Talk2Learn: A Framework for Chatbot Learning

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Abstract. The rapid expansion of technologies in the education sector has led to the development of innovative pedagogical approaches being integrated with new technologies for enhancing the learning experience. Virtual assistants or chatbot technologies have been one of the primary focus in streamlining and enhancing learning processes by integrating pedagogic approaches with innovative technologies. This paper focuses on analyzing the recent developments in educational chatbots, as well as the identified issues in the design, development, and application of chatbots in e-Learning. Accordingly, a framework that reflects the various factors that need to be considered in chatbot design and developments in e-Learning is proposed and discussed in this paper.

Keywords: Chatbot Learning · Virtual assistants · E-learning · M-learning · Technology enhanced learning · Conversational agent

1 Introduction and Background

The effective use of e-learning technologies enhanced the learner's experience in various ways [1]. For instance, Game-enhanced learning [2] and mobile learning [3] use a spectrum of tools and approaches to improve the e-learner experience based on contexts. However, lessons learnt from current e-learning practices proved that most of the above-mentioned approaches are combined to achieve the overall learning objectives. Such multimodal e-learning approach reflects the multi-faceted nature of e-learning. Embedding virtual assistance in e-learning should provide value to students while they are creating, sharing and participating in various learning activities. The recent developments in Artificial Intelligence (AI), Machine Learning (ML) along with robust linguistic processing tools, has leveraged the applicability of chatbots or virtual assistants across various commercial applications [4]. However, this needs to be applied into educational contexts to allow students to personalise their learning and use more inclusive pedagogical approaches, e.g., socially oriented. Despite the growth in

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Chatbots implementation, a substantive research gap in methods and frameworks that may help in developing chatbots applications is noticed. Hence, a framework for developing chatbots for e-learning is proposed in the next section.

2 Talk2Learn Chatbot Learning Framework

Given the above-mentioned drawbacks, Talk2Learn Chatbot Learning framework, shown in Fig. 1, is proposed. It is composed of the following twelve elements:

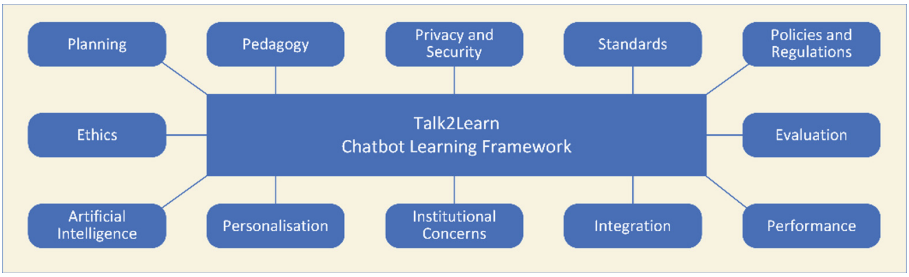

Fig. 1. Talk2Learn Chatbot Learning framework.

2.1 Planning

Rigorous planning is inevitable in technological innovations and it becomes more important in chatbot platforms. Planning includes requirement elicitation, and requirements management associated with processes and policies to apply evolving changes in educational contexts during design, development and transition phases.

2.2 Pedagogy

Effective chatbot platforms should be able to accommodate relevant pedagogies and learning approaches adopted in educational contexts. Learning is a complex process that includes various dimensions such as: assessment, learning, reflections, self-regulation, collaborative-based or connectivism-oriented learning approaches.

2.3 Policies and Regulations

The demand on chatbot technology is rising across various industries. However, the success of such innovations is not restricted to their capabilities. It includes processes that govern who is doing what and how. This can be formalised in policies and regulations. Responding to this gap is intrinsic because mistaken responses given by chatbot might lead to learner's misconceptions, student failure and further consequences.

2.4 Ethics

Chatbots are seamlessly connected with various data repositories which process enormous amount of data. This highlights the importance of the ownership of the information shared by chatbots and the ethics of collecting, sharing, processing, and other use cases associated with information manipulation.

2.5 Artificial Intelligence

Artificial Intelligence, Machine Learning, Language processors and Semantics Analysers are few technologies related chatbot development. However, such technologies are changing rapidly according to the continuously evolving requirements, rising demands, process automation. Furthermore, various Voice Recognition, Natural Language Processing technologies need to be investigated.

2.6 Privacy and Security

Privacy and security are the two factors consistently discussed during the application of technology in any setting [8]. These concerns recently increased due to the amplified abilities of machines in understanding, analysing data and capturing semantics out of thee. The rising concerns over these two issues can be attributed to the loopholes in the technology applications. Privacy and security need to be considered in chatbot development as they are developed to directly interact with humans.

2.7 Personalisation

Personalisation is one of the most important functionalities of chatbot applications in relation to learning [3]. The intelligent conversational agents must be able to recognise the user behaviors, needs, expectations and abilities. Accordingly, they need to adopt various personalised pedagogic approaches for individual users in order to enhance and improve their learning processes [5].

2.8 Performance

The performance factor can be analysed in two folds. First, the ability of chatbot applications to provide prompt responses that have quality information and services. Second, learners' performance improvement when using these applications for educational purposes, based on indicators such as user satisfaction, learners' marks, etc.

2.9 Evaluation

There is a limitation of available evaluation studies for chatbot applications. Therefore, there is a need to develop sufficient methods and processes for evaluating these applications from various perspectives. These concerns include those users-oriented, developers-oriented, technological-oriented, etc. Such evaluation needs to consider realness or naturalness in the conversation as well as the quality of conversation.

2.10 Standards

Despite chatbots development having gained popularity, few studies focused on identifying the standards for the development of such a platform and its applications. Hence, there is a need to develop universally-recognised standards and to use these when developing chatbot platforms.

2.11 Institutional

This institutional aspect acts as an umbrella for all related institutional concerns such as resources, support, and so on. Generally, these concerns belong to the following clusters. First, academic concerns where academic knowledge and supportive information are represented to chatbot applications. Second, administrative concerns where resources, support, terms and conditions, service quality can be addressed.

2.12 Integration

One great challenge of a chatbot application is its ability to efficiently co-exist with other educational systems and services. Currently, most of the universities have a various e-learning services including virtual learning environments, students record systems, etc. Effective chatbot applications should be able to co-exist with other systems, exchange and process data, etc. Current e-learning standards such as LTI are not sufficient to be extended to include chatbot applications.

3 Conclusion and Future Work

The paper has discussed various aspects relating to e-learning, virtual assistance and the development of chatbot applications in the field of e-learning. Various issues have been identified in the context of chatbot applications development, their usage and management in e-learning context. It has been shown how chatbots have a huge potential for revolutionising learning through effective human computer interaction in a natural setting. Talk2Learn framework for chatbot learning has been presented in this paper to guide the process of educational chatbot design and development. Currently, researchers are in the process of implementing Talk2Learn framework to develop different educational chatbots prototypes using various technologies. The extended version of this work will be based on real use cases from authentic learning experiences to measure the actual impact of such technologies on learning and teaching.

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