Opportunities and Challenges in Using AI Chatbots in Higher Education

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ABSTRACT
Artificial intelligence (AI) conversational chatbots have gained popularity over time, and have been widely used in the fields of e-commerce, online banking, and digital healthcare and well-being, among others. The technology has the potential to provide personalised service to a range of consumers. However, the use of chatbots within educational settings is still limited. In this paper, we present three chatbot prototypes, the Warwick Manufacturing Group, University of Warwick, are currently developing, and discuss the potential opportunities and technical challenges we face when considering AI chatbots to support our daily activities within the department. Three AI virtual agents are under development: 1) to support the delivery of a taught Master's course simulation game; 2) to support the training and use of a newly introduced educational application; 3) to improve the processing of helpdesk requests within a university department. We hope this paper is informative to those interested in using chatbots in the educational domain. We also aim to improve awareness among those within the chatbot development industry, in particular the chatbot engine providers, about the educational and operational needs within educational institutes, which may differ from those in other domains.

CCS Concepts
•Information systems → Information retrieval → Users and interactive retrieval → personalisation

Keywords
Chatbot; AI in education; personalised educational service; AI in educational simulation; AI in application training; AI in helpdesk support; intelligent systems.

1. INTRODUCTION
A chatbot is an artificial intelligence (AI) automated software tool that simulates a conversational interaction'between the user and a computer, using natural language [1]. Where chatbot technology is enabled, the end user is able to 'talk' to a pre-built AI chatting robot, rather than a human individual [2].

AI conversational chatbots have gained popularity over time, and have been widely used in the fields of e-commerce, online banking, and digital healthcare and well-being, among others [3,4]. The technology has the potential to provide personalised service to a range of consumers [5,6]. However, little work has been done in the context of using the technology in educational settings. In this paper, we present three chatbot case studies recently conducted by the Warwick Manufacturing Group, University of Warwick. Three AI virtual agents are under development, with potential opportunities: 1) to support the delivery of a taught Master's course simulation game; 2) to support the training and use of a newly introduced educational application; 3) to improve the processing of helpdesk requests within a university department.

2. RELATED WORK
Chatbots have become popular in both business and healthcare settings. Liao and her team have developed a fashion chatbot to help customers to search for fashion products based on their style preferences [3]. Ko and Lin have developed a chatbot to manage business cards [4]. Madhu and his colleagues [5] have developed a medical agent to a medical agent capable of suggesting possible ailments based on the person's stated symptoms, and give a list of potential treatments. Fadhil and Gabrielli have developed a chatbot to provide nutrition education and promote healthy lifestyles [6].

The use of chatbots within educational settings is still limited. Some works have been conducted to support both online and mobile learning: For example, some chatbots have been created as intelligent tutors to teach foreign languages, such as English [7]. Verleger and Pembridge have created a chatbot to teach computer programming language [8]. Lee and Fu have used chatbots to support peer assessment [9].

Some chatbots have been created which embed elements of other latest technologies: For instance, Dascalu and Bodea [10] have developed a job interview training chatbot which has used both VR and AI technologies. Park and Jeong have developed an indoor dialog chatbot working in a mixed reality environment [11].

3. METHODOLOGY
Our pilot study investigated the feasibility of introducing chatbots in higher educational contexts through the following research questions:

- How can chatbots be used within a typical university in the United Kingdom?
- What are the potential benefits and technical challenges of introducing chatbots in a university setting?

We considered three case studies in the areas of educational simulation, educational software' training, and helpdesk support, to support our study. In each case study, an AI virtual chatbot prototype has been proposed.

4. CHATBOT PROTOTYPES

In this section, we will briefly present the prototypes we are developing, together with the approach we adopted to build these chatbots.

4.1 Chatbot in Educational Simulation Game

We created a simulation bot to support the delivery of a simulation game within a taught Master's module. In this simulation game, the chatbot acts as a virtual customer who aims to do business with a different company from the one they currently use. Students act as the current company's salesperson; they must talk to this virtual customer and do their best to retain them as a client. In order to retain the customer, students must successfully present four selling points that the current company provides. A selection of chat massages are displayed in Figure 1.

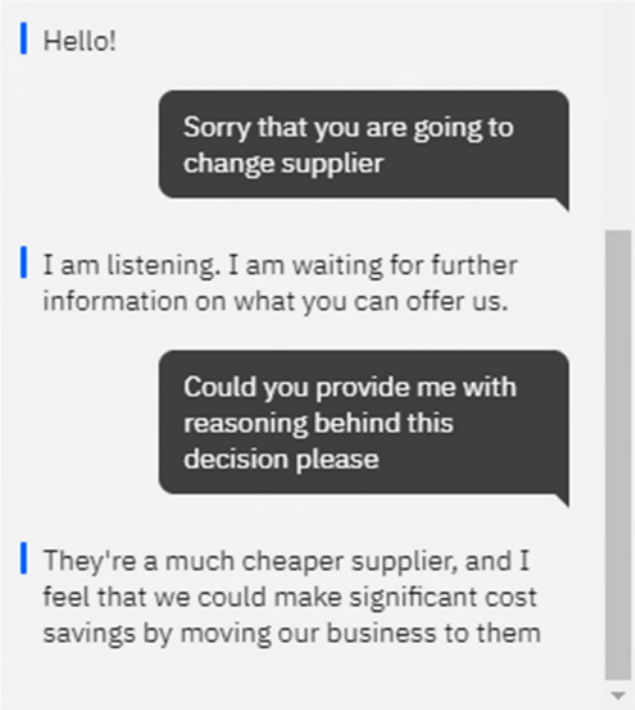

Figure 1. Simulation chatbot response snapshot

4.2 Chatbot in Educational Application Training

A reading list bot has been developed to support the training of users of a newly introduced educational software—the digital reading list. A digital reading list system was recently introduced to many UK universities, in order to allow library reading resources to be better managed by librarians, teachers, and students [12]. Teachers can generate a digital reading list for each of their courses. Students can view these lists, which inform them exactly where, when, and how to access each book in the library, based on the information provided in the list. However, a significant number of users do not know how to use this software, as it is a newly introduced educational application. The chatbot will act as a virtual tutor to instruct teachers and students on how to use the software, and train them to solve basic technical issues on their own as necessary. A selection of chat examples are presented in Figure 2 below.

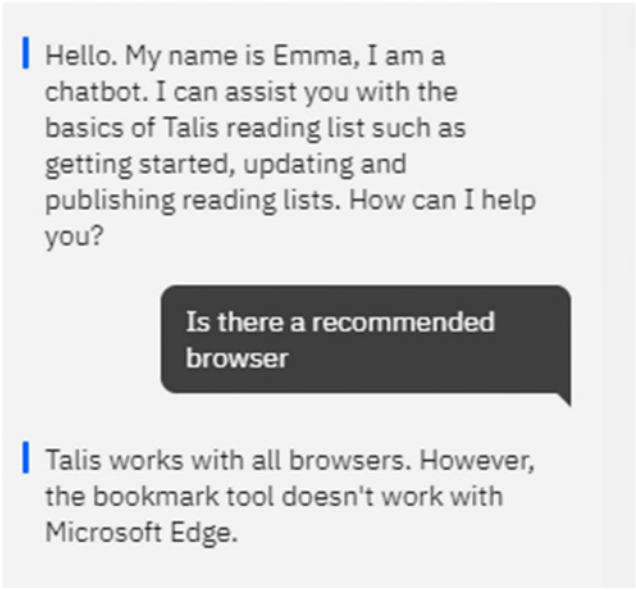

Figure 2. Reading list chatbot response snapshot

4.3 Chatbot in Helpdesk Support

As one of the largest departments within the university, we receive hundreds of requests from our students and staff every day. At times, the helpdesk cannot respond to these requests quickly enough, due to large workloads and staff shortages during holiday periods. A helpdesk bot was introduced to answer frequently asked questions, to respond to basic requests, and to guide users in effectively submitting helpdesk requests to the correct teams. A selection of chat messages are shown in Figure 3.

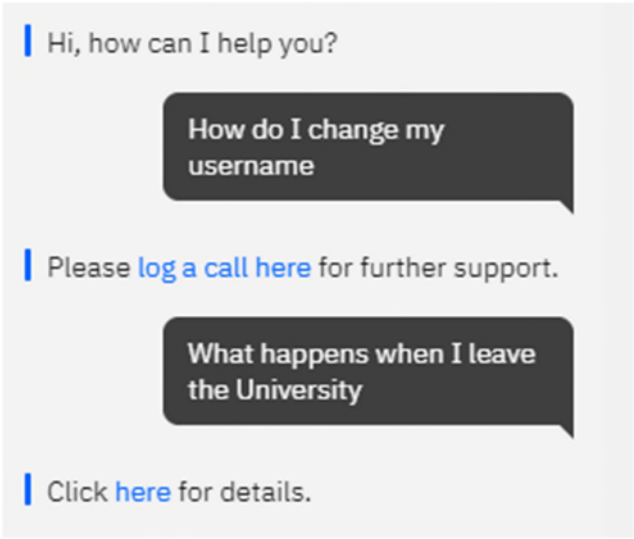

Figure 3. Helpdesk chatbot response snapshot

4.4 Methods for Creating Chatbots

In order to develop each chatbot, we followed the four main steps below.

Step one: collect pairs of sample questions and answers

For each chatbot prototype, we collected roughly 30 sample question types and their corresponding sample responses from teachers and support staff.

Since end users may ask the same types of questions but frame them differently, we generated 150 pairs of questions and answers based on the original 30.

Step two: decide on the conversational response types

Based on the length of conversations, we decided how the chatbots would answer each type of question. Some questions can be answered directly in-chat, while others will need to be directed to human support; a select number of questions will need to be directed to other teams, both internal and external to the department.

Step three: develop the chatbot prototypes

Next we selected and used a bot development engine to create and host the chatbots we had designed.

Step four: review the chatbot prototypes

In order to review the chatbots, we evaluated the prototypes against with the potential benefits we have identified from literatures and pervious work experience, to explore if current technologies can actually support the primary benefits we have identified.

5. OPPORTUNITIES AND CHALLENGES

In this section, we first present the potential benefits that our chatbots are trying to achieve. Subsequently, we discuss gaps and technical challenges chatbot developers are currently facing. We will discuss each of the unsolved challenges in detail.

Table 1. Review of the simulation bot

Potential benefits / opportunities	Can this be met in the current prototype?	Can this be effected in the near future?
A1: By talking to the chatbot students can retain the customer by presenting four must-have selling points that the current company has.	Yes	NA
A2: The chatbot can understand and differentiate between the must-have and optional selling points students raise in the interaction.	Yes	NA
A3: The chatbot can prompt students if they become stuck during the interaction.	Yes	NA
A4: Students will not realise they are talking to a robot as opposed to a human.	No yet	Not sure
A5: Difficult questions asked by students can immediately be redirected to course teachers.	No yet	Possibly yes

A4 & A5: There are always questions that chatbots cannot answer. In addition, it is impossible to predicate all potential scenarios for interaction while building a bot (see Table 1). Some chatbot-building platforms, such as IBM Watson, are currently developing solutions to this by introducing search skills that connect to internal databases and redirect questions to human agents as messages via mailing systems, such as Intercom [13,14]. However, these are not ready to use by bot developers yet.

B2: To change and update responses provided in the chatbot requires necessary AI knowledge and technical skills. In most cases, teaching and support staff responsible for maintaining or updating responses in the chatbots do not currently have these skills, as shown in Table 2. User friendly interfaces, which would allow multiple users to access the chatbot-building framework, would be very useful to enable less technically knowledgeable staff to make changes to the content of chatbots easily, without damaging the whole product. However, currently, there is no such technology available in the market.

B5: It would be advantageous if the chatbots were able to consider users' feelings during interactions as one of our targets is to provide positive service experiences to our students and staff (see Table 2). Some providers have proposed the idea of having 'tone analyses' which could measure the users' potential emotional state [15,16], and provide appropriate responses during the interaction. However, this feature would require high-level AI programming skills in order to build it into a bot, which most bot creators do not possess.

Table 2. Review of the reading list bot

Potential benefits / opportunities	Can this be met in the current prototype?	Can this be effected in the near future?
B1: Answers provided by the chatbot are short enough to read and follow easily.	Yes	NA
B2: Training staff can easily and quickly change or update answers contained in the chatbot.	No yet	Not sure
B3: Further support, such as email contact and links, are provided when users need extra assistance.	Yes	NA
B4: Inputs with grammatical and typing mistakes can still be understood by the chatbot.	Yes	NA
B5: The chatbot is able to be aware of the user's feelings during the conversations, and provide suitable emotional care as necessary.	No yet	Not sure

Table 3. Review of the helpdesk bot

Potential benefits / opportunities	Can this be met in the current prototype?	Can this be effected in the near future?
C1: The chatbot is able to guide users to submit requests to the correct teams.	Yes	NA
C2: The chatbot is able to redirect submitted requests to the correct teams/persons automatically.	No yet	Possibly yes
C3: The chatbot is able to guide users to browse helpdesk-related websites in order to save them time.	Yes	NA
C4: The chatbot is able to automatically fill in the request form while interacting with users.	No yet	Not sure
C5: The chatbot can be fully integrated with current university systems.	No yet	Not sure

C2: The result in Table 3 shows that, staff and students may be unsure which teams in the department their helpdesk requests need to be submitted to. This creates extra workload for the helpdesk team, who must redirect their inquiries to the correct team. This requires the helpdesk staff to be very experienced in order to know the relevant team for referral. Some chatbot building platforms have stated that they have features which can auto-assign user requests to different teams as pre-specified [13,14,15,16,17,18]. However, this feature is not yet ready to use by bot developers.

C4: Time would be saved and workload reduced significantly if chatbots could automatically fill in users' request forms and redirect the requests to the right team while interacting with customers (see Table 3). Most chatbots have the potential to collect extra information from users by asking additional questions, or allowing users to make selections from a number of options provided by the chatbot [13,14,15,16,17,18]. However, we are currently facing difficulties with auto-forwarding user requests to the right team, as mentioned earlier.

C5: After the chatbots are built, they need to be able to fully integrate with universities' current systems, in line with their policies and regulations regarding to data privacy and security. Typical systems include universities' websites, VLEs, mailing systems and helpdesk systems. However, currently, these chatbots are still standalone applications which have not been successfully integrated with existing systems (see Table 3).

6. CONCLUSIONS AND FURTHER WORK

In this paper, we have proposed and discussed the opportunities of having three different AI chatbots in the areas of learning and teaching, educational application training, and helpdesk support, and have shared our practical experiences of developing these chatbots together with the technical challenges faced currently within a university department.

We hope this paper is informative and be able to offer inspiration to educational colleagues, with teaching, research or administration roles, who are interested in the use of chatbots in education.

We also wish to improve awareness within the chatbot development industry, in particular among chatbot engine providers, of the educational and operational needs of educational institutes, which differ from other domains. Most of the popular chatbot development platforms are not originally designed to support educational activities.

In conclusion, these chatbot prototypes are not yet ready for use, as a number of significant technical challenges still remain. The next phase of our work will focus on addressing the technical challenges identified, potentially in collaboration with the university's technical teams, or third-party industry partners. After these challenges are resolved, a potential next step will be to invite further stakeholders to experiment with these prototypes in order to explore how to better design personalised educational services via AI chatbots for students, teachers and staff in a university environment.

7. REFERENCES

[1] Maroengsit,W., Piyakulpinyo, T., Phonyiam,K., Pongnumkul,S., Chaovalit,P. and Theeramunkong,T. 2019. A Survey on Evaluation Methods for Chatbots. *In Proceedings of the 7th International Conference on Information and Education Technology* (ICIET 2019). ACM, New York, NY, USA, 111-119. DOI=10.1145/3323771.3323824

[2] Molnár,G. and Szüts, Z. 2018. The Role of Chatbots in Formal Education, *IEEE 16th International Symposium on Intelligent Systems and Informatics* (SISY), Subotica, 197-202. doi= 10.1109/SISY.2018.8524609

[3] Lizi, L., You, Z., Yunshan, M., Richang H., and Tat-Seng C. 2018. Knowledge-aware Multimodal Fashion Chatbot. *In Proceedings of the 26th ACM international conference on Multimedia* (MM '18). ACM, New York, NY, USA, 1265-1266. DOI=10.1145/3240508.3241399

[4] Meng-Chieh, K. and Zih-Hong, L. 2018. CardBot: A Chatbot for Business Card Management. *In Proceedings of the 23rd International Conference on Intelligent User Interfaces Companion* (IUI '18 Companion). ACM, New York, NY, USA, Article 5, 2 pages. DOI=10.1145/3180308.3180313

[5] Madhu, D., Jain, C. J. N., Sebastain, E., Shaji,S. and Ajayakumar, A.2017. A novel approach for medical assistance using trained chatbot, *International Conference on Inventive Communication and Computational Technologies* (ICICCT), Coimbatore,243-246. DOI=10.1109/ICICCT.2017.7975195

[6] Ahmed, F. and Silvia, G. 2017. Addressing challenges in promoting healthy lifestyles: the al-chatbot approach. *In Proceedings of the 11th EAI International Conference on Pervasive Computing Technologies for Healthcare* (PervasiveHealth '17). ACM, New York, NY, USA, 261-265. DOI=10.1145/3154862.3154914

[7] Xuan, L. P., Thao, P., Quynh, M. N., Thanh, H. N., and Thi, T. H. C. 2018. Chatbot as an Intelligent Personal Assistant for

Mobile Language Learning. *In Proceedings of the 2018 2nd International Conference on Education and E-Learning* (ICEEL 2018). ACM, New York, NY, USA, 16-21. DOI=10.1145/3291078.3291115

[8] Verleger, M. and Pembridge, J. 2018. A Pilot Study Integrating an AI-driven Chatbot in an Introductory Programming Course, *IEEE Frontiers in Education Conference* (FIE), San Jose, CA, USA, 1-4. DOI= 10.1109/FIE.2018.8659282

[9] Yi-Chieh, L. and Wai-Tat, F. 2019. Supporting peer assessment in education with conversational agents. *In Proceedings of the 24th International Conference on Intelligent User Interfaces: Companion* (IUI '19). ACM, New York, NY, USA, 7-8. DOI=10.1145/3308557.3308695

[10] Stanica, I., Dascalu, M., Bodea, C. N. and Bogdan, M. A. D. 2018. VR Job Interview Simulator: Where Virtual Reality Meets Artificial Intelligence for Education, *Zooming Innovation in Consumer Technologies Conference* (ZINC), Novi Sad, 9-12. DOI=10.1109/ZINC.2018.8448645

[11] KyuHwon, P. and Young-Seob, J. 2019. Indoor Dialog Agent in Mixed Reality (video). *In Proceedings of the 17th Annual International Conference on Mobile Systems, Applications, and Services* (MobiSys '19). ACM, New York, NY, USA, 708-709. DOI=10.1145/3307334.3328595

[12] Talis Aspire Reading List. https://talis.com/talis-aspire 2019.

[13] IBM Watson. https://www.ibm.com/watson/ 2019.

[14] Dialogflow. https://dialogflow.com/ 2019.

[15] Wit.ai. https://wit.ai/ 2019.

[16] Pandorabots. https://home.pandorabots.com/home.html 2019.

[17] Gonda,D. E., Luo,J., Wong, Y. and Lei,C. 2018. Evaluation of Developing Educational Chatbots Based on the Seven Principles for Good Teaching, *IEEE International Conference on Teaching, Assessment, and Learning for Engineering* (TALE), Wollongong, NSW, 446-453. doi=10.1109/TALE.2018.8615175

[18] Ranoliya,B. R., Raghuwanshi,N.and Singh,S. 2017. Chatbot for university related FAQs, *International Conference on Advances in Computing, Communications and Informatics* (ICACCI), Udupi, 1525-1530. doi=10.1109/ICACCI.2017.8126057