

Summary

As shown with the different pilots, students were not interested in using another tool for something they were already doing using the LMS provided by the University of Granada (PRADO) or some of their teachers (SWAD). Moreover, informal communication between students (not including their teachers) was already taking place using Whatsapp or Telegram (this last one, very popular among students in ICT fields). **Case #1** was the only one in Pilot 4 that used Differ, since the findings in Pilot 3 and in this same case already showed that students were not willing to use tools they were not already familiar with.

Taking this into account, the other cases were addressed using Telegram, and setting up specific chatbots for different tasks. The students‘ familiarity with the application and the fact that they were already using it for the same purpose made them shift to the “official” chat group with their teacher to ask questions and share solutions with the other students. Engagement was around 100% in this chat group, and almost all the students participated at least once asking questions, responding, sharing their thoughts or participating in the different polls during the course. Also, an important finding was that students were willing to help others by explaining their own solutions which favoured the best learning process of all.

4.3. University of Leeds

In Pilot 4 in University of Leeds participated in three courses/cases of University pre-sessional participants because the initial plan of piloting in summer school was cancelled due to COVID-19 pandemic. Differ communities were created among following users: (1) around 600 applicants to the Lifelong Learning Centre for mature students; (2) around 700 applicants for the Plus Programme, for students from disadvantaged or “less represented” backgrounds; and (3) around 500 applicants for Computing BSc, MSc, PhD programmes due to start end September 2021. Only one case description was provided by the partner institution and available information.

Case #1

- **Course name**: Plus Programme
- **Number of students**: approximately 700 applicants were offered Differ

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- **Course description**: Not a taught course, but a support programme for Leeds University applicants from disadvantaged or "less represented" backgrounds, to encourage them to take up their offer of study at Leeds University.
- **Description of students' engagement with Differ**: Applicants were offered use of Differ as a platform to communicate with each other and with Plus Programme administrative staff.
- **Affordances and challenges**: This was not an ideal cohort for several reasons: (1) unlike Leeds University registered students and the Summer School students, we had no control over applicants prior to registration and arrival at Leeds, so we could only suggest they try Differ; (2) applicants likely already used widely-used general chat platforms (Facebook messenger, Whatsapp etc) and Differ would not be novel to them; (3) these are not "educator-led" classes, as the Plus Programme is not staffed by academic educators but by clerical staff; (4) on arrival at Leeds, all new students would be required to take up the standard Leeds IT systems so any take-up of Differ would be temporary.

Overall opinion of educators participating in Pilot 4

The administrators who oversee student recruitment of these 3 cohorts thought Differ might offer an additional incentive or attraction to follow through their offer of study. The Plus Programme administrators were sufficiently impressed by Differ to commit to its continued use in applicant support, beyond the end of the EDUBOTS project.

4.4. University of Zagreb, Faculty of Organization and Informatics (FOI)

In the Pilot 4 new functionalities of Chatbot Bo and languages were introduced, but only four courses and five teachers were involved in total. Since all of the teachers had previous experience with Differ, there was no need for additional training. Main motivation of teachers to continue to use Differ was in recognizing it as a useful solution, especially for large groups of students (e.g. first year of study, when students do not know each other). As for the differences between Pilots 3 and 4, they primarily relate to the additional functionalities of the chatbot, as well as the availability of initial conversations in the Croatian language. Due to the uncertain situation around COVID-19, the interest of teachers was not great for inclusion in Pilot 4 despite all the efforts of the project team.

Case #1

- **Course name**: Business Communication
- **Number of students**: over 100

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- **Course description**: The course is held in the 1st year of bachelor's studies. Teaching activities were fully online except the first and the third week when seminars were held face to face. Goal of the Business Communication course is to teach and prepare students for various forms of business interactions like presentations, negotiation, sales, written communication, and writing CV-s. Students were mostly 18-19 years old full time students.
- **Description of students' engagement with Differ and/or Hubert**: Students were invited to the communities in Differ in 3rd week of winter semester. For each seminar group a community was created and students were initially invited during the face to face classes, and later reminded via Moodle system. In total 7 communities were created. Role of educators was to initiate the weekly communication relevant for the upcoming activities. Hubert was used at the end of the semester, after almost all course activities ended. Students were invited to evaluate the course activities of the teachers.
- **Affordances and challenges**: The course had over 300 enrolled students, but their interest for Differ was not great. Since students were first year students, we assume they were overwhelmed with all academic activities and coping in a new environment which was pretty demanding. In the case of Hubert, students participated in survey/ course evaluation, but there was not much interest. One of the reasons are parallel online surveys about the quality of online lectures that were conducted by the Faculty for all courses in the winter semester.

Case #2

- **Course name**: General Pedagogy
- **Number of students**: *less than 50*
- **Course description**: The course is mandatory for students enrolling in the "Teacher in Informatics" program on the graduate level, and elective for other courses. The course is introductory course to the topics of education, primarily for students who want to become teachers of Informatics in primary and secondary level schools. The course consists of lectures which focus on schools as education institutions, teaching, teachers and students, especially from a standpoint of contemporary pedagogy. Further topics focus on school settings, students' perspective, educational systems and other related topics. Seminars follow the lectures with additional insight in the topics which are of interest to the students.
- **Description of students' engagement with Differ**: Differ was introduced in the course as a part during the lectures. Students were additionally invited via LMS Moodle official forum for communication on the course. They got short guidelines on how to join the community and use the app. Course teacher created five topics in Differ: Buffy Up! (for introduction), Hey what's up? (for chatting), Q&A Exams, Q&A Homework and Q&A Other. Students did not participate actively in the topics, nor did they use any of the Q&A sections. Some students used private messaging to directly ask the teacher or another student a question, and just a few of them posted a message or a reply in the topics.
- **Affordances and challenges**: Main challenges were that students have official LMS Moodle with most of the functionalities and they aren't eager to use additional tools. Secondly, the group is rather small and most of the students know each other beforehand,

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so there's no need for introduction. Most of the questions are answered during the face-to-face classes. Because of the COVID and the large number of different apps which were promoted by different teachers, students were tired of using ICT. Some students pointed out that they prefer other apps, such as Discord.

Case #3

- **Course name**: Intelligent systems
- **Number of students**: *over 100*
- **Course description**: The course is elective in the winter semester of the 2nd year of the Master's Degree at the university graduate study Information Systems. The goal of the course is that students: create a theoretical knowledge of intelligent systems technology and their most important techniques, which should enable the competence of students in solving specific complex problems of practical application, but also research. In addition, emphasis is placed on acquiring competence for the practical application of theoretical knowledge to solve complex problems. Through the exercises, the most effective methods of application are introduced and practised, and the theory from the lectures is deepened. This is achieved by applying the highest quality software tools in the field of intelligent systems, using illustrative examples from practice and applying complex techniques and methods, which are well described theoretically in lectures and present in software tools. Teaching activities consist of the lectures and practical laboratory exercises. Students were mostly full-time, interested in the course topics since the course is elective.
- **Description of students' engagement with Differ**: Differ was introduced in the course as a part of a computer exercise. Students got the guidelines uploaded on the learning management system on how to join the community and use the app. An educator created in Differ topics for discussions with the students. Differ was used to further explain course announcements in LMS if needed. Students were actively participating in the discussions, mostly to get the answer to some exercise related problem or administrative questions. Most of the students used private messaging to directly ask the educator without other students seeing the message.
- **Affordances and challenges**: Motivate students to use Differ since they already used many other applications.

Case #4

- **Course name**: E-learning Systems
- **Number of students**: less than 50
- **Course description**: At the graduate study programme in Informatics the course is obligatory at one study programme (Informatics in Education), while elective at the other three study programmes. The purpose of this course is to get acquainted with the principles and specifics of e-learning, technologies and processes on which it is based

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and the various possibilities of application, in order to get competence for application and management of such systems in education and business. Objective of the laboratory exercises: introduction to various practical solutions, tools for development of e-learning content, and integration and management of e-learning content in the learning management system. The students are mostly full-time students, mid-twenties. Majority of the students choose to enrol in the elective course because they were interested in the topics of the course.

- **Description of students' engagement with Differ**: Differ as a chat tool was used less frequently than in the previous year (Pilot 2). When the students first encountered Differ, they needed to introduce themselves in the Open chat channel (basic information, hobbies etc.). A teacher created in Differ various topics for discussions with the students: Announcements, Open chat, Exercises, Project, Exam. Students did not post much messages in topics opened in the community, but only when a teacher asked them something. There were several messages related to activities deadlines and about the project. Some of the students contacted the teacher in a private message channel. However, despite less engagement in Differ than in the previous year, student results and activities were the same or slightly better in this semester than in the previous year.
- **Description of students' engagement with Hubert**: Hubert was used only once in the semester as a part of the laboratory exercise topic Evaluation in e-learning. Since the exercise was obligatory, all the students conducted two evaluations: Students' self-reflection - Middle of Semester, and Informal course evaluation - During the Semester. After the evaluation, they needed to fill-in the survey about Hubert usability.
- **Affordances and challenges**: Students are overloaded with various applications in still pandemic situations in which part of the teaching in this semester was online and teaching in smaller groups was onsite. They used their usual communication tools (FB Messenger, Discord etc.) to communicate with each other, not Differ. Even the engagement of a teacher (although less frequent then in the previous pilots) did not engage them to post questions in Differ topics, rather they sent it to the teacher's email address. However, 2-3 students frequently asked questions using private messages in Differ.

Summary

What all subjects in Pilot 4 have in common is the perseverance of teachers in using chatbot solutions on subjects. Positive experiences of teachers play a big role, primarily due to faster and easier communication with students. On the other hand, the experiences of subject teachers after the semester include students' scepticism about trying new solutions and how they stay with existing communication channels such as Messenger or Discord. It was also difficult to motivate students to participate in giving feedback for the course with the help of Hubert because there were a lot of parallel surveys at the university or the faculty level about the quality of teaching. However, in one course Hubert was also used for students' self-reflection, with the use of a new template of questions that was constructed.

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Conclusion

Altogether, during four pilots which were conducted from January 2020 till December 2021, chat applications Differ and Telegram and chatbots Hubert and BO within Differ were implemented into 67 higher education courses at the universities from Croatia, Cyprus, Granada and UK. This document presented affordances and challenges in using aforementioned tools in teaching practices during COVID-19 era.

Educators' main motivation to use chat tools and chatbots was to stimulate communication among the students and students with educators, and to further engage students into the learning process. While at the first Pilot, there was enthusiasm present among educators to try new technical solutions with the students, unfortunately breakout of the COVID-19 pandemic didn' help much with implementation of the new chat platforms. While some of the educators perceived an emergency switch from onsite to online teaching as an opportunity to bond with the students in an online environment using chat applications, other educators noticed saturation with the usage of online tools from the students' part. Differ as a chat platform was just another tool introduced into online teaching that didn't offer significant advantages in comparison to the chat tools students already used for their private communication.

On the other hand, Hubert as a tool for self-reflection and course evaluations required less effort and time commitment from the student to use it. One of the main benefits of using Hubert was the interactivity and fun way of collecting information for course evaluation from the students. One of the main challenges that was experienced by educators was the quality of the thematic analysis that Hubert performs based on students' actual responses.

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