

Society and Artificial Intelligence: Chatbots in the Educational Process

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Abstract

One of the most important sociological phenomena in the current panorama is Artificial Intelligence (AI). In the near future, the application of this type of technology is expected to revolutionize different social sectors, such as health, marketing, industry, communication, etc. Inevitably, this will prompt changes in certain social structures. A recent response to this has been the outlining of the first European AI law, which will come into force in 2026 to regulate different social challenges. The educational sector will also need to adapt to face the social changes brought about by AI. In this chapter we focus on the potential and/or limitations that chatbots have for the educational community and how these are geared towards the self-regulation of learning. The application of these types of programmes, based on AI, is slowly being incorporated into the educational system as a very useful tool, but it also poses certain challenges to the system.

Keywords: Artificial Intelligence, chatbots, education, society.

8.1. Introduction

In the academic world, Artificial Intelligence offers significant benefits in efficiency in relation to administration, teaching and especially research tasks. AI can handle large amounts of data (Big Data), which makes knowledge in the field of research easier to interpret, analyse, correlate and be accessible to a larger percentage of the population. The different AI applications, pro-

grams or assistants that are being introduced in primary and secondary education today take three different forms: 1) intelligent conversational software agents (chatbot); 2) the creation of online platforms for self-learning; and 3) the use of educational robotics. Chatbots have proved to be very useful when tutoring students; they are capable of answering and addressing questions and adapting to the student's learning. During the COVID-19 pandemic, the creation and use of online platforms was widely adopted, creating very efficient learning spaces. In this scenario, educational robots can be useful when carrying out collaborative learning, developing practical cases in a fun and more entertaining way (Moreno, 2019, p.263-265).

The possibilities that AI offers as a methodological resource look very promising in the field of educational. This is reflected in one of the objectives set out in the latest Spanish education law, Organic Law 3/2020, of December 29, to adapt the educational system to the challenges of the 21st century, which includes the use of AI.

A rigorous and scientific analysis of the social and economic impact of AI in education is therefore necessary in order to address the challenges and risks faced by the educational system as a consequence of the new scenarios derived from the development of AI. In this discussion, the analysis focuses on chatbot programs applied to education.

8.2. Society, Artificial Intelligence and Education

We currently find ourselves, through our growing knowledge of AI, at the gates of a new technological revolution that will exponentially change all areas of the lives of individuals and society. Opinions range from the most optimistic to the most pessimistic, from a future free of cares to one of the loss of free will, with humans being under the control of machines and robots. We lurch from hope to despair, and back again. In a scenario where we have seen the potential power of Information Technology, we still lack all the information to make a safe and accurate diagnosis. Thus, while our quest for knowledge and our adaptability pushes us to embrace the future, our anxieties and concerns make us hesitant.

Since the middle of the last century, progress has been made in the development of new technologies, and this has been accompanied by the theorization of what could happen in the individual, collective, productive, economic, environmental, educational, and health spheres, to name a few. The field of social sciences defined the new emerging society as the information and communication society. Other definitions followed suit: knowledge society (Bell, 1976), network society (Castells, 1999), risk society (Beck, 1998) and liquid society (Bauman, 1999). Nevertheless, the one thing that united all these theories and research was the important role that knowledge and its influence on information and communication would play in the future. This led to the question, yet again, of who would control this knowledge and how it would be used in everything related to digitalization, globalization, production methods and the future of science.

Although the development of these new technologies came from those who had economic power rather than political power, it was soon clear that individuals and social groups could collaborate in the construction of this new reality, possibly leading to an even greater democratic participation in decision-making. However, the onset of the new century saw the rapid growth of technological innovations and their application in all spheres of life, and this increased the uncertainty and anxiety in the minds of individuals and institutions. This has been further exacerbated by the current global crisis in areas as fundamental as politics, the environment, the economy, social inequalities, health epidemics, war conflicts, communication networks, education, and new types of disinformation. In other words, we find ourselves in a panorama of instability, of continuous, persistent change. In addition to this, there are enormous advances being made in the field of genetics, nanotechnology and robotics (Ray Kurzweil), all of which means that the use of AI in a global context poses, at the very least, a source of concern. This evident revolution, which is no longer so latent, must be contemplated as a sudden interruption of the historical continuum, a rupture of the existing social and economic order, from what has been a progressive conception of history.

Recently, faced with this rapid and immense revolution in AI and the systemic risk it presents, state and interstate governments, under a degree of sociopolitical and economic pressure,

have taken the first steps towards managing this risk by establishing legislative processes to ensure that those at the core of this revolution are not large multinational economic groups whose partiality and exploitation of social and individual control is primarily for economic gain. To manage this risk, the role of civil society, the media and education is extremely important.

In this new emerging society, in which wide-ranging changes are already occurring at an unprecedented rate, where AI will occupy a prominent place, education is a key tool to define not only how society should be configured, but who can access these new technologies, under what conditions, when and how. Training, learning, and improving the skills of citizens and workers for current and future times is an essential requisite. Since the current mode of intervention in political decision-making is strongly related to the existing education model, it is appropriate to analyze the interrelationship between AI and education. That is the focus of this chapter.

As a reference framework for education, we refer to the 2030 Sustainable Development Agenda, approved by the United Nations (UN) in 2015, whose Sustainable Development Goal (SDG) number 4 is the following: 'Ensure inclusive, equitable and quality education and promote lifelong learning opportunities for all'. For consideration in line with this objective is the UNESCO requirement of a human-centered approach to AI, where the objective is to "include the role played by AI in solving current inequalities in terms of access to knowledge, research and the diversity of cultural expressions, and ensure that AI does not widen the technological gap within and between countries" (UNESCO, 2023).

With this in mind, UNESCO prepared educational material (UNESCO, 2021) aimed at promoting the training of those responsible for formulating educational policies related to AI, in order to promote shared understanding of the opportunities and challenges that AI provides in the field of education. The document is a guide on how to proceed in the face of the influence of AI in education, how to improve education and what to do to achieve SDG 4, highlighting, above all, the role of AI in its ethical, inclusive and equitable role, the improvement of teaching and learning through AI, and the coexistence of individuals with new emerging educational trends.

8.3. Artificial Intelligence: A Brief Historical, Conceptual and Normative Contextualization

Historical contextualization

The genesis of Artificial Intelligence can be pinpointed as coming from the work of the American neuroscientists McCulloch and Pittis (1943). These scientists created the first neural calculation model with which they tried to imitate the behaviour of the brain's neurons. Years later, Alan Turing (1950) published a paper under the title "Computing Machinery and Intelligence", in which he raised the question of whether machines could think, which gave rise to the Turing test (a tool to evaluate whether a machine has intelligent behaviour). Subsequently, in 1956, a group of scientists from the fields of computer science and neural networks met at Dartmouth College with the aim of presenting various projects related to games and reasoning programs. Very little came out of that meeting, except for the origin of the term Artificial Intelligence, a concept coined by John McCarthy (1956) to name this new line of research, which was an independent and specific field within computing. MacCarthy, as indicated in the Recovery, Transformation and Resilience Plan (2023) of the Spanish Government, defined AI as "the science and engineering of making intelligent machines, especially intelligent computer programs" (para. 10).

In the 1960s, there was a hiatus in the development of this technology due to its elevated cost, which meant it was only feasible in large research centres. An important milestone in this decade was the creation of the programs Logical Theory and General Problem Solver (GPS), both developed by the Americans Newell and Herbert (1972), and which were used for the resolution of mathematical theorems and problems in general. According to Pertusa (2023), the 1970s and 1980s were decades in which AI made great progress, especially in the workplace. Many companies, through this technology, saw how they could improve efficiency and effectiveness ratios in their workers, so the implementation of this technology gradually spread over the decades that followed. Starting in the 1980s and 1990s, large computer programs were at a much more advanced stage in

terms of information processing capacity; the algorithms were increasingly more complex, had the capacity for autonomous learning, and were designed for decision-making. Implementation of these computer programs experienced a boom in the sectors of medicine and business management. Over the last twenty years, progress has focused on robots. These machines are capable of interacting with the physical world; they can maintain contact with humans through language, develop learning techniques, and manage large amounts of data. In the current decade, AI is expected to continue evolving, with greater implementation in all sectors of society, such as medicine, robotics, autonomous driving and learning. We are at a complex moment in time in light of all the sectors affected and the uncertainty generated by AI, especially in the world of work, where it is feared that many jobs will disappear. We are facing what some refer to as the fourth industrial revolution. In the future, according to Arbeláez (2021), AI will be able to introduce specific approaches such as symbolic AI and machine learning. By imitating human thinking, symbolic AI uses algorithms to solve real-world problems and specific situations, while machine learning, through mathematical models, can handle large amounts of data, create classifications and provide results. Both approaches are important for natural language development and future AI programs.

These complex machines can learn and adapt as they interact with the environment. As sociologist Edgar Morin stated (*El País*, January 28, 2024), “technology progresses, thinking regresses.”

Concept of Artificial Intelligence

Artificial Intelligence aims to imitate human intelligence in its ability to communicate, think, react and even reason. According to the dictionary of the Royal Spanish Academy (2023), it is a “scientific discipline that deals with creating computer programs that execute operations comparable to those carried out by the human mind, such as learning or logical reasoning.” Authors on the subject of AI put forward varying definitions of this technology. The different versions that exist usually refer to rationality or human behaviour regarding the efficiency of this technology.

To contextualize the concept, we can cite a few of the many definitions. Alluding to the creators of this discipline, AI could

be defined as “the use of computer programs and programming techniques to shed light on the principles of intelligence, and on human intelligence in particular (Boden, 1984, p. 28). Alternatively, a less specific definition would be “a set of techniques, algorithms and tools that allow us to solve problems for which, a priori, a certain degree of intelligence is necessary, in the sense that they are “problems that challenge even the human brain” (García, 2012, p.5). We also have the definition put forward by the Ministry of Science, Innovation and Universities of Spain (2019) that “Artificial Intelligence can be understood as the science and engineering that allows us to design and program machines capable of carrying out tasks that require intelligence to be completed” (para. 12).

Given these definitions, and especially considering the challenges that this technology poses on the global scene, “sociologists will have an essential role in this. At the moment, computer programs imitate a human mind, as if they were individual and autonomous minds, but the human mind is basically social” (Collins, 2009, p.188). If we want robots to be more like humans, we must take into account the social dimension. In other words, our social interaction with others, our thinking, our emotions, and our intelligence depend on the social relationships we engage in.

Regulatory framework for Artificial Intelligence

One of the main issues on the agenda of Western leaders is the advancement, investment and progress of this technology and, consequently, there is concern as to how to ensure it is regulated. Industry and large companies that use technology want to delay its regulation for as long as possible, since, with no ethical and moral limits, they can take advantage of this legal loophole.

On December 11, a draft of the first European regulation on Artificial Intelligence was established by the Presidency of the European Parliament and the European Council. The Government of Spain, on its electronic administration portal, indicates that the main objective of this draft is that all programs marketed in European territory must respect fundamental human rights and European values; otherwise they will be prohibited. This provisional agreement currently forbids “cognitive-behavioral

manipulation, non-selective removal of facial images from the Internet or CCTV images, emotion recognition in the workplace and in educational institutions, social scoring, biometric categorization for inferring sensitive data, such as sexual orientation or religious beliefs, and some cases of predictive policing for individuals” (para. 14).

8.4. Attitudes and Perceptions towards the Use of Artificial Intelligence in the Classroom

It is clear that the incorporation of Artificial Intelligence in education calls for pedagogical models to change and adapt. Changes are being implemented gradually, but in the immediate future, teaching-learning methods at a global level need to undergo an educational revolution. Let us now look more closely at attitudes and perceptions regarding this technology, especially those of teachers, by reviewing a set of recent studies.

One of these studies is the latest Ipsos Global Education Monitor (2023), which analyses the latest advances in the objectives set by the European Union in terms of education. This report includes a country comparison, key education indicators and information on recent and ongoing policy developments at all educational levels in EU countries. A survey was carried out in 2023, in 29 countries, with a sample of 23,248 adults across Asia, North America, Latin America and Europe. The report concludes that teachers’ attitudes towards the use of AI are generally positive, but not equally so in all countries. One in five thinks that it will have a negative result on students. Curiously, among the countries that think that this effect will be more negative than positive are countries such as Canada, France, Italy and the United States. Moreover, the report states that, in most countries, one in three thinks that AI should not be banned in schools. Regarding teacher training, in general terms, more than 65% think that teacher training is necessary; in Spain, 62% consider it essential.

Another report that also provides interesting data in this regard is the one carried out by the research institute of the technology consultancy Capgemini (2023), which surveyed teachers, family members and students, with a sample of 7,200 respond-

ents across Asia, Europe and North America. In this report, a significant number of teachers were concerned about the ChatGPT program, with 48% of them having either banned it in the classroom or restricted it for specific activities, since they believed that creativity and writing could be affected. Despite this perception towards this program, the majority of people surveyed approve the benefits of AI programs in general and consider that study and evaluation plans need to be adapted to this technology; 85% believe that education in digital skills is beneficial for the future of students and that the positive consequences outweigh the risks.

8.5. Chatbots as a Methodological Resource in Learning

What are chatbots?

Among the AI programs being developed in the 1960s was the so-called ELISA program in the United States, in 1966. This program was the origin of chatbots, and aimed to give the impression that a person was talking to another person instead of to a machine. Chatbots continued to be developed with limited success, until the beginning of the new millennium with the arrival of Smarter Child, where communication could be maintained in a colloquial style using natural language. This program made its foray into platforms like Messenger and was very successful until 2007, when a problem with the patent and a buyout by Microsoft made it disappear. Since then, other types of assistants have come into our lives, such as Siri, Google Assistant, Alexa, etc.

When defining chatbots, authors express varying views; some differentiate them from virtual assistants and others view them as the same and interchangeable. What authors do agree on is that the differences are rather technical, thus, for us non-experts, we will consider Chatbots and virtual assistants as the same thing.

We could say that a chatbot is an assistant or conversation program between a person and a machine: “chatbots are programs that can interact with users using natural language. They are virtual assistants capable of establishing a dialogue between

a computer and a human, either by writing text or using their voice” (Dimitriadis, 2020, p.47).

They act by giving responses that have been programmed or structured in advance. In the most complex ones, mathematical models are used, such as algorithms, which make these machines learn automatically, and they can interact with humans by processing natural language.

Chatbots in education

Since the COVID-19 pandemic, there has been a boom in learning platforms, and especially chatbots. The pandemic has been an important milestone in the development and use of chatbots by students, teachers and families. People discovered the benefits of these programs, where anyone could connect and resolve problems from anywhere in the world and at any time, without the need for a teacher to be present.

Chatbots develop different educational functions. On the one hand, there are those that offer administrative assistance and guidance in the educational and academic field and, on the other hand, those that focus on learning and teaching, through which tutorials can be delivered, exercises presented and activities completed to achieve the pedagogical objectives through a very efficient interactive role.

The following examples are among the most used Chatbots aimed at pedagogical work. Firstly, virtual assistants (these answer questions and help to learn) are among the most used: Duolingo is popular for learning languages and grammar, adapting to the student’s level; and Mathbot is used for learning mathematics, with each problem being explained step by step to facilitate understanding of the process. Secondly, there are intelligent tutoring system programs (these analyze the student’s evolution, identifying the tasks in which the student needs to improve, and adapting the content to meet this need). Among the most popular systems are the programs Dreambox Learning and Thinkster Math, which are both used in the subject of mathematics and follow the student’s evolution, adapting the contents and explanations to his/her level, and clarifying doubts along the way. Lastly, there are adaptive learning platforms (these enable the creation of personalized content for each student based on his/

her needs), such as Smart Sparrow, which allows teachers to personalize teaching experiences at different levels and to meet the different needs of their students.

A teacher's choice of chatbot will depend on the specific skills he/she is looking to teach, as well as the methodology to be used in learning. In summary, from the presented examples of these programs, and depending on the task being performed or the pedagogical objective for which each activity is intended, chatbots can be framed or classified within the following four aspects: 1) learning; 2) resolution of problems or doubts, both administrative and teaching; 3) tutoring; and 4) adaptive or individualized content.

Some authors propose a broader classification, classifying chatbots according to: administrative or management tasks; frequent questions; student support; motivation; practice of skills and abilities; simulations; reflection and metacognition; and learning evaluation (Brustenga et al., 2018, p.19). What is evident is that this technology has many adaptive capabilities in the field of teaching and learning.

8.6. Advantages and Challenges of Chatbots in the Educational System

According to studies carried out regarding chatbots in the field of education, the results are very positive; "the objectives of chatbots in education can be described by one of the following categories: improvement of skills, efficiency of education and motivation of students" (Wollny et al., 2021, p.7). In general, students are more comfortable and motivated using technology; today's students were born in the technological era and their socialisation with these types of programs, video games, etc., is part of the norm. They feel much more comfortable talking to a machine which does not control them and does not make value judgments, where the relationship is more one-to-one. Even the visual format can be very attractive, which encourages students to express themselves with greater freedom. Another important aspect is the personalization of learning. By adjusting to the pace of learning of each student, these programs are invaluable in

tackling school failure. They are particularly important in supporting children with various disabilities, who struggle to learn in the classroom, by enabling them to continue at the same pace as the class. Interactive learning, therefore, encourages students to make their own decisions about their own learning, increases their self-perception and reinforces their confidence. The self-regulation of learning has a lot to do with the socio-constructivist theory, which points to the student as the main author of his/her knowledge and learning; the student has to be able to learn and solve problems and situations on his/her own, with the role of the teacher as a guide and mentor. In meetings to adapt university studies to the Bologna Plan, those present welcomed this form of learning, valuing it highly. Learning by competencies has also been incorporated into primary and secondary education and, therefore, chatbots offer an enriching tool to learn and work by competencies. Having the ability to organize one's own learning is considered one of the basic competencies in the learning process and has therefore become a relevant competency within the framework of the current strategies of the European Union (2018).

There are authors, such as Zimmerman (2008), who consider the self-regulation process as an open process consisting of three phases. The first phase is the planning phase, where the activity to be carried out is firstly organized, driven by the desired outcome, the reason for doing the task, etc., which are factors that promote student motivation. The second phase covers self-control, self-organization, and self-learning. The third phase is the assessment of the work learned and an analysis of strategies for the next activity.

The majority of studies on the advantages of chatbots focus on students, especially on knowing their perception of this technology and evaluating their academic results from its use. However, the role of teachers has been less studied. One of the advantages for teachers, achieved through the use of technology, is that they no longer need to be the owners of knowledge, since there is an entire virtual world of knowledge where books are no longer the tool for learning. Teachers can direct students as to where to go for the answers. The teacher's role becomes one of helping students develop critical, personal, emotional and intellectual analysis skills, using technological tools. With this shift away

from the traditional method of transmitting knowledge, the teacher can focus on other issues related to the learning process.

One of the disadvantages of this technology is that programs are usually created by large companies, and this means that they often do not meet the proposed learning objectives. To better understand the educational needs, there must be greater collaboration between teachers and the companies that create these educational tools. There are very few chatbots available that have been created by teachers. Many teachers lack the skills required to manage the complexity of the programs, and need to be offered training. Likewise, teachers need to be involved more directly with companies in the preparation of teaching guides and their objectives. These teaching programs can be adapted to meet the needs of individual students, which is one of the benefits of using these programs, but this is beyond the scope of most teachers, and collaboration is required between educational agents and companies or publishers.

Another disadvantage is that the technology, content and activities are not well-adapted to students with disabilities, thus this area needs more attention, particularly to help teachers work with families in a more fluid and communicative way, participating in the learning process through chatbots. One of the variables that appear in the Pisa reports is the importance of family involvement in the educational development of the student. There are several studies that support the idea that the greater the degree of participation of families in the learning centres, the better the students' academic results. Among some examples are the Rimkeby School in Stockholm, or the studies carried out at Harvard University, where they have a specific line of communication between family and education. Chatbots could further promote communication and facilitate tutoring between families and teachers.

The authors Okonkwo and Ade-Ibijola (2021) identify possible issues that will need to be addressed. Firstly, there is the ethical issue: What is going to happen to our privacy? Where is our data going to go from conversations? Secondly, how is this technology going to be evaluated? These authors point out that, at the moment, we have few tools for this task. Thirdly, there may be negative effects regarding the student's attitude when implementing this tool. Lastly, investment is needed in programming

the appropriate responses of the human language, and having the adequate time and resources to carry out each of the appropriate adaptations of the programs.

It is evident that the role of teachers is going to change, and this poses a new challenge in the generation of learning situations, which will require a review of the study plans of the Faculties of Education Sciences and of course a radical change in the education system. Society is changing and teacher training has to change to be in line with the new social realities. For this to happen, a greater investment in technological resources and training is needed. Let's hope we are not too late.

8.7. Conclusion

It is evident that AI is part of our lives and its development and implementation in the immediate future is unstoppable. The educational system is not blind to this; for some years now, educational processes have been carried out through platforms and conversational assistants such as chatbots.

Chatbots designed with pedagogical approaches in line with educational needs and projects are an invaluable tool that has achieved very good academic results for both students and teachers. These pedagogical approaches have to be based on theoretical models, such as the socio-constructivist theory.

We must continue our research into chatbots, creating new chatbots that can offer a more individualized approach to learning, particularly for students with disabilities. Further studies are also needed on how to involve the family as a member of the school community in accessing these chatbots.

The school community (teachers, students and family) must be involved in the development of these programs or assistants; they must be part of the design, development, and implementation and evaluation process. Most programs are led by technology companies, often ignoring the teaching needs. These companies pay more attention to general content of the subjects than to competencies and pedagogical foundations. Understanding the needs of the students who will be using these assistants is essential. To this end, joint collaboration is necessary. Despite all the possibilities and potential of these programs, chatbots are

still mainly used in subjects related to science and language learning, with an obvious gap in social sciences.

One of the great challenges posed by these assistants is the training of teachers, and the new role they face within the teaching-learning process in a society where knowledge is no longer only in the hands of teachers. Teachers need to adapt their role, putting the teaching focus on imparting values and a critical view of the world around us.

In order to meet the objectives, set by the Spanish Government in this regard, and by the rest of the countries of the European Union, further investment in education is required. Not all students have the same resources to access technologies, and our education system, although it is adapting, is doing so very slowly.

In line with the development of AI, which is occurring at a rapid pace, there has to be the development of legal guidelines. The European Union needs to regulate more efficiently the ethical aspects that we are facing today. This is even more important when we consider that the education sphere affects our young population, and failure to manage this effectively can have complex consequences for the future.

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