

Abstract

In the new contemporary pandemic paradigm, higher education in public administration and beyond knows challenges, barriers, and opportunities for the academic process. Shocks, environmental changes and physical distancing in recent years have led to the implementation of efficient solutions in educational services, based on artificial intelligence (AI). Thus, in the global academic landscape, many international universities have adopted a 'chatbot', a digital interface designed to stimulate conversation with people. Modern algorithmic communications have effects, such as: increasing the number of enrollments in public administration programs, improving academic experience and active student participation, while reducing administrative tasks on university staff. This paper aims to provide a glimpse on the perceptions of the potential impact of conversational artificial intelligence on public administration (PA) programs from universities and to reflect on its implications for university leaders and staff work and also on students' engagement. The paper will focus on how AI tools will help university programs to be more effective, and how technology will support the limited human resources in this sector. In order to gather the data for this research, the interview was used as well as case studies from international universities that have implemented a chatbot. The research findings capture technological and digital advances that will continue to shape the higher education landscape and its curricula, especially in PA programs. As a result, leaders will need to monitor how artificial intelligence, in particular conversational agents, influences universities' images; attraction and retention for students in PA programs and other important partners; staff productivity, and how to be more proactive in initiating pilot projects. This is one of the few publications that looks at the expectations for conversational AI in higher education today. In this sense, implementing a chatbot can be a competitive advantage in a market where modern technologies weigh heavily and make a difference.

Keywords: artificial intelligence, chatbot, communication, universities, innovation.

The Contribution of Artificial Intelligence to Stimulating the Innovation of Educational Services and University Programs in Public Administration*

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1. Introduction

Education and training are the safest investments in the future, playing a crucial role in stimulating growth, innovation, and job creation. Education and training systems need to respond to the opportunities and challenges of today's digital transformation, as the COVID-19 pandemic has brought about unique changes in the educational landscape around the world. These digital transformations and behavioral changes profoundly affect the personal, social, and professional lives of education managers, teachers, and students, and the university environment has become increasingly diverse, dynamic, and competitive.

While artificial intelligence (AI) is receiving a lot of attention these days, it is not as new as people may imagine. AI has been around for at least 30 years, but thanks to a convergence of technology, it is now expanding and reaching government halls. Machine learning, like the human brain, not only mimics but also learns from how we interpret information and experiences. When you combine robots with machine learning, you have gadgets that can quickly take over repetitive human jobs. By the year 2050, several economists expect a substantial shift in the workforce. Others argue that new jobs will be generated to compensate for the majority of any job losses. The following factors are responsible for much of AI's growth: complex algorithm advancements; significant increases in computer power and speed; the ability to process data from a variety of sources (voice, videos, text, social media, etc.); the ability to store and retrieve large volumes of data in milliseconds.

Governments at all levels will face a slew of new challenges as AI advances, including ethics, privacy, human control, policy bias, predictive analytics, decision-making, citizen involvement, planning, and the future of work. Until recently, AI was predominantly taught in schools that focused on computer science, engineering, robotics, and programming. Particularly when it comes to AI training, people who aspire to work in public administration and obtain a degree in public policy are mostly kept out of technology education.

Artificial intelligence (AI) is a vague concept, as scientists and theorists have not reached a consensus regarding an unanimously accepted definition. However, it can be understood as a system, a mechanism, which uses reasoning, logic, and other human traits to perform tasks independently and with available resources. The term 'artificial intelligence' is used, according to Russell and Norvig (2003), when a computer performs human cognitive functions like learning and problem-solving. AI is evolving quickly and is becoming more accessible to businesses and academic institutions alike.

In the new contemporary paradigm, we are witnessing amazing advances in AI technologies which, in recent years, have begun to penetrate into a fundamental area for any society: education. Education and training are the safest investments in the future, playing a crucial role in stimulating growth, innovation, and job creation.

The European Union estimates that by the end of 2030, the number of students will reach 414 million, and this reality indicates that schools and universities will have to become more attractive, modern, and flexible to have a competitive advantage (OECD, 2008). In fact, a recent research report on AI in education predicts that the global AI

market in education will reach \$25.7 billion in 2030, up from just \$1.1 billion in 2019 (Prescient & Strategic Intelligence, 2020). In terms of promotion and interaction with the beneficiaries of the educational process, AI technology can make a significant impact in several ways, including collecting large amounts of data about students' preferences and interests, writing, and sending personalized messages, that directly match their needs, non-stop interactions with smart programs, etc.

Based on interviews with 6 managers from universities that have implemented chatbots, this paper is an overview of the potential impact of AI conversational agents on universities worldwide and reflects on its implications for managers, staff, and students. This article presents upcoming best practices from institutions that introduced chatbots, analyses interview responses and gives university executives and educational policymakers insights for future decisions.

2. Literature review

In the literature, it can be seen that there are many definitions of artificial intelligence, and this term is constantly being updated as technology advances. In a broader context, according to Fischer and Ryn (2021), machine learning is the use of AI, which allows the detection of patterns used for explanation and anticipation processes. AI works by identifying patterns in available data, and then using this knowledge for new data, but also refers to systems that exhibit intelligent behavior, assessing the environment and acting autonomously to achieve specific goals. Henman (2020) states that the public sector is rapidly developing and implementing AI to accelerate governance as well as operations, public services, and compliance and security tasks. Starting from Sharma, Yadav and Chopra's (2020) point of view, it can be reasoned that due to rapid digital technological change, it is inevitable that the government will innovate traditional methods in education in order to better engage students, teachers, and other stakeholders to cope with a complex changing environment and become more resilient by using smart technologies that can act as facilitators of innovation, sustainability, and competitiveness. AI can help free the higher education workforce by implementing it in automating repetitive tasks while reducing costs and increasing higher education actors' satisfaction and involvement. Moreover, Mehr (2017) predicts that AI will have a greater impact if it is used to reduce administrative problems in general, especially in higher education, and improve the human experience as opposed to replacing people. Sousa *et al.* (2019) characterize AI systems as independent entities capable of operating independently, acquiring knowledge, recognizing patterns, and making judgments by analyzing diverse scenarios. Furthermore, the integration of mobile devices with applications enables the provision of online public services to beneficiaries regardless of their location. Consequently, automated administrative decision-making procedures have become extensive, with AI offering more sophisticated approaches to decision-making in difficult situations (Henman, 2020).

The development of AI is promising and there are a growing number of applications and programs that, based on it, offer effective solutions to accomplish various tasks.

University education, with the ultimate goal of contributing to the proper consolidation of an intelligent and efficient educational system, is progressively incorporating this technology into the higher education service. Therefore, intelligent tools can enhance the delivery of public services by processing natural language or analyzing large amounts of data to support public decision-making, among other uses (Villagrasa, 2020).

Chatbots integrate AI language processing skills and can be used in an educational environment. Chatbots, commonly referred to as conversational agents or virtual assistants, are computer programs that mimic human speech using artificial intelligence. They can be applied in a variety of industries, including education, to give students individualized and engaging learning opportunities (Clark and Mayer, 2016). Mauldin (1994) first used the word ‘chatterbot’ to refer to systems that could simulate human communication and pass the Turing Test. The implementation of this principle as software occurred in the early year of 1966, when Joseph Weizenbaum introduced ELIZA (Weizenbaum, 1966; McNeal and Newyear, 2013). ELIZA was created to be understood like a therapist who asks questions and provides answers. In its basis, it is a simple natural language processing system that can carry on a conversation. Nowadays, chatbots potentially can be used in a wide variety of ways and are becoming intrinsic to the way we live our everyday lives.

Chatbots are data-fed and are specifically designed to effectively analyze and interpret information that has been previously sent to them. They are also supported by human contribution, which means that any unanswered questions will be analyzed and addressed by the person in charge. Thus, flexible, and timely algorithmic communications like these can have many beneficial effects, such as: increasing enrollment, improving academic experience, and more active student participation, while reducing administrative burdens on university staff.

In higher education systems, the ability to give students immediate feedback and guidance is one of the key advantages of employing chatbots. For instance, a chatbot for language learning can assist students in honing their speaking abilities by starting a discussion and offering feedback and corrections. Similar to this, a math chatbot may guide students through issues and give detailed explanations of how to solve them. Chatbots have the potential to facilitate individualized learning experiences for students, allowing them to progress in a personalized rhythm and improve their skills more efficiently by giving them immediate feedback.

The ability of chatbots to offer students personalized learning experiences is another advantage of their use in education. The AI may adjust the material and difficulty level to the student’s requirements and preferences by examining the student’s communications with the chatbot. Since students are more likely to learn when the subject matter is interesting and challenging, this can help them stay motivated and engaged. Additionally, chatbots can be utilized to support teachers and enhance traditional classroom instruction (Popenici and Kerr, 2017). For instance, a chatbot can offer more materials and practice activities to students who require them, freeing up the teacher’s time to concentrate on providing more specialized training to those individuals, but also to track the progress of their students’ development and spot areas where they might need more assistance.

There are currently a number of cases where chatbots are employed in the classroom or in different university activities. For instance, the well-known language-learning program Duolingo employs a chatbot to replicate conversations in the language being studied (Duolingo, undated). Similar to this, IBM Watson Education has created a chatbot called ‘Teacher Advisor with Watson’ that offers tailored suggestions for math classes based on the student’s learning preferences and background (IBM, undated).

Over time, the introduction of advancing technologies has led to the expansion of chatbot capabilities into the field of AI. This expansion has been driven by advancements in machine learning, data analytics, and, notably, natural language processing (NLP). NLP enables computers to engage in communication with both humans and other machines using natural human language (Sharma, Goyal and Malik, 2017; Androniceanu *et al.*, 2018; Singh, Joesph and Jabbar, 2019; Štefanišinová *et al.*, 2021; Pucheanu *et al.*, 2022; Androniceanu, 2023). Currently, two distinct categories of chatbots are employed in various applications: written chatbots and conversational chatbots. Chatbots that are scripted employ conversations that are less sophisticated in nature. This is because they rely on pre-determined answer buttons inside the conversation to efficiently and precisely provide responses. Conversational chatbots employ AI techniques to identify user intents and retrieve appropriate responses. The chatbot employs machine learning and NLP techniques to acquire knowledge and enhance its ability to respond accurately and naturally with appropriate answers (Interreg North Sea Region, undated).

It is common practice in the world of higher education to use chatbots for the purpose of streamlining administrative tasks, particularly in areas like the admissions office, the registrar’s office, and the bursar’s office (Singh and Thakur, 2020; Ehrenpreis and DeLooper, 2022). Since it might be time-consuming to react to each inquiry individually, chatbots have been viewed as a viable solution (Ehrenpreis and DeLooper, 2022). Chatbots are gaining popularity because they can replace human interaction in many contexts. Conversational AI solutions are ideal because they eliminate the need for students to wait for answers and solutions, despite the fact that they are increasingly tech aware and expect them immediately. Quick communication is essential for any educational institution in its pursuit of new students. Due to their availability, chatbots have found a useful niche in the classroom. They will not form an opinion based on the inquiries you ask. And they are supposed to direct you along pathways that will lead to results faster. They also can be anonymous. This is essential for specific population groups. Institutions can benefit from chatbots because they create a safe zone where users can ask these kinds of questions without worrying about offending anyone. This approach, which is sometimes called ‘conversational design’, yields ideas that are simpler to understand and explore than a course catalog that is printed or even a complete website. This content adaption works better for students who are using assistive technology, including screen readers, and for students who are using their phones (Morrow, 2021).

Tinto (2016) wrote an article on how to improve student persistence and retention, presenting a series of experiences that shape students’ motivation. Thus, Tinto (2016) highlights several elements that exert an influence on a student’s motivation to persist in

college. These aspects include self-efficacy, which refers to an individual's belief in their ability to successfully complete tasks and achieve desired outcomes. Additionally, a sense of belonging, or the feeling of being accepted and included within the college community, plays a crucial role in motivating students to persevere. Lastly, the perceived value of the curriculum, or the extent to which students regard the educational content as relevant and beneficial, also contributes significantly to their willingness to continue their college education. For students of public PA programs, it is even more important to feel they are part of a strong community, that they get support during the entire study program, and that their knowledge and experiences are very useful for their future careers, given the fact that their employment in public administration institutions will exploit their potential and knowledge to the maximum. It is important for them to be aware that the effort put in and the time allocated to professional development in the field of public administration can have a positive impact on the communities where they choose to work. Using chatbots can help with all three points, providing up-to-the-minute information. This reality means that students are not only more likely to see the value of what they are studying, but they can increase their confidence in their own ability to succeed.

Overall, chatbots have the potential to revolutionize education by giving students individualized and engaging learning opportunities. The use of chatbots in education appears to have a bright future, even though there is still much to be discovered in this area.

3. Illustrative cases of conversational AI use in universities

IBM Watson is widely recognized as a highly valued chatbot solution that has been successfully adopted by numerous universities. Universities can use it to speed up student responses, download and deliver documents, and answer specific academic questions. Furthermore, in 2015, Professor Ashok Goel from the Georgia Institute of Technology introduced 'Jill Watson', an artificial intelligence teaching assistant who facilitates student interaction (Goel and Joyner, 2017). Professor Ashok Goel initially introduced the AI Teaching Assistant, Jill Watson, to an online class without disclosing to the students that she was not a human entity. The revelation of her non-human identity was made known to the students only upon the conclusion of the course. The first version of the Jill Watson Assistant was developed by him and a group of graduate students, exploiting IBM Watson technology. Since 2016, he has been among the pioneering educators who have incorporated the utilization of a virtual teaching assistant into their educational practices (Goel and Polepeddi, 2019; Ekren and Kumar, 2020).

The University of Murcia in Spain has recently initiated a test phase of an AI-powered chatbot named 'Lola'. This chatbot is designed to address questions from students pertaining to various aspects of campus life and academic programs. School authorities were taken by surprise when they discovered that, since the chatbot's launch, it has answered more than 38,700 requests accurately in more than 91% of the cases. In addition to being able to respond to students' questions instantly after work program hours, university administrators discovered that the chatbot raised student motivation. It should be noted

that all these benefits were obtained without the need to change the staffing structure (UJMD, 2020).

At the same time, the Polytechnic University of Valencia has implemented the ‘Pau’ chatbot. It has served almost 7,000 users on its devices in a month, generated 8,413 conversations, and sent over 24,700 messages in response, and it is the second of all the Spanish ones, after the chatbot Lola we talked about earlier. One of the most important features of Pau is the speed with which he can answer users’ questions. In this first phase of the chatbot implementation, the average duration of the conversations was 51.7 seconds. At the same time, it was noted the minimum error rate, which was 4.95% (Lavanguardia, 2019).

More and more universities are betting on the inclusion of virtual assistants to serve students. Complutense University of Madrid has its own chatbot—‘Carol’. It interacts with new students by answering questions they have about admission issues, enrollment steps, and other questions that students may have at the beginning of the university year. In addition, the chatbot is ready to perform specific actions, such as pre-registration and registration. Lola’s experience at the University of Murcia made it possible to specify the most frequently asked questions by students. Carol handles the answers to these questions at the Complutense University of Madrid, thus allowing those in charge of student services to focus on solving more complex problems (Informacion, 2019).

Starting in 2016, Georgia State University launched a chatbot program called ‘Pounce’. The transition from high school to college is not easy, as there are many steps to take to enroll in classes. In addition, motivation can drop seriously during the summer months, so much so that there is a phenomenon of ‘melting summer’ in which students do not appear at all. Pounce guides students through enrollment steps, campus facilities, etc. Pounce answered more than 2,000 questions on a variety of topics, from financial aid to housing, which reduced the summer meltdown by 21%. Students who used Pounce also had higher rates of completing key enrollment steps than those who did not (Moldovan, 2020).

The enrollment services staff at Ocean County College in New Jersey was fed up with sending emails that received only a 10% engagement rate. ‘Reggie’ began with an extensive database of 1,200 inquiries pertaining to enrollment, specifically targeting new students. These questions covered a wide range of topics, including but not limited to the application process. Additionally, some questions were related to the cost of the registration fee. During the first year of college, Reggie responded to a total of 14,000 requests, resulting in a twofold expansion in her knowledge capacity. During the second year, there was a notable 26% rise in his level of engagement, and he successfully responded to 98% of the requests without needing external assistance. The teachers involved in the admission process used the time gained for research activities (Henry, 2021).

Arizona State University has developed a text messaging chat called ‘Sunny’, giving students the opportunity to ask questions about the university and campus life. By providing human assistance alongside their chatbot, the university is able to provide quality services and continually improve Sunny’s machine-learning knowledge. In fact, machine learning is a key factor in the development of a chatbot, which is similarly emphasized by George

Washington University chatbot ‘Martha’. Thus, both work with the premise that the more students use the chatbot, the more efficient it becomes (Grossnickle, 2019).

A more advanced approach may include digital coaching, as implemented by Staffordshire University, the first higher education institution in the United Kingdom, which created the ‘Beacon’ chatbot to support students with lessons and daily life. Beacon offers personalized support to students, as well as access to tutors and over 400 frequently asked questions covering every aspect of life in the institution (Staffordshire University, 2019a). AI holds significant importance within the institution’s digital vision and serves as an essential component in its strategic plan for the year 2030. Thus, the University of Staffordshire is a true pioneer and provides the strategic framework for the future development of colleges and universities in the United Kingdom. Also, in 2019, Beacon won a UK National Technology Award (Staffordshire University, 2019b). Lancaster University has also made the leap into chatbot technology to help its students navigate their academic lives. ‘Ask LU’ helps students in the same way as Beacon (Lancaster University, undated).

Bethel University in Indiana is a tiny Christian college of liberal arts, which has suffered a decline in student retention for three consecutive years. The management decided to implement ‘Wilhelm’, an AI text messaging robot that interacts with students to find out where they need support, and the results were not long in coming (EDSIGHTS, undated). Colleges and universities continue to face significant difficulties in maintaining student retention rates. Bethel University has taken a different approach and used conversational AI to communicate with students about personal issues that could cause them to drop out of school. This has proven to be the best way to increase retention quickly.

At George Washington University, chatbots are being launched to support IT, administrative, and teaching functions. Before the university could introduce its chatbot, ‘Martha’, students had to call, send an e-mail, or go to campus during business hours to get the help they needed. Today, Martha answers students’ frequently asked questions, reducing personal queues and increasing student satisfaction with fast response time (Hill, 2019).

In Romania, the ‘Iuliu Hațieganu’ University of Medicine and Pharmacy in Cluj-Napoca, implemented for the first time in July 2021 a chatbot for local universities. Officials claim that in 99% of cases the answer was automatic, and the chatbot answers in two foreign languages, English, and French. At the same time, they are very satisfied with the impact, because, due to the influx of candidates, they could not cope and had no other solution. This finding supports the notion that AI systems have the potential to enhance many repetitive jobs and procedures, therefore enabling professors to allocate their time to other activities (Doroşenco, 2021).

In the end, from the 12 successful cases presented above, it can be concluded that while conversational AI technology can be extremely useful in online education, administrators implementing the technology should consider how to find a balance between using smart software and human-based approaches. On the one hand, too much interaction with AI can result in a sterile and cold virtual communication environment. On the other hand, too little or no adaptation of AI poses an operational risk to universities that strive to thrive and attract as few students as possible in the modern age. What is certain is that

in industries such as higher education, there will always be a need for human interaction and correspondence. In conclusion, from the illustrative cases presented in this section, we can extract several benefits from the best practices, such as: answering students' questions instantly; increased student motivation and retention; the accurate rate of answers; offering personalized support to students; providing a safe environment for students to ask personal questions without feeling that they are judged; freeing time for teachers and administrative human resources, in order to concentrate on more demanding activities.

Therefore, we believe that educational policymakers and higher education leaders should collaborate closely and carefully consider the role that AI in general, and chatbots in particular, will play in educational organizations when developing strategic objectives and medium to long-term plans.

4. Research methodology

The main objective of this study is to draw attention to the impact that artificial intelligence (conversational agents—chatbots) might have on universities around the world, especially on public administration university programs, and to reflect on its implications for educational policymakers, university leaders, staff work, and students.

In the higher education system, attitudes, comprehension, and expectations are not always clearly defined. By conducting an analysis of the qualitative data that was acquired we were able to start constructing a clearer picture of how people see the potential implications of AI conversational agents. Specifically, it addresses the following three research questions:

- RQ1: What were the main opportunities and challenges for universities worldwide that implemented conversational agents (chatbots)?
- RQ2: How can the academic curriculum be improved by implementing a chatbot?
- RQ3: What impact does the chatbot have on university marketing and, implicitly, on attracting and retaining students?

The information presented in this research was gathered through online interviews with academic community stakeholders. For this research paper, we chose a direct and qualitative method. This method is much more relevant, given the topic we have chosen, because we can get more in-depth information (Şandor, 2013; Chelcea, 2022). The primary objective of data analysis is to generate deductions, lessons, or findings through the process of systematically organizing and dividing datasets into concise and comprehensible fragments of information (Bailey, 1982). Based on Mihăilescu (2000) and O'Connor *et al.* (2008), the use of online interview techniques can mitigate the effects of geographical separation by providing opportunities to engage with individuals who would otherwise be challenging or unattainable to connect with. Online interviews can also help participants provide more in-depth, reflective responses and even permit uncomfortable or sensitive interactions with the researcher (Madge and O'Connor, 2002; Deakin and Wakefield, 2014). Additionally, building rapport with individuals online might be more difficult and

different from in-person interactions (James and Busher, 2006; Deakin and Wakefield, 2014; Seitz, 2016; Weller, 2017; Archibald *et al.*, 2019).

In order to conduct online interviews at universities around the globe, both the researcher and the interviewee must give up certain aspects of their anonymity. Although Internet platforms permit varying degrees of anonymity (Meng *et al.*, 2017), we identified and selected only the institutional e-mails, which meant that users had to register with their real name and personal identification information in order to access their Internet accounts (Lee and Liu, 2016). According to James and Busher (2006), due to the open nature of the internet and digital media, it makes it impossible for researchers to protect the anonymity of participants in their studies.

We examined email, phone, and videoconferencing to determine which interview format was most suited. Although earlier research (Sturges and Hanrahan, 2004) suggested that the interviewing method did not affect participant responses, it was carefully considered which alternative method would be most appropriate in this situation and enable similar quality data for our preferred methodology of semi-structured interviews. Email was our preferred method of communication (Fritz and Vandermause, 2018) since it is a tool that is both helpful and practical for qualitative researchers. Participants did not have to worry about their communication being overheard by other people, which would have been a breach of their privacy (Seitz, 2016). In order to reflect the information gathered during the research period, open-ended questions were developed.

Building and preserving trust with participants is crucial for qualitative research (Lincoln *et al.*, 1985) as well as for producing the rich, detailed information we hoped for (Bouchrika, 2023), which in turn supports the study (Creswell and Miller, 2000; Attia and Edge, 2017). As a result, we put a lot of time and effort into how we spoke with participants in order to build rapport, credibility, and trust while maintaining ethical legitimacy.

4.1. Participants and data collection

Worldwide, there is a small number of universities that implemented conversational agents. This fact forced us to include a limited number of universities in the group of potential respondents. The target population of this study was formed by representatives of international universities that have already implemented conversational artificial intelligence from the 12 illustrative cases presented earlier in this paper. The selection of potential interview subjects was based on their proficiency in integrating conversational agents within higher education institutions. The selection of respondents was based on subjective sampling methods, in which the inclusion of the cases in the sample follows the subjective decision of the researcher. Thus, the sampling units were chosen according to certain criteria, so as to ensure that the sample is representative of the target population (Rotariu and Iluț, 1997, p. 122). In order to obtain answers, we sent e-mails to the representatives of the institutions presented above. Text messages were sent between April 15 and May 15, 2022. The first emails were sent in mid-April. The invitation to answer the questions in the guide was reiterated 2 times, once at the end of April, and the last time in the middle of May.

An important limitation of this study is that only six prominent university representatives with extensive chatbot experience provided answers to the interview guide. These respondents are directors and managers, responsible for implementing AI conversational agents in their universities. A total of six directors/ managers accepted to participate and answer to the interviewee: 2 from the USA, 2 from the UK, 1 from Spain, and 1 from Romania; 2 women and 4 men. All the specific quotations from the answers were anonymized using the terms ‘Respondent 1’ ... ‘Respondent 6’.

- Respondent 1 (R1) – Georgia State University, USA;
- Respondent 2 (R2) – Staffordshire University, U.K.;
- Respondent 3 (R3) – Arizona State University, USA;
- Respondent 4 (R4) – University of Murcia, Spain;
- Respondent 5 (R5) – the ‘Iuliu Hațieganu’ University of Medicine and Pharmacy in Cluj-Napoca, Romania.
- Respondent 6 (R6) – Bolton College, U.K.

The data collected is of significant importance to our research because it comes from experienced people, whose universities have already implemented a chatbot. Thus, the answers are measurable and provide real information about the impact of the implementation of the chatbot. In addition, most of these respondents have been implementing this technology for some time, and so we wanted to find out how the chatbot has evolved over the years. Also, some of the respondents provided us with their own materials, links, and research to complement the answers already provided.

5. Results analysis

As we said above, through our research questions we want to better understand, in particular, the four dimensions that the chatbot can bring to the routine and university programs of public administration and beyond. The answers provided by our respondents gave us some interesting and beneficial details.

So, we will start with the first dimension: communication between students, as individuals, and the university, as an institution. All the respondents pointed out that communication has improved a lot, growing the satisfaction of persons involved by answering in real-time to their needs, saving costs and time, and making all the processes more efficient. This is one of the many opportunities.

By implementing a chatbot, the university was ‘[...] able to deliver personalized attention to students at scale and cut through the communication clutter. Messages sent via e-mails that are only opened by 14% of students are now ‘opened’ by nearly 100% of students on the chatbot, and the chatbot answers tens of thousands of students’ questions every week’ (R1). During the pandemic, this technology helped a lot, because the staff was bombarded (asked) with an enormous number of messages, and the chatbot answered them all 24 hours a day, 7 days a week. Respondent 1 also states that the Pounce chatbot is drawn after the team’s mascot, so it is very friendly and a well-known figure among

students. In addition, the language used by the chatbot is much more casual than the traditional language used by the university through official messages, which can make it difficult and sometimes annoying for students. All of these things help a lot in communication.

Similar things can be seen in the answers given by the other respondents. For example, R2 points out that the implementation of Beacon exemplifies the university's commitment to addressing the different needs of its student community through innovative measures. Designed with the purpose of facilitating the academic success and advancement of students, Beacon serves as a mechanism to encourage and guide them toward engaging in actions and activities that are conducive to their educational achievements.

'[...] It created a single simple channel of communication to our students [...]' (R2). The aim is to guarantee that each student receives the necessary assistance and guidance to fully engage in university life and realize their maximum capabilities. In other words, the Beacon chatbot is more of a digital coach, so communicating with students is the order of the day. The chatbot offers personalized answers and even reminds students what to do on some days.

Respondent 3 even mentioned that the students shared their experience with chatbots on social media platforms such as Reddit, Instagram, and Twitter. '[...] This has been very beneficial for us because we are often able to use the chatbot to communicate with students about topics that they usually wouldn't respond to through other communication channels. [...] The effects of the implementation are many, but the most significant effect has been the ability to connect with students—the chatbot sent millions of messages and interacted with tens of thousands of students. [...] we saw great influence in students' interactions with the chatbot throughout the COVID-19 pandemic. When ASU transitioned to remote learning in March 2020, Sunny chatbot became a reliable tool for students because they were able to receive updates and resources for virtual learning. We also found the interactions to be a lot more vulnerable during this time. Students would share their mental and emotional challenges with the chatbot. Thus, it allowed us to identify students who were struggling and provide them with the support they needed.' (R3).

Also, the chatbot Lola from the University of Murcia enjoyed a wide appreciation from the students from the first days. Respondent 4 said that a great advantage is the use of a natural language and the very fast answers that the chatbot gives—'[...] Lola assisted over 4,600 students, most of whom connected via mobile, having over 13,100 conversations and resolving over 38,700 requests. [...] The emphasis on natural language is not surprising, because not feeling like talking to a robot is an essential and integral part of the process. [...] Lola is by far a great breakthrough for our university when it comes to communication.'

Respondent 5 said the chatbot was a real success from the first registration session. 'Chatbot was implemented on the 66th day of the 84th of admission. I think the most significant effect was that in just the 18 days she worked, helping human resources, Ana provided 15,843 answers, out of a total of 16,459 (96.3%). The robot successfully answered repetitive questions, so that a total of only 809 messages reached the university staff, through all communication channels.' At the same time, a huge advantage in terms of communication is that the chatbot responds in two foreign languages, English and French, being

a very important aspect for international students. In addition, communication barriers have been significantly reduced by implementing the chatbot, as the technology works non-stop.

Respondent 6 mentioned that ‘[...] the service has over 2,500 question and answer pairs. [...] The development of the Ada service has enabled Bolton College to derive multiple benefits for its students, teachers, and campus support teams. With regard to students, they are able to acquire real-time information, advice, and guidance to support their studies, they can pose subject topic questions to Ada as they engage with online learning tutorials, they can acquire their GCSE exam results or they can seek out information to support their studies even when the physical campus is closed during the Covid19 pandemic or during college holidays.’ The college experimented with iOS and Android applications for the Ada service, but it was discontinued due to lack of expertise and funds to support the development and maintenance of these applications. At the same time, the College also created an Alexa application, but this was interrupted because the adoption of students was low. Many of Ada’s answers include hyperlinks, images, and videos, and such answers were not appropriate on a VoiceFirst platform like Alexa.

The second dimension that we want to investigate through the answers provided by the respondents refers to how this technology can improve the academic curriculum. In the case of this dimension, we learned from the second respondent (R2) that during their interactions with candidates and students, the chatbot collects large amounts of data, which contains relevant information about the behavior, motivations, and interests of students. All of this data helps us determine the preferences of students, without the need to ask them directly. Of course, this goes hand in hand with the distribution of a questionnaire for them to complete, but the data generated from the chatbot can never lie, while human beings could. Thus, the generation of this data by the chatbot is a huge competitive advantage in an increasingly crowded university market. There’s another use for the chatbot. Beacon gathers a lot of information during its contact with candidates and students. These statistics are an invaluable resource for institution marketing staff and a beneficial tool for introspection and growth because they provide insightful information on student behavior. ‘[...] In the same way, we can see what preferences students have and how we can improve our curriculum for next year. This is a huge competitive advantage.’

In addition, respondent number four also reinforced this belief, saying that another benefit of the chatbot is the collection of data containing information about students’ areas of interest. ‘This data is analyzed to help the university create new services and innovative programs to further enhance students’ educational experiences,’ (R4) he said.

The last respondent (R6) said that the university management called a small group of computer science students to train Ada with pairs of questions and answers and to observe the tendencies of their colleagues, and this was an advantage because the chatbot was trained by some of the beneficiaries of the education system.

The third dimension we wanted to investigate was time saving. From this perspective, the first respondent (R1) told us that the chatbot responds quickly to questions, and the system thus minimizes the need for staff interventions. This saves a lot of time and gives

them time to complete other daily tasks. Also, from the students' point of view, they are satisfied that they receive answers almost instantly, without any gaps, and this is very important in the world of the speed in which we live.

These ideas are also highlighted by the other respondents. For example, respondent number two (R2) mentions that the chatbot has the functionality to provide reminders to students about various things, such as the fees they have to pay, which again saves the time staff would use to contact and talk to the students. At the same time, this chatbot saves a lot of time during the admission periods, because many questions are repeated, and no representative is needed to answer.

In addition, R5 also emphasized the international framework for this time-saving component. International students often asked them questions at different intervals from the university's working hours, and this provoked later answers. However, with the help of this technology, they now receive almost instant answers.

'[...] Artificial intelligence is booming and growing internationally. Although the ways in which artificial intelligence is used in business, public institutions, and academia differ, its implementation has the same two main objectives: streamlining the use of human resources and increasing organizational performance. [...] Prior to the implementation of the chatbot, the number of e-mails and phone calls to the Department of International Students was huge, in the hundreds of days during the admission period. Currently, Ana can respond to over 90% of the requests of international candidates, which has led to a 'depressurization' of the secretarial staff of the Department. This translates into lower costs related to the admission process. Moreover, any employee who does not have to answer the same questions on a daily basis can use his time for other administrative activities, improving the quality of services provided by the university. [...] on the one hand, the international candidates received clear, accurate, real-time information, and on the other hand, the staff of the Department was relieved of certain tasks, simple in a way, but time and energy consuming.'

The last dimension we wanted to analyze is the marketing of universities, the way in which students can be attracted and retained. The first respondent (R1) pointed out that after the implementation of the chatbot, summer melt decreased by 21.4%, helping students to stay in university. At the same time, they used the chatbot to promote their career fair among students, and they participated in greater numbers than if they had learned about the event from traditional ways of communication. In fact, the chatbot also helps to attract students, being an innovative and modern tool, which young people receive with enthusiasm because it quickly solves their problems. These beliefs were also reinforced by the second respondent (R2). At the same time, he pointed out that some students who are more timid use such a tool with confidence, and sometimes it can be an advantage in terms of their retention. As the beginning of a new academic year approaches, prospective students are filled with questions concerning course items, tuition rates, housing arrangements, and similar matters. Undoubtedly, admissions departments are currently seeing a high volume of inquiries, necessitating a substantial allocation of time and resources to promptly address this surge.

‘[...] Thus, the chatbot becomes not only the best friend of the students but also the best friend of the entire staff, because it frees up their time and helps them considerably. [...]’. In our days, the typical student exhibits a greater level of comfort and preference in engaging with a conversational artificial intelligence system for certain specific objectives. A student may experience reticence in seeking clarification from an individual about a matter of minimal significance or may be hesitant to inquire about a personal issue due to feelings of embarrassment. Chatbots exhibit a lack of judgment. The notion of a ‘stupid question’ does not apply to chatbots, as they function as a discreet and reliable source of information, particularly for sensitive subjects.

In addition, R5 noted that the chatbot helps a lot in the process of attracting and retaining students, especially international ones because it can facilitate a more effective interaction between the university and them. Because chatbots never go to sleep, international students do not need to be concerned about the time difference between their home country and the country where they study. This is an important advantage since they can contact the university office whenever they need it. Also, many of the candidates ask questions and then come back for other questions, and this is because they are satisfied with the answers they receive in such a short time. All this creates an open and helpful atmosphere for both sides.

6. Discussion

From all the respondents’ answers, the implementation of conversational AI in higher education institutions represents a significant advancement towards the future of academia. Conversational AI agents possess the capability to rapidly process vast quantities of enrollment paperwork, promptly providing pertinent information as required within a few seconds. Chatbots are necessary for several purposes such as facilitating enrollment, providing information on financial aid, offering details on residence availability and fees, and addressing general inquiries from prospective students regarding university forms.

Referring to RQ1, the main opportunities for universities worldwide come from the innovative power of disrupting artificial intelligence in university education. These are mainly found in three areas such as improving the internal efficiency of academic organizations, improving the decision-making process of universities, and improving student-university interaction and communication, which aims to provide better services and increase student involvement in university activities. At the same time, AI systems can contribute to the achievement of educational goals by increasing efficiency in achieving a specific goal, and the quality of a result can be improved by using AI. Such systems outperform people by analyzing large amounts of data or can contribute to greater consistency in decision-making (Caradaica, 2020; Hîntea, Hamlin and Neamțu, 2022, p. 85; Hudrea, Spoaller and Urs, 2023, p. 60).

From the interviewees’ answers, and especially from the literature, it can be understood that the adoption of AI can be hampered by various challenges that may involve organizational responsibility for errors produced by AI systems as well as the lack of market-level

political regulations (Campion *et al.*, 2020). Dwivedi *et al.* (2019) classified the challenges posed by the implementation of AI in the public sector in general into seven categories: social, economic, technological, data-related, organizational and managerial challenges, ethical, as well as political and legal challenges. The possibility of job losses and a widening income gap are two examples of the social difficulties posed by AI technology. Unrealistic expectations regarding AI technologies are another. Economic challenges involve costs and investments related to the implementation of AI by higher education organizations and include impediments to economic profitability and sustainability. As a result, high costs often prevent universities from implementing artificial intelligence due to the investment required in technology and the high demand for limited specialists, which increase educational and salary costs (Campion *et al.*, 2020).

Technological challenges involve the inherent properties and attributes of AI technologies, which mostly pertain to the issue of algorithmic opacity that hinders the comprehension of how data inputs are translated into definitive conclusions. Additionally, AI systems encounter obstacles when it comes to effectively handling unstructured data. Dwivedi *et al.* (2019) claim that AI systems are unable to comprehend human circumstances in their entirety or to extract the appropriate meaning from them. The challenges related to data include the inadequacy of the current database in terms of size, the lack of established standards dictating the collection, acquisition, and storage format, and the complexities associated with data integration. When AI is used in the public sector, it can lead to mass monitoring and a loss of privacy. It can also make it easier for hackers to get to data and use it for their own gain (Campion *et al.*, 2020).

The challenges faced by organizations and managers involve various aspects, including strategic concerns such as the absence of well-defined plans for the development of AI. Additionally, there are management-related issues, such as the ability of organizations to adapt and withstand the challenges associated with sharing data in a resilient manner. Furthermore, there are concerns pertaining to human resources, as the potential integration of AI threatens to replace traditional human resources inside organizations (Sun and Medaglia, 2019). At the same time, ethical challenges related to public distrust of decisions based on AI, unethical use of shared data, and lack of transparency in decision-making processes must be taken into account. The perception of trust in higher education is a way of understanding how universities' efforts are assessed in terms of AI, which may include the trust of students in academic organizations to properly manage the risks of AI. Finally, the use of artificial intelligence can be hampered by political and legal challenges that can involve a variety of factors such as the absence of market-level political regulations, lack of accountability for decision-making, and organizational responsibility for mistakes made using artificial intelligence (Sun and Medaglia, 2019). Although there are regulations in the European Union that monitor the protection of personal data and confidentiality, namely the GDPR, the adoption of artificial intelligence is a major concern for its efficiency. Moreover, there is a need to implement specific regulations that address legal and ethical issues, as well as the confidentiality and security of data (Campion *et al.*, 2020).

Regarding RQ2, it resulted from the interviewees' responses that the academic curriculum can be improved by implementing AI technologies like chatbots since they are data-fed. The dataset comprises pertinent information pertaining to the conduct, incentives, and preferences of students. The collection and analysis of this data assists decision-makers in understanding student preferences, avoiding the need for direct inquiry. This input provides a significant advantage in the higher education market. The study's findings indicate that, given the increasing importance of AI in public administration and the need to prepare the next generation of students for that career, PA school leaders should be more receptive to integrating it into their curricula. AI will transform public administration globally. Over the course of the next ten years, legislators and senior public managers will lead the way in implementing AI in state and local administration and make decisions regarding the technology's place in society. Rather than relying just on the guidance of computer science experts, we have to provide the PA students with the knowledge and resources they need to accomplish this.

When it comes to RQ3, it resulted that students are more attracted to interact with a chatbot in a safe environment, where AI technologies are not boring or aggressive in their answers, being also available non-stop for students' needs. The universities that implemented chatbots increased the motivation and the retaining rate of their students but were also able to attract new candidates, by clarifying in a matter of seconds any aspect they didn't know regarding the admission process, the way the campus was organized, and by creating a sense of belonging.

Chatbots offer a more streamlined alternative for collecting feedback from students. They simplify the process of gathering information from students by employing natural language dialogue instead of traditional manual methods such as questionnaires and surveys. This approach enables chatbots to directly inquire about students' opinions and input, focusing solely on the questions that pertain to their individual circumstances.

Chatbots have advantages for staff since they alleviate the need for repetitive manual responses to frequently asked inquiries, enabling them to allocate their time and resources toward other duties. They can also provide advantages to staff members in instances where there are modifications in procedures or activities. Conversational assistants have the capability to promptly implement updates, thereby ensuring the simultaneous dissemination of the latest data across all platforms. The implementation of this practice enhances the efficacy of communication and accelerates the dissemination of the newest information to the personnel. Chatbots not only deliver information rapidly, but they also engage users with tailored experiences. In the end, this aids organizations in meeting the expectations of their personnel and students while also enhancing customer service.

The onset of the COVID-19 pandemic forever changed higher education as close quarters and socialization suddenly turned universities and colleges. So, higher education institutions began to embrace digital transformation by automating menial tasks and communicating better through technology. Moving forward, higher education institutions will need to provide the technology for students to text or chat on any question.

7. Conclusion

The impact of this tool is considerable, and the concrete examples from many international states and even from Romania are a solid benchmark. First of all, the use of artificial conversational intelligence saves the most important human resource, a resource that can never be recovered: time. The time spent by the staff involved in answering students' and candidates' questions can be used for other purposes. At the same time, from the point of view of digital marketing (Popescu *et al.*, 2021; Nica *et al.*, 2022a; Nica *et al.*, 2022b) in such a competitive market, a chatbot can be a major advantage. As far as potential students are concerned, universities need to act quickly and accurately when it comes to communications, especially in the context of increased competition. When a candidate interacts with the institution, the response in terms of speed, tone, and accuracy makes an impression. World examples show that today's students enjoy such digital interactions, especially when they are accessible, non-stop, and provide good quality answers, and a chatbot can make the difference in a candidate's mind between choosing one faculty or another. Thus, providing high quality interactions exactly when and where they want is not only expected but is the key to staying ahead of the competition.

Also, through this tool, significant improvements can be made to the academic curriculum, because through the large amount of data generated, we can understand the trends, interests, and behaviors of students and other relevant stakeholders. Furthermore, chatbots assist organizations in breaking down concepts and language into manageable pieces. This approach, which is frequently called 'conversational design', generates ideas that are simpler to understand and explore than a course catalog that is printed or even an entire website. Put differently, these technologies have a unique function in breaking down barriers and improving information availability and accessibility. As a result, communication is effective.

Additionally, we believe that rapidly advancing technological advances in AI will no doubt continue to shape industries, especially in higher education. Consequently, university leaders in education programs should closely monitor the ways in which conversational artificial intelligence influences educational policy, ethics, and student involvement. The global AI survey findings were revealed in March 2019 by Microsoft and Times Higher Education. While it is widely acknowledged among university administrators that AI will assume a significant role in higher education over the next 10–15 years, a mere 41% of the surveyed institutions have implemented an AI strategy, and only 43% have dedicated a budget specifically for AI-related initiatives (Papaspriidis, 2020).

One of the study limits refers to the small number of interviewees. Although we have sent repetitive invitations to the twelve selected universities (the illustrative cases presented in section 3), only six decided to answer the questions. The fact that only American and European universities were chosen to participate in the study is a further limitation.

In particular, strategies that facilitate significant and long-lasting changes to the educational environment through educational policies could be the focus of future research, as well as the contexts and actions required to accelerate the adoption of AI in higher

education institutions and the necessary steps throughout the various stages of transition. Lastly, there are also more general study directions that could be explored in the future, such as examining how different AI technologies might influence higher education across the globe that vary in terms of size, field of study, and geographical position.

In the end, we would encourage more educational policymakers, university leaders, and administrators to become proactive in initiating pilot projects to test the use of AI in various ways, such as implementing a chatbot. At the same time, we believe that students should learn about how algorithms use data, and their contribution to the design and development of AI systems could be further encouraged. Thus, as technology in higher education is ever changing, the chatbot may well have a chance to make a real impact in the field. In a complex and volatile world, resilience and adaptability are essential attributes for a higher education actor, who will need to be more agile learning new skills in order to interact with new technology and change occupations. The results of this study will make a significant scholarly contribution to the existing body of literature in Romania and internationally, namely in the domains of digital education, public policy, and decision-making.

AI systems are quickly becoming essential tools in the toolkit of public administration schools, where speed, efficiency, and effectiveness may save a lot of time and money while reaching results faster than humans could anticipate. Taking into account the results of the study, we recommend that the decision-makers in the education system consider initially the possibility of introducing and implementing AI in organizations (universities). Adopting and implementing AI, as reflected in previous studies published in the literature, will significantly contribute to improving the quality of services. AI shouldn't be seen or treated as a threat to human resources, since it doesn't necessarily eliminate or replace jobs. AI can represent the best way to enhance an organization's services and achieve greater levels of quality, having the potential to increase and create new career prospects as well as better opportunities for employees, customers, and other relevant stakeholders.

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Appendix: Interview guide

1. What is the most significant effect of implementing conversational artificial intelligence for your university?
2. How do you think the implementation of the chatbot influenced the interaction with the students?
3. What impact did the chatbot have on the way you communicate with students?
4. What impact did the chatbot have on your university staff?
5. What are the main benefits you noticed after implementing the chatbot in the university?
6. How did the students react after the implementation of the chatbot?
7. What are the limitations of your chatbot?
8. If you were to implement a new chatbot now, what features would you like to have from the beginning, so that you don't have to implement them along the way?