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Exploring the Potential of Chatbots in Higher Education: A Preliminary Study

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Abstract**—**We report upon a study introducing a chatbot to develop learning communities at a London University, with a largely international student base. The focus of the chatbot was twofold; to ease the transition for students into their first year of university study, and to increase study engagement. Four learning communities were created using the chatbot; level 3 foundation, level 4 undergraduate, level 6 undergraduate and level 7 post-graduate. Students and programme leaders were provided with access to the chat bot via mobile app prior to their study induction and throughout the autumn term of 2019. At the end of the term, data were collected via questionnaires and focus groups with students and teaching staff to allow for identification of benefits and challenges. Findings indicated a positive correlation between study engagement and engagement with peers. Students reported that the chatbot enabled them to obtain support and connect to their programme leader. Both staff and students also made recommendation on how engagement could be further enhanced using the bot in terms of; clearly specified purpose, integration with existing university systems, leading by example and connectivity. Extending upon these recommendations, a second pilot study is planned for September 2020, for which the focus will be upon improving attendance rates, student satisfaction and module pass rates.

Keywords**—**Chatbot, e-learning, learning communities, student engagement.

I. Introduction

A lack of student engagement is currently a challenge in Higher Education (HE) [1]. This challenge is driven by a range of factors including student expectations, backgrounds, needs and, increased feelings of isolation and loneliness [2]. Evidence of low engagement is evident in low retention and progression statistics, for example, in some institutions fewer than 70% of students are completing their academic programmes. Increased feelings of isolation and loneliness are generally reported as reasons for poor integration of students into university life. These factors present numerous challenges within HE, particularly in the transition from school to university life [3].

This paper reports upon the utilisation of a chatbot to assist students in integrating into learning communities to address the above challenges. Chatbots offer an innovative solution towards improving the student experience by "tapping" into the popularity of mobile phone use [4], [5]. Differ was utilised in a pilot study at a small London University with a largely international student base. The focus of the pilot study involved creating four distinct learning communities using the chatbot; level 3 business foundation students, level 4 business undergraduate students, level 6 business undergraduate students and level 7 marketing post-graduate students. Students and programme leaders were provided with access to the "Differ" chatbot via mobile app prior to their study induction and throughout the autumn term of 2019.

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II. Background Motivation

A. The Current Challenge

Regarding the challenges of low student engagement and increasing drop-out rates, prior research has highlighted some insightful associations. For example, a relationship has been identified between provisions of individual student support and drop-out rates, especially where students feel isolated when transitioning from school to university study [2]. In the case of international students, feelings of isolation may be amplified due to the added complexity of dealing with cultural adjustment within the country of study [6].

Of interest to the study reported within this paper is easing the transition for international students into their first year of university study. A study on cross-cultural adjustment [7] identified feelings of "social-isolation" as a key cause of low engagement for international students. Social isolation is defined as experiencing feelings of *"loneliness and marginalisation"* [8]. These feelings can be exacerbated if students receive little opportunity to engage in learning communities within which they could receive peer support [9]. Developing these important support connections with peers is acknowledged as a facilitator in successful learning [10], and a necessary component of establishing "learning communities" [11].

B. Benefits of Chatbots to HE

There has been growing interest in the use of chatbot technology to address the challenge of low student engagement [12], [13]. The adoption of chatbot technology within HE has been associated with several benefits including; improving student motivation [14], improving student attention [15], encouraging collaborative learning [16], promoting communication with peers [17] and increasing student's sense of ease [18].

Scholars also assert that chatbots can assist with developing meaningful interactions between peers and mentors, which has been correlated with a decrease in drop-out rates [19]. This is due to chatbot technology facilitating the establishment of learning communities, providing students with a sense of belonging [20]. Chatbots, powered by artificial intelligence, enable students to communicate via a chat interface [21], and

use pattern matching to link students to a "mentor" [22].

C. Significance of Study

The study reported here offers a chatbot solution to assist international students integrate into university life, and form learning communities. This solution was utilised to counteract feelings of isolation, disconnection and lack of engagement with; programmes of study, peers and the university in general.

III. Methodology

A. The Differ Chatbot

This study utilised a chatbot called Differ, the result of a 4-year long Norwegian research and development project including BI Norwegian Business School and an Educational Technology Start-up company (EdTech Foundry). Based in Oslo, the development team participated in the study. Differ is a mobile messaging application for students and educators in HE to facilitate conversations, replacing Facebook and WhatsApp groups into one integrated environment. Differ can be used as a mobile application as well as a desktop application (see Fig. 1).

Fig. 1 The Differ Chatbot on desktop and mobile app

Differ uses Chatbot technology and pattern matching to match students to peers, mentors, and initiate conversations within learning communities [23]. The institution of focus for this study was a small (approx. 3,500 students), private not for profit, London University with a 90% international student base.

B. Setting up Learning Communities

Working alongside EdTech Foundry, four learning communities were created using the Differ chatbot; level 3 foundation, level 4 undergraduate, level 6 undergraduate and level 7 post-graduate. Students and programme leaders were provided with access to the "Differ" chat bot via mobile app prior to their study induction and throughout the autumn term of 2019. Each learning community area consisted of; an announcements page that programme directors could use to post community announcements, an open chat area that staff and students (and their peers) could contribute to, and a list of students enrolled within the community. Using Differ, students were able to connect to classmates via one-to-one chat and group chat. Students were also able to connect to their programme director via one-to-chat using Differ.

Prior to induction week for the autumn term, students were sent a link to sign up to Differ via email to encourage them to connect to their new classmates. Students and staff were provided with an introduction to the features of Differ during induction week. Throughout the autumn term of 2019 both students and programme directors were provided with access to the Differ chatbot via mobile app and desktop depending on preference.

C. Data Collection Protocols: Questionnaires

At the end of the autumn term, data were collected regarding student usage of the Differ chatbot. A 15-item questionnaire was distributed to students across all four learning communities to ascertain student opinions on having used the chat bot over the autumn term. The questionnaire consisted of four sections; demographic information, study programme engagement, usage of Differ and future recommendations for the chatbot. Within the questionnaire design, a mixture of question types was used which included Likert style responses to gauge strength of agreement and open-ended questions.

D. Data Collection Protocols: Focus Groups

To further expand the data collection, four focus groups were held with; level 4 undergraduate, level 6 undergraduate, level 7 post-graduate and programme directors. Student focus groups comprised open-ended questions related to; engagement with study programme, connectivity with peers, usage of Differ, how students used Differ to connect to others, perceived benefits and ideas for future development of the chat bot. The programme director focus group comprised 12 open-ended questions related to; student engagement on academic programmes, student engagement through differ, perceived benefits of the chat bot, perceived challenges and ideas on future development. All focus groups ran for approximately 40 minutes and were recorded and transcribed.

IV. Study Findings

A. Quantitative Data: Programme Engagement

As part of the study, 74 participants completed the questionnaire, 58% (N = 43) were male, and 42% (N = 31) were female. Ages ranged from 17 years of age to 31 years of age (M = 21, SD = 2.655). The number of questionnaire responses received across the various learning communities varied; 34% (N = 25) were from level 3 foundation students, 23% (N = 17) were from level 4 undergraduate students, 23% (N = 17) were from level 6 undergraduate students, and 20% (N = 15) were from level 7 postgraduate students.

Participants reported an overall positive engagement with their studies (M = 7.89, SD = 1.458) and their classmates (M = 7.38, SD = 2.105). A Pearson correlation analysis yielded a significantly strong positive correlation between engagement with the academic programme of study and engagement with

classmates ($r(73) = 0.629$, $p = 0.000$), such that participants who reported engagement with their studies were likely to report engagement with their classmates. Similar levels of engagement were reported across each of the learning communities (see Table I).

TABLE I
MEANS AND STANDARD DEVIATIONS OF ENGAGEMENT WITH PROGRAMME AND CLASSMATES

	N	Engagement with studies Mean (SD)	Engagement with classmates Mean (SD)
Level3 Foundation	25	7.56 (1.583)	6.29 (2.379)
Level4 undergraduate	17	8.29 (1.571)	7.35 (1.966)
Level6 undergraduate	17	8.05 (1.390)	7.35 (2.089)
Level7 postgraduate	14	7.78 (1.121)	8.28 1.637)

B. Quantitative Data: Use of Differ

Out of the questionnaire responses, 55% of participants reported that they had signed up to the Differ chatbot application, 12% had connected with their classmates prior to induction week, and 15% had connected with their classmates during the autumn term. Participants were also asked whether Differ enabled them to connect to their programme leader, feel connected in general and obtain support. The results are shown in Table II.

TABLE II
FREQUENCY DATA OF STUDENTS IN USING DIFFER

	N	To connect to Programme Leader (*N*)	To feel more connected (*N*)	To obtain support (*N*)
Level3 Foundation	12	0	0	3
Level4 undergraduate	3	1	1	2
Level6 undergraduate	13	9	4	8
Level7 postgraduate	13	1	0	0

A one-way ANOVA was conducted to ascertain the association between signing-up to Differ and general engagement. Results indicate that sign-up rate was not associated with general engagement with studies, ($F(1, 71) = 3.944$, $p = 0.051$), or general engagement with classmates, ($F(1, 71) = 0.667$, $p = 0.702$).

C. Qualitative Data: Facilitation of Connection

Qualitative data were obtained from both the questionnaires and the four focus groups. 17 of the 52 participants (from both the questionnaire and the focus groups) who signed up to Differ reported they did not feel connected because they did not use the app much. A further 10 participants indicated that they used other chat apps to connect with peers such as WhatsApp and Facebook. However, participants did state they had used Differ to connect with their Lecturer, to notify of their absence in class, to ask about assessments, or to send files. Participants stated that they felt more comfortable using the app to contact their Lecturer rather than email as the chatbot form of communication felt more personalized.

D. Quantitative Data: Support Provision

Those who indicated that Differ provided support stated that the app enabled them to connect with their classmates and teacher more easily and closely. In particular, participants stated that they received support via Differ from their Lecturer in understanding assignments better, and in getting a response quicker than via email. Participants were asked about how they see Differ being used in the future. Responses were grouped into four themes; promoting student-teacher interaction, promoting the chatbot throughout the university, networking, and Q&A features. Comments are summarised in Table III.

TABLE III
IDEAS ON FUTURE USE OF DIFFER

Theme	Comments made
Promoting student-teacher interaction	The app could promote student-teacher interaction and should be used more widely by teachers and the University as a whole. As such, the app could be integrated with other University systems, and other platforms that students already use, such as Blackboard and University emails.
Promotion of the chatbot throughout the university	Differ should be the only app used at the University, and should be accepted by everyone, in order to be beneficial.
Networking	The app could serve as a networking app, to connect with peers that students may work with in future.
Q & A features	The app could include additional features. For example, it was suggested that Differ include a Q&A feature, whereby students ask the app questions, such as "when are my assignments due?" and the app responds with a list of assignments and deadlines.

E. Quantitative Data: Enhancing Engagement

Participants were asked how they felt Differ could be used to enhance engagement. Responses were grouped into three themes; integration at module level, accessibility from the university landing page, and improved interaction from lecturers. Comments are summarised in Table IV.

TABLE IV
IDEAS ON ENHANCING ENGAGEMENT VIA DIFFER

Theme	Comments made
Integration at module level	The use of Differ could be mandatory and used for every module more purposefully.
Accessibility from the university landing page	Differ should be made accessible on the landing page of the University's website and app, for greater awareness and familiarity.
Improved interaction from lecturers	There should be more University driven communications through Differ, including by Lecturers.

V. RECOMMENDATIONS AND CONCLUSIONS

Drawing on participant feedback, four recommendations are made for the future use of Differ concerning; the purpose of the chat bot, integration with existing university systems, leading by example, and connectivity as focal points for improvements. Details on these recommendations are provided in Table V.

Extending upon the findings reported within this study, a second pilot-study is planned for September 2020. By this time the functionality of the chatbot will be enhanced to include a Q&A feature by which students can ask the chatbot questions relating to assessment deadlines. In this follow up study, the usage of the chatbot will focus on one academic programme at individual module levels to improve interaction

between students and lecturers, and will be accessible via the university's currently VLE (Blackboard). Specific measures for investigation within the future proposed study are; attendance rate, student satisfaction and module pass rates. These measures will allow for deeper insights into the utilisation of the Differ chatbot for improving student engagement with peers, and their programme of study.

TABLE V
RECOMMENDATIONS MOVING FORWARD WITH DIFFER

Recommendation	Explanation
Recommendation One: Purpose of the chatbot	Differ currently competes with other apps that students are either already using or are familiar with. The purpose of Differ should be different to the purpose of other apps, such as WhatsApp.
Recommendation Two: Integration with existing university systems	The need to use Differ, rather than other apps needs to be established. This could be done by expanding the adoption of the app across the institution, and integrating it with existing systems, such as Blackboard.
Recommendation Three: Leading by example	Lecturers and the institution should initiate and facilitate connection and use of the app, leading by example. Lecturers should be encouraged to refrain from using other platforms, such as Facebook and WhatsApp, to direct students to Differ.
Recommendation Four: Connectivity as the focal point	The chat feature of the app should not be the selling point, as students have other forms of chat. Rather, the selling point should be connectivity with the Lecturer and the coursework/content of modules/programmes.

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