Proceedings Paper:
Merelo, J.J., Castillo, P.A., Mora, A.M. et al. (4 more authors) (2022) Exploring the Role of Chatbots and Messaging Applications in Higher Education: A Teacher's Perspective. In: Zaphiris, P and Ioannou, A, (eds.) Learning and Collaboration Technologies. Novel Technological Environments. Technologies. Novel Technological Environments Book Subtitle 9th International Conference, LCT 2022, Held as Part of the 24th HCI International Conference, HCII 2022, 26 Jun - 01 Jul 2022, Online. Lecture Notes in Computer Science, 13329 . Springer , pp. 205-223. ISBN 978-3-031-05674-1

https://doi.org/10.1007/978-3-031-05675-8_16

Exploring the Role of Chatbots and Messaging Applications in Higher Education: A Teacher's Perspective

Juan J. Merelo[1] [0000-0002-1385-9741], Pedro A. Castillo [1] [0000-0002-5258-0620], Antonio M. Mora[2][0000-0003-1603-9105], Francisco Barranco[1], Noorhan Abbas[3] [0000-0002-1434-6497], Alberto Guillén[1] [0000-0001-9918-3238] and Olia Tsivitanidou [4][0000-0002-9985-0333]

[1] Department of Computer Architecture and Technology, University of Granada, Granada, Spain

[2] Department of Signal Theory, Telematics and Communications, University of Granada, Granada, Spain.

[3] School of Computing, University of Leeds, Leeds, UK

[4]CYENS Centre of Excellence, Nicosia, Cyprus

Correspondence: jmerelo@ugr.es

Abstract. The use of new technologies such as messaging applications and chatbots in higher education is rapidly growing in Western countries. This entails a careful consideration of the potential opportunities and/or challenges of adopting these tools. Hence, a comprehensive examination of the teachers' opinions and needs in this discipline can shed light on the effective ways of enhancing students' learning and boosting their progress. In this contribution, we have surveyed the opinions of instructors based in Spain (mainly) and Spanish-speaking countries. Specifically, we aimed to collect teachers' feedback about their opinions regarding the introduction of the messaging platforms and chatbots in their classes, understand their needs and to collect information about the various educational use cases where these tools are valuable. In addition, an analysis of how and when teachers' opinions towards the use of these tools can vary across gender, experience, and their discipline of specialization is presented. The key findings of this study highlight the factors that can contribute to the advancement of the adoption of messaging platforms and Chabots in higher education institutions to achieve the desired learning outcomes.

Keywords: Educational Chatbots; Messaging platforms; Higher education

1 Introduction

The introduction of new technologies in the classroom, to be successful, involves extra teacher training, devising methods for enhancing student engagement with the new technology, and indeed acquiring new skills by students and teachers alike. Some technologies are readily adopted, but others require longer time for full adoption. In most cases, the magnitude of the uptake of the new technology impinges on the collaboration of all the parties using it. Hence, examining the users' opinions is an important first step in boosting this collaboration and reaping the benefits of the technology. Recently, a surge in the use of synchronous instant messaging tools in higher education such as WhatsApp, Telegram and Facebook Messenger took place. Some messaging applications have built-in chatbots to support a synchronous conversation between the

different parties [25], while other chatbots are developed as standalone systems and can possibly be attached to a messaging application using an API (Application Program Interface).

A chatbot is a program, sometimes developed using Artificial Intelligence techniques, able to communicate in a similar way as humans do [11], using, in some cases, natural language. Indeed, most of these applications would be, apparently, close to passing a classic Turing test [15], since they are able to answer almost any question fluently, and even pose own questions in their conversations. The recent advancement in this discipline has played an important role in many fields especially in education and online tutoring [24]. These automatic systems facilitate the delivery of personalized learning by adapting to students' pace of learning and providing customized online tutoring outside the classroom. Thus, chatbots can significantly contribute to providing interactive learning experiences as well as improving individual attention [3]. In this sense, chatbot technology offers a great opportunity for the improvement of tutoring systems [3], as not all students are comfortable with face-to-face tutoring with the instructor. In many cases, some students experience stress because of their need to ask a question in front of the entire class and resort to contacting their teachers later via email. Consequently, this can lead to not only a delay in obtaining answers to their questions but can also cause a significant increase in their teachers' workload, especially when factoring in the disproportion between the class size and the number of teachers. Hence, the chatbot technology has a potential to mitigate this problem by providing answers to students' questions and facilitating a dynamic and autonomous learning experience [12, 13]. In addition, using an automated system such as a chatbot, can draw teachers' attention to topics that students struggle to comprehend or need further assistance in understanding.

The majority of studies conducted so far have studied how these messaging applications and/or chatbots are used to deliver personalized learning in classrooms that occurs anytime anywhere, promote collaborative learning experiences, group discussions [19] and boost students' sense of belonging to their institutions [2]. Hence, due to the paucity of research that explores the use of these technologies from the teachers' perspectives, this paper aims to investigate their opinions/needs and the challenges/opportunities of adopting these technologies in classrooms to paint a better picture of how they can positively contribute to enhancing the learning process in higher education institutions.

In this study, we use the key findings of the first phase of this study reported in [16] about students' opinions and preferences of using messaging applications for educational purposes in collecting and comparing teachers' opinions about this matter. In this paper, we aim to answer the following research questions:

RQ1 - Are teachers already using messaging apps in their classes?
RQ2 - Which chatbots' features would teachers find useful in their classes?
RQ3 - Which kind of interaction do teachers prefer with their students?
RQ4 - What kind of interaction media features do teachers value the most?

By answering these questions, we aim to aim to explore best practices and innovative use of chatbots in higher education. The remainder of the paper is organized as follows:

first, an overview of the current research in this field is presented. The methodology used in designing and conducting the surveys is explained in Section 3, and the results of the surveys are shown in Section 4. Finally, we discuss these results and conclude with a series of recommendations.

2 Background

The widespread and rapid adoption of free Mobile Instant Messaging (MIM) tools/platforms such as WhatsApp, Telegram, WeChat and Facebook Messenger stems from their simplicity, ease of use and multi-modality (i.e. video, audio, text) [26]. Using these tools in higher education can facilitate the delivery of personalized learning that occurs anytime anywhere, promote collaborative learning experiences and group discussions [19]. WhatsApp is, at least in most Western countries, the most popular MIM platform used by educators to provide assignments' feedback to students, support course discussions, and provide learning resources in informal learning set-tings [19]. Moreover, the use of WhatsApp in higher education could enhance social presence [26] and foster trust relationships between educators and students embedded in the social learning process [10]; however, this last paper also reflects the need for learners to "take ownership of the tool" and the advantages of social learning in general. At the same time, it also mentions different challenges, among which the most important is the blurring of social and academic life; indeed, there are challenges when using MIM tools that occur due to the blurring of boundaries be-tween academic and private life. This can lead to technostress [10], difficulty in managing responsibilities, especially among mature students, and lack of privacy [26]. Students' dropout of the MIM groups, as they can leave groups at any time, can hinder their learning and undermine educators' efforts [17]. In addition, there is a need to set rules and norms for these MIM groups in order to maintain the safety of these online communities for students [2]. However, these rules should not affect students' ownership and control, since it is vital to advance in their learning [10] process. This is why examining the role of MIM in higher education is still a challenge, and why the opinions of the teaching community towards them have to be examined, as we do in this paper.

The use of MIM, although possibly valuable by itself, can be enhanced via the use of chatbots, which, being conversational agents, usually dwell in systems where synchronous conversations take place. The use of conversational agents (chatbots) in higher education is still at its infancy [28]. Nevertheless, recent studies examining their positive impact on students' academic performance [20] and engagement [25, 2] have led to a growing interest in using this technology in the (possibly virtual) classroom. Indeed, the use of chatbots in collecting course feedback from students in higher education improved students' response quality and boosted their enjoyment levels [1]. According to [22], using either tools such as mobile devices or teaching strategies based on gamification [29] can improve student motivation. In this sense, the authors in [21] adopted a quasi-experimental, survey-based approach to report the positive impact of using instant messaging tools in boosting students' knowledge and mitigating their feelings of isolation.

Several higher education chatbots' evaluation studies have been undertaken. For instance, a recent evaluation review study presented by Smutny and Schreiberova [24] examined 47 educational chatbots implemented in Facebook Messenger with the focus to identify characteristics and quality metrics such as language, subject matter and platform, whereas the study under- taken by P´erez and collaborators [20] aimed to categorize educational chatbots, according to their, purpose into service-oriented and teaching- oriented. The first category includes those that provide service support such as the chatbot Ask Holly [8] and Dina [23]; both chatbots respond to students' questions about enrolment and registration. Ask L. U. [14] answers students' frequently asked questions about timetables, grades, tutors and societies. LISA [7] and Differ [25] facilitate breaking the ice between new students by introducing them to each other.

On the other hand, teaching-oriented chatbots are more sophisticated, as they set personalized learning outcomes and monitor learning progress. For instance, [9] reported on "eduAssistant", a virtual teaching assistant chat- bot developed on the Telegram messaging platform. In this study, the Tele-gram platform is chosen because it is easy to use, students are familiar with its features, and it enables them to exchange messages in different formats (text, audio and video) [9]. In addition, Telegram could operate on all devices and operating systems. The "eduAssistant" chatbot acts as an automatic agent in teacher-content-student, facilitating real-time feedback loops and providing a personalized learning experience relevant to the students' acquired skills and knowledge. Using this chatbot, educators can create interactive instances in their lectures where they pose questions to their students and the chatbot assists those who need further help by giving them more hints and reporting it to their educator's dashboard [9]. This can help educators locate those students that need more attention and send them more educational resources relevant to their academic attainment. In addition, a recent study has analyzed how the use of chatbots positively affected the learning outcomes of students in a Chinese class [6].

3 Methodology

This study followed a quantitative approach towards addressing its research objective, by collecting rich data about the use of messaging applications and chatbots by educators in both universities and colleges through the use of two online surveys. Both surveys were piloted by the authors of the paper and their colleagues before using it in the study. All the comments collected from this trial were incorporated in the surveys.

For addressing research questions 1 -3, an online survey was administered (i.e., Google Form), in Spanish, comprised by six questions focusing on demo-graphic data (i.e., sector, gender, degrees, discipline, age, teaching experience), followed by four multiple choice questions allowing the participants to choose multiple answers in each of those. The multiple-choice questions focused on the use of messaging apps in the teaching practice, the type of chatbot use cases that teachers consider useful to be used in their teaching, and the type of interactions that teachers prefer to have with their students while using messaging apps in their teaching, and the impact of COVID on the teaching practice. This survey was administered to both university and tertiary non-

university teachers (i.e., teaching in the vocational sector). The responders were reached out through the use of mailing lists and Telegram groups. The survey was shared among university teachers that teach in Spanish (mainly Andalucía and Galicia) universities, and also Costa Rica and Mexico, and tertiary non-university teachers who are based mainly in Andalucía. Data collection with the use of the survey took place in the first quarter of 2021, post-pandemic and while, at least in Spain, many universities had mandatory virtual teaching. Responses were stored automatically in a Google Drive spreadsheet.

For addressing the 4th research question, a second online survey was administered (i.e., Google Form), in Spanish, comprised by four questions focusing on demographic data (i.e., gender, age, degrees, teaching experience), followed by two multiple choice questions with single answers and one multiple choice question allowing the participants to choose multiple answers. The items of this survey focused on the kind of interaction media features that the teachers value the most. The survey was administered to university teachers teaching at the University of Granada, but also student teachers who attended a teacher formation course (on the use of new technologies in higher education). The responders were reached out using mailing lists, while an invitation to participate in the survey was also promoted in the newsletter of the vice deanship for International Relations of the University of Granada. Responses were stored automatically in a Google Drive spreadsheet.

4 Results and analysis

Our findings per Research Question (RQ) are given in the sections that follow. For addressing RQs 1-3 data from the first survey was used. A total of 282 teachers responded to this first survey, from which 193 teachers mentioned that they teach at the University (68.4%) and 89 at other tertiary education institutions (31.6%). In relation to their gender, 179 teachers were male (63.5%), 98 females (34.8%) and 5 teachers preferred not to indicate their gender (1.8%). In terms of age, most of the participants (n=111) in this survey were 45-55 years old (39.4%), while 91 teachers were 35-45 (32.3%), 46 were 25-35 (16.3%) and 34 teachers were older than 55 (12.1%). Last, 84 teachers had a teaching experience of 16-25 years (29.8%), 75 teachers 6-15 years of experience (26.6%), 69 teachers had 0-5 years of experience (24.5%) and finally, 54 teachers had more than 25 years of teaching experience (19.1%).

4.1 RQ1 - Are teachers already using messaging apps in their classes?

Teachers were queried about whether they use messaging apps in their classes, specifically, Telegram, WhatsApp, Slack (an application used mainly in IT departments and software development), or any other messaging app, and whether they use messaging apps provided by their academic institution (see Table 1). Overall, the majority of the teachers responded that they do use messaging apps in their classrooms, from which apps provided by the academic institution (n=159, 56%) and WhatsApp (n=124,

44.0%) were the most common responses. Only 19 teachers (6.7%) replied that they do not use any messaging app in their class.

Table 1. Use of messaging apps to assist the learning process

Messaging App	Yes		No	
	Frequency	%	Frequency	%
Telegram	62	22.0	220	78.0
WhatsApp	124	44.0	158	56.0
Slack	15	5.3	267	94.7
Other	60	21.3	222	78.7
Provided by the Academic Institution	159	56.4	123	43.6
None	19	6.7	263	93.3

With respect to specific disciplines, Engineering and Technology teachers are more active in their use, but the number of teachers from Humanities who answered they used these apps in their classes is also remarkable (around 60% use the apps provided by their institutions). Although no significant differences were found regarding gender, female teachers answered they use instant messaging apps more than male teachers (about 10% more). Also, teachers in vocational Education use WhatsApp more than university teachers. Regarding the distribution of the use of messaging apps per age, there are no significant differences for WhatsApp and apps provided by their own academic institutions. However, younger teachers also use Telegram with more than 25% responding they do, a percentage that falls to about 10% for teachers that are 55 or older. One interesting result is that about 65% of teachers with more than 25 years of experience use the platforms provided by their institutions while the percentage goes down to less than 50% for teachers with 6-15 years of experience.

Some of the questions in the survey were focused on the impact of the COVID19 pandemic between the 2020 and 2021 academic years in the teachers' attitudes towards the use of instant messaging apps in their class. Our main intention in this case was to assess whether a crisis will bring about some kind of change in the use of tools. Teachers' responses are summarized in Figures 1-4 below, showing that about 77% of teachers already used these tools before the pandemic and kept using them during the pandemic lockdowns that forced students and educators to use remote education schemes. Moreover, approximately 15% of them switched their messaging app for one that offered a safer interaction with their students. According to the responses, an additional 16% started using messaging apps during the pandemic for the first time in their classes.

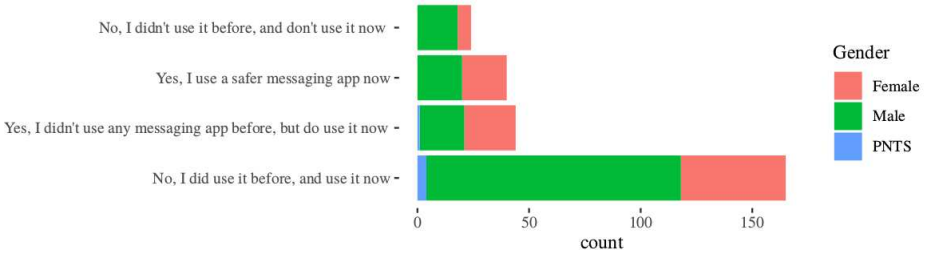

Fig. 1. Total count of responses for the use of messaging apps after the COVID-19 pan-demic grouped by gender (PNTS stands for Prefer Not To Say).

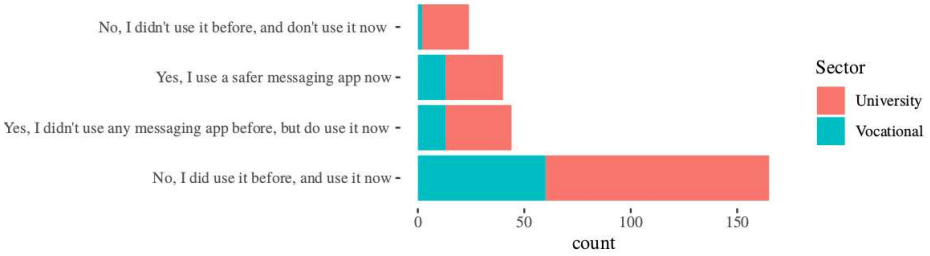

Fig. 2. Total count of responses for the use of messaging apps after the COVID-19 pan-demic grouped by sector (PNTS stands for Prefer Not To Say).

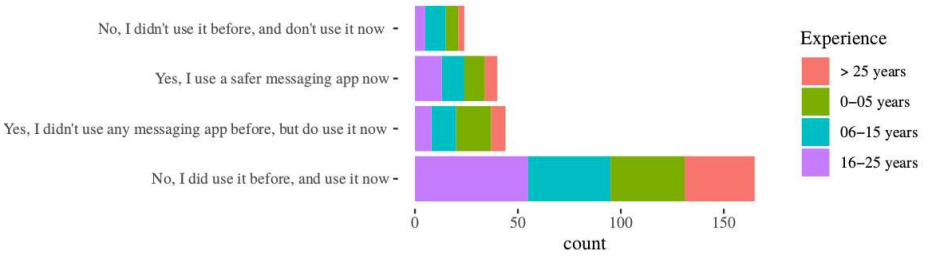

Fig. 3. Total count of responses for the use of messaging apps after the COVID-19 pan-demic grouped by years of experience (PNTS stands for Prefer Not To Say).

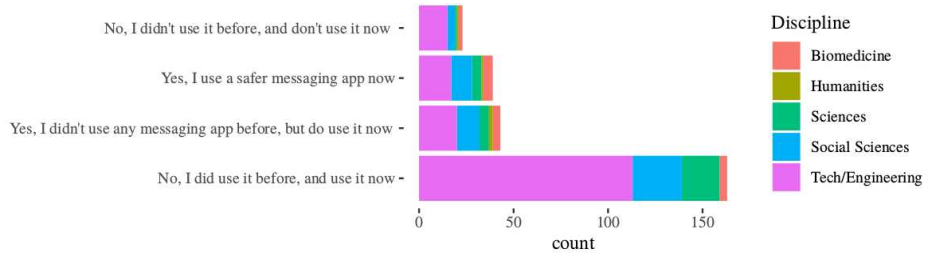

Fig. 4. Total count of responses for the use of messaging apps after the COVID-19 pan-demic grouped by discipline.

A chi-square test of independence was performed to examine the relation between instructors' discipline, sector, and gender and any potential changes that occurred to the use of messaging apps due to the covid-19 pandemic. The relation between the latter variable and the instructors' sector was significant, $X^2_{(4, N = 282)} = 9.598$, p =0.048. The frequencies cross tabulated are given in Table 2, Pearson's residuals for the Chi-square test are given in Figure 5. In effect, this finding indicates that how teachers responded to the use of messaging apps during the pandemic and in particular, whether they changed their habits in the use of apps for teaching purposes, was related to their sector (university vs vocational). The majority of the teachers (n=165) mentioned that no changes in their habits occurred due to the emergency remote teaching, as the use of messaging apps was part of their teaching practices and remains the same, from which 105 teachers come from the university, and 60 teachers from the vocational sector.

Table 2. Sector * post-covid changes cross tabulation

		Sector		Total
		University (f)	Voca-tional (f)	
Post-covid changes	Yes, I use a safer messaging app now	27	13	40
	Yes, I didn't use any messaging app before, but do use it now	31	13	44
	No, I did use it before and use it now	105	60	165
	No, I didn't use it before and don't use it now	22	2	24
	Other	8	1	9
Total		193	89	282

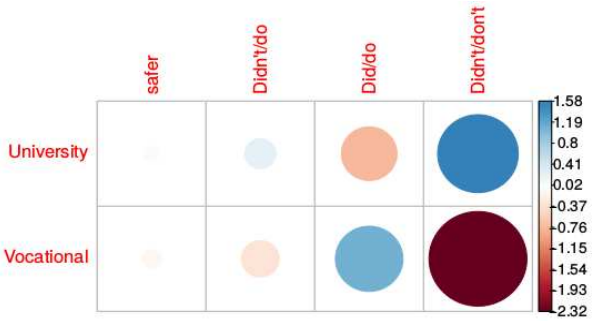

Fig. 5. Analysis for sector and post-covid changes

The relationships between changes in the use of messaging apps, due to the covid-19 pandemic, and the instructors' discipline, $X^2_{(24, N = 282)} = 44.856$, p =0.006, as well as the gender, $X^2_{(8, N = 282)} = 16.249$, p= 0.039 were also significant. This finding indicates that how teachers responded to the use of messaging apps during the pandemic

was also related to their gender and discipline. In fact, from the majority of the teachers who did not change their habits in this respect (n=165), most of them are males (n=114) and come from the technology (n=60) and engineering (n=53) disciplines (see Tables 3, 4).

Table 3. Gender * post-covid changes cross tabulation

		Gender			Total
		Male	Female	Prefer not to say	
Post-covid changes	Yes, I use a safer messaging app now	20	20	0	40
	Yes, I didn't use any messaging app before, but do use it now	20	23	1	44
	No, I did use it before and use it now	114	47	4	165
	No, I didn't use it before and don't use it now	18	6	0	24
	Other	7	2	0	9
Total		179	98	5	282

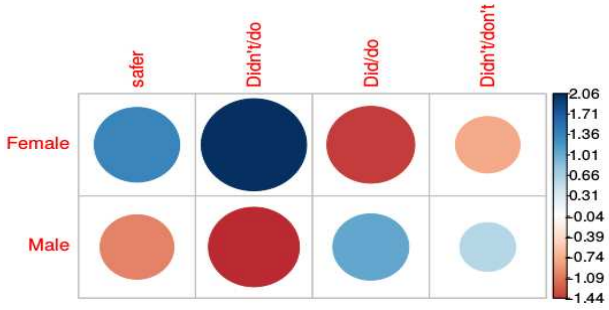

Fig. 6. Analysis for gender and post-covid changes

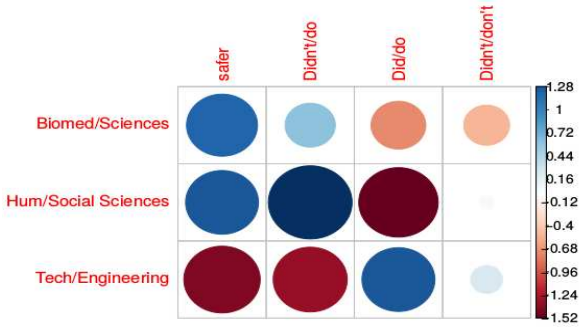

Fig. 7. Analysis for discipline and post-covid changes

Table 4. Discipline * post-covid changes cross tabulation

		Discipline							Total
		Engineering	Social Sciences	Sciences	Biomedicine	Humanities	Technology	Other	
Post-covid changes	Yes, I use a safer messaging app now	7	11	5	5	1	10	1	40
	Yes, I didn't use any messaging app before, but do use it now	13	12	5	4	2	7	1	44
	No, I did use it before and use it now	60	26	20	4	0	53	2	165
	No, I didn't use it before and don't use it now	14	4	1	2	1	1	1	24
	Other	5	0	1	1	1	1	0	9
Total		99	53	32	16	5	72	5	282

4.2 RQ2 - What kind of chatbots would teachers find useful in their classes?

For answering RQ2, teachers were provided with a list of different potential chatbot functionalities (use cases) and were requested to respond on whether each given use case would be useful in their classes. The findings are summarized in Table 5.

Table 5. Perceived useful chatbot use cases

Chatbot use cases	**Yes**		**No**	
	Frequency	**%**	**Frequency**	**%**
Answering to students' FAQs	148	52.5	134	47.5
Assigning student grades	113	40.1	169	59.9
Facilitating agenda formation	171	60.6	111	39.4
Sharing class material	136	48.2	146	51.8
Other use case	25	8.9	257	91.1

From the findings it occurs that the most favorable use case for chatbots in Higher Education and vocational training is their use for the facilitation of an agenda formation (171 positive response, 60.6%), followed by the FAQs use case (148 positive responses, 52.5%) and the sharing class material use case (136; 48.2%). Answers to these questions are plotted in Figures 8, 9, 10, 11, grouped by gender, sector, years of experience in education, and discipline respectively.

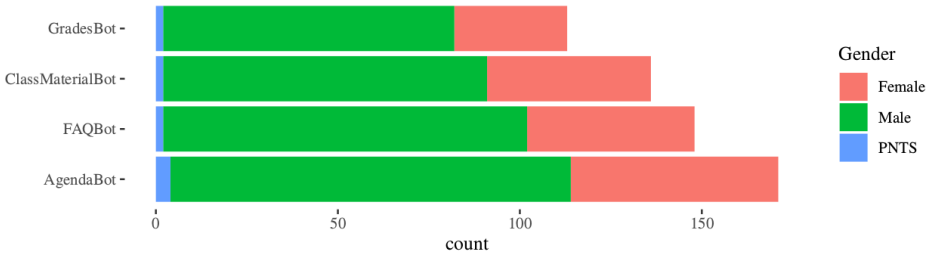

Fig. 8. Count of types of chatbots for class perceived as the most useful for teachers grouped by gender (PNTS stands for Prefer Not To Say).

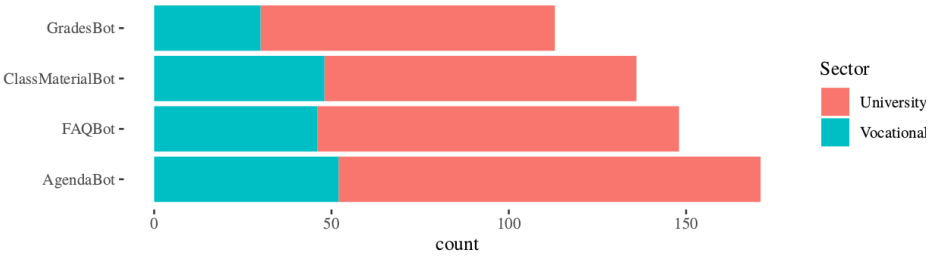

Fig. 9. Count of types of chatbots for class perceived as the most useful for teachers grouped by sector.

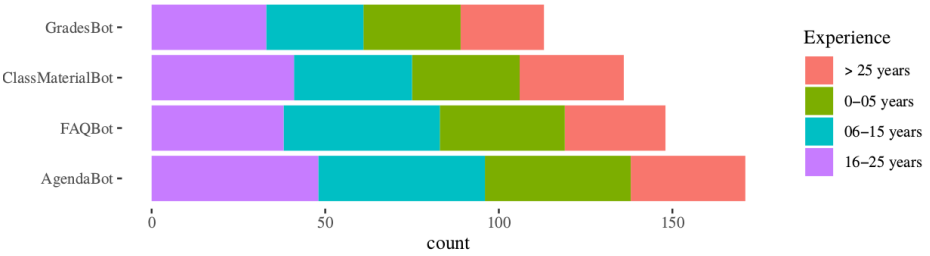

Fig. 10. Count of types of chatbots for class perceived as the most useful for teachers grouped by years of teaching experience.

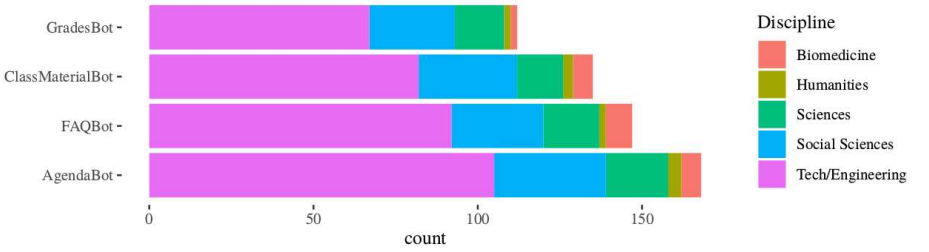

Fig. 11. Count of types of chatbots for class perceived as the most useful for teachers grouped by discipline.

A chi-square test of independence was performed to examine the relation among participants' preferences for specific chatbot use cases. The relation between agenda and the FAQs use case was significant, $X2_{(1, N = 282)} = 10.467$, $p = 0.001$. The frequencies cross tabulated are given in Table 4. Out of the 171 teachers who consider useful the use of chatbots for agenda preparation in the class, 103 also consider useful chatbots' use for FAQs.

Table 6. Agenda use case * FAQs use case cross tabulation

		FAQs		Total
		Yes	**No**	
Agenda	**Yes**	103	68	171
	No	45	66	111
Total		148	134	282

4.3 RQ3 - What kind interactions do teachers prefer with their students?

Since chatbots are intended to mediate or help in this interaction, it is essential to understand the kind of interaction teachers prefer. In order to find out these modes, and thus answering RQ3, teachers were provided with a list of different kind of interactions that may take place among students and between students and the teacher, with the use of messaging apps. The findings are summarized in Table 7. Distribution of teachers' preferences for the chat groups with their students per gender are illustrated in Figure 12.

Table 7. Type of interactions preferred

Kind of interactions	**Yes**		**No**	
	Frequency	**%**	**Frequency**	**%**
Chat interactions among students in the same course	171	60.6	110	39.0
Chat interactions among students, teachers, and the faculty	13	4.6	269	95.4
Chat interactions among students of the same study year and teachers	51	18.1	231	81.9
Teacher not being part of the interaction	113	40.1	169	59.9

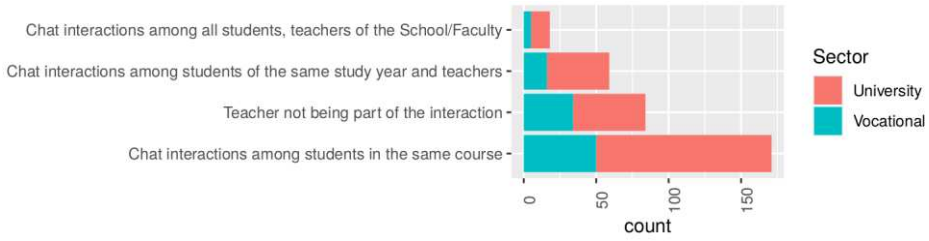

Fig. 12. Distribution of teachers' preferences for the chat groups with their students: from groups only with their students from a specific course to groups with greater social interaction with all students in their School or Faculty.

Regarding the social factor of chat groups that teachers use in class, it appears that the vast majority prefer small groups only with the students from the same course. Thus, teachers do not want to participate in a chat group with students; either they want to simply leave the students alone in their own chat group, or otherwise they prefer not to be part of that interaction. Chat interactions among students, teachers, and the faculty were less preferred by the teachers.

4.4 RQ4 - What kind of interaction media features do teachers value the most?

For addressing RQ 4, data from the second survey was used. A total of 205 teachers responded to this survey, from which 187 were graduate teachers (91.2%) and 18 student teachers (8.8%). From those, 124 were (60.5%), 65 female (31.7%) and 16 teachers preferred not to indicate their gender (7.8%). In terms of age, the majority of the participants (n=70) was again, as in the first survey, 45-55 years old (34.1%), while 67 teachers were 35-45 (32.7%), 42 were 25-35 (20.5%) and 26 teachers were older than 55 (12.7%). In terms of teaching experience, 59 teachers had a teaching experience of 16-25 years (28.8%), 51 teachers had 6-15 years (24.9\%) and 0-5 years of experience (24.9%), and 44 teachers more than 25 years of teaching experience (21.5%). The teachers were asked about what kind of interaction media features they value the most; the frequencies and percentages of their responses are given in Table 8.

Table 8. Interaction media features valued by teachers

Interaction features	**Yes**		**No**	
	Frequency	**%**	**Frequency**	**%**
Analytics	108	52.7	97	47.3
Connectivity	119	58.0	86	42.0
Familiarity	121	59.0	84	41.0
Hidden Phone	113	55.1	92	44.9
Horizontally	134	65.4	71	34.6
Official formation	42	20.5	163	79.5
Pluggability	65	31.7	140	68.3
Sustainability	157	76.6	48	23.4
Unidirectionality	27	13.2	178	86.8
Officiality	150	73.2	55	26.8
Synchronous communication	45	22.0	160	78.0
Other	5	2.4	200	97.6

Teachers' responses are distributed between positive and negative in relation to the media features: analytics, connectivity, and hidden phone, while for the features: familiarity, horizontally, sustainability and officiality the majority provided a positive response, designating their preference to these features. On the other hand, the majority

of teachers seems to consider not valuable the presence of official formation, pluggability, unidirectionality and synchrony in the interaction media features of messaging apps. In other words, the majority of the teachers seem to prefer to use messaging apps to which they are already familiar, and which have been granted by their academic institution, normally also accompanied with technical support by the university's staff and which do not require any actions on the behalf of the teachers for maintenance. In addition, the majority of the teachers value more the messaging apps in which there is no hierarchy in the communication level among the different users (i.e., teachers, students), and when the use of the app does not require or reveal their personal phone number. Last, most of the teachers value the most messaging apps that provide analytics in a form of a dashboard. A chi-square test of independence was performed to examine the potential relationship among the various features. The statistically significant correlations are given in the table that follows.

As indicated from the chi square results, the presence of the analytics feature in messaging apps, has been found to be positively correlated with the presence of features such as, connectivity, familiarity, official formation, pluggability and sustainability. That means, that teachers who prefer to use an app (or tool) that provides analytics about students' actions and/or performance, most probably also prefer this app to be able to be connected to other applications, offer different plugins to the teachers and be an app with which the teachers are already familiar, while receiving some training from the university about its use and do not have to worry about its maintenance. In addition, the hidden phone feature was found to be correlated with the features: official formation (i.e., the university offers some training courses or talks about the tool/app) and unidirectionality (i.e., only the teacher can publish information in the channel). This can be expected, as teachers might prefer not to reveal personal data, such as their personal phone number, when the tool is being introduced by the university and when the level of communication is one-way (i.e., from the teacher to the students). Furthermore, pluggability has been found to be correlated with official formation, implying that teachers who prefer pluggability as a feature in a messaging app/tool, they should also prefer to having this tool/app being properly and officially introduced by the university and offer some training about its usage.

Table 9. Chi-square analyses

	Connectivity	Familiarity	Horizontality	Official formation	Pluggability	Sustainability	Unidirectionality	Officiality
Analytics	12.172***	4.855**	Ns	4.144*	12.490***	4.314*	ns	ns
Connectivity	-	Ns	5.971***	ns	16.286***	ns	ns	ns
Hidden phone			Ns	5.678*	4.683*	ns	4.515*	ns

Horizontality	-	Ns	ns	ns	ns	ns	5.453*
Official formation			-	8.163**	ns	ns	ns

***p<0.001, **p<0.01, *p<0.05

5 Discussion

This study sheds the light on educators' growing usage of messaging applications in classrooms even before COVID19. Recent research [19] examining the use of messaging applications in higher education claimed that WhatsApp is widely used by educators. However, in this study, although 44% of educators reported using WhatsApp in their classrooms, more than half of the survey responses (nearly 56%) claim using technologies supported by their institutions. One possible explanation for this finding could be that educators wanted to ensure that their institutions can oversee their efforts in supporting their students during the learning process. Another reason could be attributed to institutions mandating the use of specific technologies that they support. Hence, this finding probes more queries about the actual reasons contributing to this shift in technology preference among educators and its implications on the students/educators' interaction and learning.

In addition, as recent research examining students' usage of messaging applications with their peers in higher education [2] argue that students prefer to use the non-institution messaging applications to form informal discussion groups with their peers, further research should aim to investigate this wide spectrum of usage of these applications and their impact on the learning process. The question examining the use of messaging applications during the pandemic (COVID19) reflects the big challenge of having to change habits during a major crisis.

The survey responses reveal some gender differences in this respect as 31% of female educators reported moving to using messaging applications to cope with the new virtual mode of learning during the pandemic compared to only 17% of male educators. Moreover, the survey responses to the question that lists the different functionalities that a chatbot can be used for indicating that nearly 60% of educators favored using chatbots in grading and 47.5% in answering students' FAQs.

The survey results, when grouping by experience, confirm the previous observation that experienced teachers are willing to accept new technological challenges, at least, similar to younger teachers. Younger educators are also willing to use chatbots for other uses. Therefore, as in many other methods of technology acceptance, answers to the survey suggest that the introduction of simple, and institution-supported, instant messaging and chatbot technologies would increase the perceived usefulness (which is one of the key metrics in technology acceptance models). Since most institutions already have some 'virtual campus' or learning management system, adding some easy automation, or connection to personal instant messaging tools, could really help on board the learning community on these new technologies.

As it appears in the responses presented above, teachers' responses are equally distributed between positive and negative in relation to the media features: analytics, connectivity, and hidden phone number; that is, none of them is a prevailing factor on choosing one technology over another. However, for the features: familiarity, horizontally, sustainability and officially the majority provided a positive response, designating their preference to these features. On the other hand, the majority of teachers seems to consider not valuable the presence of official formation, pluggability, unidirectionality and synchrony in the interaction media features of messaging apps.

Our survey results suggest that there is no precise timings to introduce chatbot technologies in classes. However, responses to questions related to change of behavior during and after the first stay at home stage of the pandemic does not suggest that major (or minor) crisis could be an opportunity to introduce new technologies, since it does not bring major changes in attitudes. A minor crisis would be, for instance, rollout of a new higher education law, or introduction of new degrees. Although external changes do offer the chance of piloting new technologies, they do not seem to bring changes in attitudes in the teaching staff (which, after all, is bound to be the same). In absence of a clear answer in this direction, the right moment to introduce new technologies is always when the IT and managing staff is ready to support it (since, as we have seen before "official" support is one of the factors that is most valued by teachers).

Survey questions related to the messaging applications being used by tertiary education teachers, opens a new line of inquiry about what they perceive as such, and about how it is used. Namely, the responses indicated that the teachers perceived as messaging application not only what is usually called a chat or instant messaging app such as WhatsApp or Microsoft Teams, but also the means provided by the university for communicating with the student, such as a feature of grading applications that will email the grade to the student. This implies that there is a need by teachers, communication with students, also mostly unidirectional, and that it does not matter so much how that need is covered. How- ever, this will need careful consideration, including how it ties with the automation of the learning experience that the chatbots bring. There are several future lines of work informed by our results of this survey. For instance, the rollout of extensive videoconferencing and virtual teaching solutions that the COVID pandemic has brought has also taught us a series of lessons. It increases isolation, for instance, and decreases the amount of synchronous contact that happens in the fringes of the classroom: teaching staff offices, before and after class. A future line of work would be focused on exactly this, and what kind of needs could be covered by chatbot technology. We will create a series of international surveys that will investigate this.

6 Conclusions

The key findings of this study shed the light on educators' preference to use messaging applications that their institutions support. Technology adoption literature often focuses on users' perceptions of the technology's usefulness and ease of use as important prerequisites for successful adoption and utilization. Nevertheless, in higher education, institutions' role in integrating these tools to their educational systems can improve the

uptake of these applications and shape the social and educational experiences of their students. To accomplish this fruitful integration, institutions must ensure that these messaging applications not only are GDPR (General Data Protection Regulation) compliant to keep students' data secure, but also should provide IT support to all stakeholders who use the applications.

Comparing these results with those obtained in student surveys in [16], we have understood better the differences between the teachers' points of view and/or intentions and that of their students when using the messaging applications in higher education. Teachers tend to adopt technologies supported by their institutions. The fact they do so could be caused by a desire to ensure that their universities can oversee their efforts in supporting their students during the learning process. Another reason could be their familiarity with the technology provided by their institutions. On the other hand, students use the non-institution messaging applications to form informal discussion groups with their peers. It is worth noting that peer support and collaboration is inseparable from learning [27] and correlates positively with higher retention in higher education [18]. Therefore, both perspectives are complementary and play different roles in promoting the learning process.

As in many other methodologies that try to assess technology acceptance, answers to the survey suggest that the introduction of simple, and institution-supported, instant messaging and chatbot technologies would increase the perceived usefulness (which is one of the key metrics in technology acceptance models). Since most institutions already have some virtual campus or learning management system, adding some easy automation, or connection to personal instant messaging tools, could really help onboard the learning community on these new technologies.

What we are going to propose next is a possible process of technology introduction that is compatible with the conclusions of this study, but that would have to be piloted in order to check its value, and its relationship with better learning outcomes, as well as higher teacher satisfaction. Once that initial introduction of institutional messaging automation tools is done, teachers (and students as well) will probably prefer the kind of bots that alleviate bureaucratic or repetitive tasks, such as answering frequent questions or answers on class or assignment deadlines, as indicated by their answers to the respective questions. These will help the introduction of more complex chatbots that will affect more directly learning outcomes, such as chatbots that help students integrate in the class or are able to identify (and address) learning problems in students or in groups of them. These should also be accompanied by analytics on student interaction, as well as possibly some natural language processing that will help assess the general mood of the class, and how different material (or external factors) affect it.

Acknowledgments

This work is part of the project EDUBOTS, which is funded under the scheme Erasmus + KA2: Cooperation for innovation and the exchange of good practices - Knowledge Alliances (grant agreement no: 612446).

References

1. Abbas, N., Pickard, T., Atwell, E., and Walker: A. University student surveys using chatbots: Artificial intelligence conversational agents. In HCI International Conference 2021, Learning and Collaboration Technologies- Chatbots in Education. Springer. 155-169 (2021a).
2. Abbas, N., Whitfield, J., Atwell, E., Bowman, H., Pickard, T., and Walker: A. Online chat and chatbots to enhance mature student engagement in higher education. Manuscript submitted for publication (2021b).
3. Agarwal, R. and Wadhwa, M.: Review of state-of-the-art design techniques for chatbots. SN Computer Science. 1(246), (2020).
4. Agresti, A.: Categorical data analysis 3rd ed. John Willey and Sons, USA, (2013).
5. Bernier, J., Barch´ein, M., Can˜as, A., Go´mez-Valenzuela, C., and Merelo, J.: The services a university website should offer. Information Society and Education: Monitoring a Revolution. Serie Sociedad de la Educaci´on, 9, 1746–1750, (2002).
6. Chen, H.-L., Widarso, G. V., and Sutrisno, H. : A chatbot for learning chinese: Learning achievement and technology acceptance. Journal of Educational Computing Research, 58(6), 1161–1189, (2020).
7. Dibitonto, M., Leszczynska, K., Tazzi, F., and Medaglia, C. M.: Chatbot in a campus environment: design of lisa, a virtual assistant to help students in their university life. In International Conference on Human-Computer Interaction, 103–116. Springer, (2018).
8. Durham University: Meet holly, (2021).
9. Fernoag˘a, V., Stelea, G.-A., Gavril˘a, C., and Sandu, F.: Intelligent education assistant powered by chatbots. In The International Scientific Conference eLearning and Software for Education, 2, 376–383. " Carol I" National Defense University. (2018).
10. Gachago, D., Strydom, S., Hanekom, P., Simons, S., and Walters, S.: Crossing boundaries: lectures' perspectives on the use of whatsapp to support teaching and learning in higher education. Progressio, 37(1):172–187, (2015).
11. Gong, L. : How social is social responses to computers? the function of the degree of anthropomorphism in computer representations. Computers in Human Behavior, 24(4):1494 – 1509, (2008).
12. Griol, D., Molina, J., and de Miguel, A.: The geranium system: Multimodal conversational agents for e-learning. Distributed Computing and Artificial Intelligence, 11th International Conference, 290, 219–226, (2014).
13. Kim, H. Y.: More than tools: Emergence of meaning through technology enriched interactions in classrooms. International Journal of Educational Research, 100(101543), (2020).
14. Lancaster University: Lancaster University launch pioneering chatbot companion for students, (2019).
15. Moor, J.: The Turing test: the elusive standard of artificial intelligence, volume 30. Springer Science & Business Media, (2003).
16. Mora, A., Guill´en, A., Barranco, F., Castillo, P., and Merelo, J.: Studying how to apply chatbots technology in higher-education: First results and future strategies. In Zaphiris, P. and Ioannou, A., editors, 23rd International Conference on Human-Computer Interaction, HCII 2021, 24, 1–14. Springer Nature Switzerland AG. (2021).
17. Mwakapina, J. W., Mhandeni, A. S., and Nyinondi, O. S.: Whatsapp mobile tool in second language learning: Opportunities, potentials and challenges in higher education settings in tanzania. Technical report, Macrothink Institute. (2016).
18. O'Boyle, N.: Front row friendships: Relational dialectics and identity negotiations by mature students at university. Communication Education, 63(3):169–191, (2014).

19. Panah, E. and Babar, M. Y.: A survey of WhatsApp as a tool for instructor-learner dialogue, learner-content dialogue, and learner-learner dialogue. International Journal of Educational and Pedagogical Sciences, 14(12), 1198 – 1205, (2020).
20. P´erez, J. Q., Daradoumis, T., and Puig, J. M. M.: Rediscovering the use of chatbots in education: A systematic literature review. Computer Applications in Engineering Education, 28(6), 1549–1565, (2020).
21. Pimmer, C., Bruhlmann, F., Odetola, T. D., Oluwasola, D. O., Dipeolu, O., and Ajuwon, J. : Facilitating professional mobile learning communities with instant messaging. Computers & Education, 128, 102 – 112, (2019).
22. Roblyer, M., McDaniel, M., Webb, M., Herman, J., and Witty, J. V.: Findings on facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites. The Internet and Higher Education, 13(3), 134 – 140, (2010).
23. Santoso, H. A., Winarsih, N. A. S., Mulyanto, E., Sukmana, S. E., Rustad, S., Rohman, M. S., Nugraha, A., Firdausillah, F., et al. : Dinus intelligent assistance (dina) chatbot for university admission services. In 2018 International Seminar on Application for Technology of Information and Communication, 417–423. IEEE, (2018).
24. Smutny, P. and Schreiberova, P.: Chatbots for learning: A review of educational chatbots for the Facebook Messenger. Computers & Education, 151:103862, (2020).
25. Studente, S., Ellis, S., and Garivaldis, S. F.: Exploring the potential of chatbots in higher education: A preliminary study. International Journal of Educational and Pedagogical Sciences, 14(9), 768 – 771, (2020).
26. Tang, Y. and Hew, K. F.: Is mobile instant messaging (mim) useful in education? examining its technological, pedagogical, and social affordances. Educational Research Review, 21, 85–104, (2017).
27. Timmis, S.: Constant companions: Instant messaging conversations as sustainable supportive study structures amongst undergraduate peers. Computers & Education, 59(1), 3–18, (2012).
28. Yang, S. and Evans, C.: Opportunities and challenges in using ai chatbots in higher education. In Proceedings of the 2019 3rd International Conference on Education and E-Learning, 79–83, (2019).
29. Yildirim, I.: The effects of gamification-based teaching practices on student achievement and students' attitudes toward lessons. The Internet and Higher Education, 33, 86 – 92, (2017).