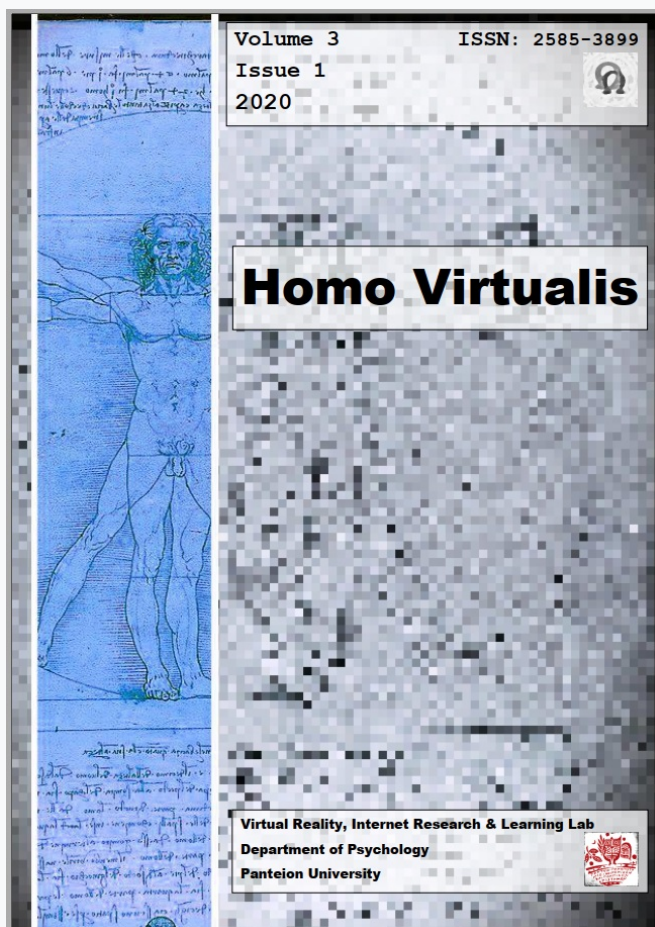


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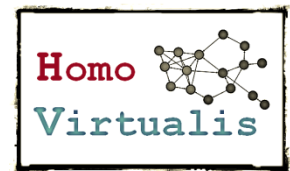
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## Evolution in Education: Chatbots

George Dimitriadis<sup>1</sup>

**Abstract:** Artificial intelligence (AI) programs that simulate interactive human conversation, known as Chatbots, are one of the ongoing trends in the global market. Companies adopt Chatbots in order to offer better services to their customers. Businesses have realized that they are able to enhance the process of customer engagement and operational efficiency through Chatbot technology. Furthermore, most of us have experienced communication of this form in many aspects of our everyday life. This paper examines how Chatbots have evolved over the years, what the advantages and disadvantages of using them are and tries to explain the rise taking place nowadays. Subsequently, it explores the potential of applying this technology in educational settings. Personalized and adaptive learning seems to be imperative today and Chatbot technology can offer invaluable services towards that direction. Finally, it investigates the possibility of using them as virtual teaching assistants relieving teachers from the burden of repetitive tasks and helping them focus more on providing quality education to their students.

**Keywords:** *Chatbots, Education, Artificial Intelligence*

### Introduction: Chatbots

Chatbots are programs that are able to interact with users using natural language. They are virtual assistants who are capable of engaging in computer-to-human dialogue either by typing text or by using voice. They first appeared in the 1960s with the developers' initial goal being to make users believe they were communicating with a real person (Shawar & Atwell, 2007). The first Chatbot was created in 1964

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under the name ELIZA and was a program designed for studying Natural Language Communication (NLP) between man and machine (Weizenbaum, 1966). ELIZA's function was based on analyzing incoming sentences, identifying keywords and matching them to answers.

The development of Chatbots has been rapid ever since as it made easier for users to communicate with computers by making greater use of their natural language. While initially their function was based on simple techniques that corresponded to a user input response, with the development and improvement of technologies such as data mining, machine learning and the application of modern architectures and standards in their design, potential interlocutors have substantially improved their capabilities. Today, they have become an integral part of life as large companies have developed numerous Chatbots, offering a variety of solutions in the business sector, customer support, information retrieval systems, entertainment as well as in science for research purposes (Colace et al., 2018).

Big IT companies could not ignore these developments. So, the Big Four, Apple, Microsoft, Amazon and Google, have taken the issues seriously by investing in the creation of their own Chatbot<sup>2</sup>. Apart from that there are thousands of Chatbots aimed at covering a wide range of functions and capable of integrating into well-known messaging platforms (Dale, 2016).

Human communication with a Chatbot has particular psychological dimensions. In such an interaction, human brain is under the impression that he/she is talking/interacting with/to another human being. This creates an environment where the human being perceives this interaction in the wrong way, imparting human characteristics to the Chatbot that do not really exist. This attribution of human characteristics to non-human beings, objects, physical or not phenomena, is a natural tendency of man called *Anthropomorphism* (Anthropomorphism, n.d.). In the case of computers this was something expected since they consist of memory, they use a language, they get viruses and have some degree of autonomy. In fact, the tendency in recent years has been to give computers a greater humanoid dimension (Margalit, 2016).

According to Margalit (2016), treating Chatbots as humans can make significant changes in the way people interact. The human brain has an innate tendency to prefer simplification over complexity. Thus communicating with a Chatbot makes it easy for someone who does not need to be emotionally involved and who knows that his / her interlocutor will not deal with the non-verbal elements that commonly exist in human-to-human communication. In addition, his repeated involvement in such communication leads him to adopt a new mental model that enhances the

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<sup>2</sup> Apple's Siri, Microsoft's Cortana, Amazon's Alexa and Google's new Assistant

"easy" way of interacting. Addiction to it can lead to divergent behaviors in the long run.

Studies have shown that when communicating with a Chatbot, people find that they are in a dominant position, they control the interaction and can lead the conversation where they want (Angeli, Johnson, & Coventry, 2001). This, unconsciously, makes them feel better, boosts their confidence, and gives them a sense of control over their lives. But the fact that they have a dedicated, patient, willing to answer and satisfy their desires chatbot at their disposal can cause problems in their relationships and in their socializing with other people since despite all these characteristics being quite appealing and satisfying the need for contact and communication, they at the same time deprive them from what people need in order to deal adequately with real situations.

It is well known, however, that the misuse of technology is always accompanied by negative consequences. This should not discourage us from the use of Chatbots nor diminish the important role they are increasingly playing in various areas of modern life. Chatbots are currently one of the biggest trends in the commercial sector. Companies use them for providing customer support, for the promotion of their products, for effective team communication in the workplace (Zamolo, 2018). According to Himanshu Rauthan (2019), the results of using Chatbots are extremely encouraging and lead us safely to the assumption that this technology is here to stay.

There are many investors from different sectors of the industry who believe in the potential of Chatbots contributing substantially to their growth. Thus, taking advantage of modern technology capabilities, they have created a variety of products offering the luxury of choice. There are Chatbots that can record users' desired choice through multiple menus, others who use artificial intelligence to process a question and give the proper answer, and others who can process natural language. The purpose of these efforts is to provide the user with a better experience, improved service, advice and guidance.

In recent years the use of Chatbots has shown an exponential increase that is definitely going to continue in the near future. The size of the Chatbot market worldwide is expected to be 1.23 billion dollars in 2025 (Kaczorowska-Spychalska, 2019).

But why does a technology product such as the chatbot, which first emerged in the 1960s and which had a lasting development course, attract so much attention in recent years? Robert Dale (2016) elaborates on the reasons why this phenomenon has taken on such dimensions. In his article "The return of the chatbots" he says that the main reason for this development is the change in the way people communicate nowadays. 50 years after the arrival of ELIZA, 6.1 billion people out of a total population of 7.3 billion, seem to be using mobile messaging. More than 2.1 billion

people use messaging applications. Facebook's Messenger app is used by 1 billion users. For teenagers of today smartphones represent the extension of their hand (Brailas & Tsekeris, 2014). It is obvious that a new type of communication has been adopted characterized by small-scale interactions as well as by participation in multiple asynchronous text messaging exchange conducted with unprecedented ease and convenience. The infrastructure required to serve this type of communication is almost available to everyone and everywhere. What we need to realize is that this infrastructure constitutes an ideal platform, fully functional, that can accommodate Chatbots and provide the perfect environment for them.

According to Dale, 2016 is characterized as the year of the Chatbot (2016). What is argued is the existence of a form of exchange with a machine be it either a digital assistant, a conversational interface or just a Chatbot using natural language. The MIT Technology Review characterizes chat platforms as one of the 10 most important technologies of 2016. Given that human nature has learned to solve its problems through speech (Botanalytics, 2016), we can say that technology is advancing on this basis and we can justify the success of Chatbots which are here to satisfy the same demands taking advantage of the developments in the field of information technology and artificial intelligence accordingly.

The successful adoption of Chatbots in various fields, as mentioned above, the improvement of services where they have been engaged in and the increased use of them in recent years makes it necessary for conducting research into the substantial use of this technology in the field of education as there are numerous educational processes that could benefit from it.

### **The use of Chatbots in the educational process**

The technological opportunities of our age which according to Koskinas (2018) are represented by the virtual presence and existence, have dramatically transformed the environment we live in a global scale. In this new landscape, people have expanded their "socio-cognitive capacities through creativity, collective and collaborative social spaces, social interaction and social learning" (koskinas, 2018, p. 1). As Tsekeris argues in his article "Industry 4.0 and the digitalisation of society: Curse or cure?" the digitalisation of the contemporary world unpredictably altered the content, nature, character and dynamics of social and human experience (2018). In line with the above considerations the educational community could not be exempted from this rule. The use of Technology in Education is becoming imperative nowadays and this among other things is because of demographic and economic factors. The reduced budgets available for educational institutions, the increased number of pupils and the need to provide personalized teaching, have focused research on finding ways and methods for utilizing cost-effective tools that can offer new and up-to-date educational solutions (Belpaeme, Kennedy, Ramachandran, Scassellati, & Tanaka, 2018).

In the field of research, it is well known that positive social interaction between teacher and student contributes to effective learning (Brailas et al., 2017; Du Boulay, 2016). Yet the growing number of students makes it difficult for teachers to interact with and provide adequate guidance. Teaching methods that respect students' particular pace (self-paced learning) appear to be flourishing today (Allaire, 2018). Massive Open Online courses (MOOCs) are more and more offered by top educational institutions such as Coursera, Edx, and Udacity forming the new trend in tertiary education (Shah, 2019).

The focus of the researchers is now on Blended Learning, which, taking advantage of information technology, includes social interaction with teachers and, at the same time, independent and self-paced learning (Gupta et al., 2019).

The development of artificial intelligence (AI) and conversational agents such as Chatbots provide many promising opportunities in the field of education (Goel & Polepeddi, 2016). Koletsi describes Artificial Intelligence as one of the radical technologies of today along with the augmented and virtual reality and blockchain environments that have transformed our lives, our communities and our societies (2019). In the recent years there have been several attempts to recruit Artificial Intelligence in many fields such as in the medical sector for developing a virtual human platform able to provide patients with clinical support and medical diagnosis or for creating successfully a virtual chess player that can adequately compete with Garry Kasparov (Brailas, 2019). As far as the education field is concerned, the use of Chatbots has been tested to a limited extent mainly in higher education institutions (Belpaeme et al., 2018) with the aim to provide students with support in scheduling, reminding dates, information of the courses etc. In most cases they are treated as simple answering machines where users can ask a question and receive an answer. Chatbots are effective in performing repetitive and predictable tasks and can therefore be an ideal tool in university institutions covering much of technical support, enrollment and more.

Georgia State University recently used a Chatbot named Pounce to support the student registration process (Henderson, 2018). Artificial Intelligence and Machine Learning enabled Pounce to be able to regulate his behavior according to the input he received. Over time, he could learn, improve his answers and become more accurate. Research on its effectiveness has shown that the services offered were similar to those of the past but with less human resources. Communication with the prospective students was characterized as equivalent to the past or even better. The prospective students received immediately and precisely the information they wanted without irrelevant details. They could communicate by text messaging, something that today's young people prefer to calling the administration office. They could also be served at any time of the day without being restricted by opening hours or holiday periods. However, Henderson (2018) emphasizes that while Chatbots can be perfect when used in small-scale repetitive functions, it will take

them time to become essential part of the teaching process of a subject such as trigonometry. According to him, just as consumers would not rely on a Chatbot to negotiate the price of a very expensive product, nor would the students whose education and career is what matters the most. Instead they would rather speak to a human.

## Conclusion

Thus, although the key feature of Chatbots is the involvement in a conversation which is known since the Socrates era for its crucial role in the process of learning and teaching, their substantial role in the learning process is still at an early stage (Di Blas et al., 2019). According to Patrick Bii's research (2013) the interactive nature of Chatbots provides many opportunities for social interaction that is crucial for the development of cognitive functions and the learning process.

Adopting Chatbots in the educational process offers many benefits. Voice Chatbots enable the learner to focus more on their learning object by communicating directly with them as opposed to the traditional way of using a computer that requires navigating through various menus using the mouse. They create a sense of pleasure and satisfaction; while at the same time encourage students to express themselves. They can collect some useful data such as feelings, moods and they have the ability to react to unforeseen situations such as increased student anxiety (Di Blas et al., 2019).

Generally, in cases where large scale lectures are held such as in university courses or when massive open online courses (MOOCs) are offered, interactive and personalized support can be achieved by recruiting Chatbots while at the same time minimal financial resources and use of elementary organizational structures are consumed and required respectively (Hone & El Said, 2016).

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## Notes on Contributor

**George Dimitriadis** is a computer science teacher at secondary education schools. He received the degree in computer science engineering from the Technical Educational Institute of Athens and subsequently attended the Pedagogical and Technical School of Patra. In 2010 he received his MA in Digital Technologies and Communication in Education (DTCE) from the School of Education, University of Manchester. Currently, he is a PhD researcher in the Psychology Department at Panteion University. His research focuses on the application of virtual communities in the educational settings.