Evaluation, development & testing of an educational support chatbot

A dissertation submitted in partial fulfilment of the requirements for the degree of Bachelor of Science (Honours) in Business Information Systems

by  B. D. Scott

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Declaration

I hereby declare that this dissertation entitled ‘Evaluation, development & testing of an educational support chatbot’ is entirely my own work, and it has never been submitted nor is it currently being submitted for any other degree.

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Date:
Abstract

The majority of the current generation occupying British universities have grown up in an era of instant information. Generation X and Y can barely remember a time before having Google to answer every conceivable question they could ask, so why has this era of instant knowledge gratification not transcribed to universities.

Artificial intelligence, more specifically chatbots are becoming an ever present in all facets of human life and how we interact with businesses and brands. But these intelligent bots haven’t been adopted by educational institutions just yet.

The aim of this study was to determine whether there is indeed a potential use for a chatbot within a university, specifically Cardiff Metropolitan University. The use of a chatbot would aim to streamline student–university communication as well as accelerating the knowledge search that is a part of every student’s daily life.

The design of the bot took place after the gathering of vital quantitative information from both staff members and students which lead to university specific functions being designed. The chatbot was then tested to show real life adoption rates with both parties and showed statistical relevance to the use of the chatbot. Results showed undoubtedly that, if introduced, a university chatbot would have incredibly high adoption rates with both staff and student users. The artificial intelligence would greatly increase the satisfaction across the board of students and would supply a solution to numerous issues for both sets of users. The implications of these findings are considered.
Acknowledgments

Firstly, I would like to thank Simon for being incredibly enthusiastic about this project from the very first day as well as an easy going and extremely helpful supervisor throughout the writing of this dissertation.

I would also like to thank my parents for their continued support throughout my undergraduate degree and my entire education.

Finally, I would like to thank Rain for her belief in my ability, without that I may have never achieved anything academically.
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1. Introduction

Less than two years ago the perception of chatbots changed from a fun novelty to a real enterprise-changing solution. We are living through the era of automation. We’ll soon have self-driving cars and smart cities, but real automation is already here and it’s in the form of a chatbot, simulating human conversation and carrying out once previously mundane and time consuming human tasks.

Chatbots aren’t a new concept, they’ve been around for decades, 1966 to be exact, when Joseph Weizenbaum published the program ELIZA. Which was able to fool users into thinking they were conversing with a real human.

April 12th, 2016, Facebook’s F8 Developers Conference. Mark Zuckerberg introduces Bots for Facebook, and in one key note speech chatbots go from being a futuristic idea to something that will change the way humans interact with brands. The idea of chatbots are introduced to the world, and they’ve been backed by some of the most profitable and forward-thinking companies in the world. Microsoft, Oracle and IBM all launch chatbot platforms, must be a winner, right?

But what are the real use-cases for these systems?

The aim of this paper is to evaluate, design and test a bot specifically for an educational institution, seeing whether it’s needed and what sort of tasks it can automate. Finding it’s best possible use and ultimately whether it’s useful at all.

Through qualitative research, from both employees of Cardiff Metropolitan University and students the bot will be built to carry out the tasks that are most needed by both parties. A comprehensive review of literature will be undertaken to help underpin the findings and help guide the development of the bot.

This paper will talk about the design methodologies and how best to get users to interact with the bot as well as the rise of messaging applications over traditional smartphone apps. A clear
justification for this technology will be sought after looking at supporting literature and the issues surrounding the lack of student – university communication.

Design of the bot will take place on the back of the qualitative research and once designed will be tested by both staff and student users. Quantitative feedback will be gathered once testers have been demoed the prototype bot to hopefully give clear and concise answers to the main questions being asked in this paper.
2. Literature Review

2.1. Introduction

Artificial Intelligence;
“The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages”. (Oxford English Dictionary, 2017)

Since the 1940s, scientists, mathematicians, psychologists and engineers have been trying to create an artificial brain whereby computers could carry out tasks that would normally require human intelligence (Brooks, 1999).

As this literature review will further discuss, AI (Artificial Intelligence) went through exciting times in the 1970s. The production of numerous functioning systems was fortified by the developments of Mr. Alan Turning throughout the 1930s and 1940s. These developments cemented a basis for AI that remains visible in the world today. Turing, known as the god father of computer science and famous for cracking the German military’s Enigma Code, was estimated to have shortened the war by two years (Turing, 2004). Turing made much of his breakthroughs in the 1940s and 1950s before passing away in 1954. He is most celebrated for the creation of the Turing Test, a test created in 1950 to analyses whether a machine can imitate a human, known commonly as the ‘Imitation Game’ (Mauldin, 1994). A computer system passes the Turing Test if it is mistaken for a human more than 30% of the time (Warwick & Shah, 2018). By the 1980s AI was flourishing as the technologies advanced immensely. Many of the developments from this time have helped underpin the success of AI society witnesses today (Armstrong, et al., 2016). Below, Figure 1 illustrates the Turing Test, from a behind a screen, C is trying to determine which of A and B is a computer and which is a human.
Today, the majority of people living in a developed country are exposed to some element of AI (Elgan, 2015). For example, Amazon Alexa, Google Home, Siri or even just predictive text on your mobile. AI has revolutionised the world for the better, but its development has certainly not reached capacity, with much room for further improvement (Muller, 2016).

Geoffrey Horrell, Director of Product Incubation at Thomson Reuters suggests that the ultimate goal of AI is to not take humans jobs but to assist them (Horrell, 2017). Despite all the advances in technology, workers still spend the majority of their time reading and analysing data. By teaching machines to understand what useful data is and what is not, it allows humans to work on more high-value customer centred work – improving opportunity costs (Horrell, 2017).

Artificial intelligence is an important part of everyday life and has been for quite some time. The world and its inhabitants have taken to AI naturally and it has progressed to the crest of a wave where arguably the developments in the next 10 years will out shine the developments of the previous 50. As humans who thrive for development and progression the world must embrace the next wave of developments in AI, one of which being automated systems and chatbots.
2.2. Chatbots

Chatbot;
“A computer program designed to simulate conversation with human users, especially over

AI is fundamental to the development of chatbots, which are the primary focus of this paper.
The objective of the following dissertation is to establish whether there is a use-case for a
chatbot in an educational institution. It aims to examine whether there are tasks that can be
automated, and if so, whether both the staff and the students may find it beneficial and useful.

Conversational apps such as WhatsApp, Facebook Messenger, Slack and Amazon Alexa are
continually changing the way humans interact with software. They are being used to help
increase efficiency and improve productivity (Shevat, 2017).

Despite the technology having been available, the presence and use of chatbots has only
materialised in recent years. The first known chatbot was created in 1966, a bot called
ELIZA, it simulated a Rogerian psychotherapist, someone who simply repeated the human’s
words back to them (Yuan, 2016). Although ELIZA was not labelled as a chatbot at the time,
the functions it carried out were in line with that of a modern day chatbot (Auslander, 2002).

ELIZA was designed to potentially pass the Turing Test. Although she did not pass the test,
she was the first well-known system of great prevalence that would eventually become what
is recognised today as a chatbot (French, 1990). Since ELIZA, numeros systems have been
developed. The next biggest one that helped shape AI and chatbots was ALICE - Artificial
Linguistic Internet Computer Entity (AbuShawar & Atwell, 2015). ALICE was able to have
conversations through the use of pattern matching, meaning she could reply if the user went
completely off topic (Wallace, 2009). After ALICE, it was a long time before the next
advancement was developed. In 2006 IBM released Watson, initially programmed to win the
game ‘Jeopardy!’; now used to reveal insights from large quantities of data (Best, 2013).

Mitsuku, was first won the Loebner Prize in 2013, an award given to the most "human-like"
Chatbot and a prize celebrating Mr. Alan Turing’s Turing Test. Mitsuku has won the prize
three times, including its most recent attempt in 2016 (Milton-Barker, 2016). Mitsuku has all
the AIML (Artificial Intelligence Mark-up Language) files of ALICE and is constantly being added to with the developer Steve Worswick claiming to have been working on Mitsuku since 2004 (Wallace, 2017). It uses pattern and word matching to give intelligent answers to questions, for example see below Figure 2 for the word tree. Mitsuku is seen as the benchmark for current chatbots that want to pass the Turing Test, and in the 2013 Loebner Prize placed 13 places above an unofficially entered Siri (Milton-Barker, 2016).

Cleverbot officially came online in 1998 under a different name, Jabberwacky and since then has had a number of re-developments, with the AI behind the bot being developed by Rollo Carpenter (Love, 2014). Cleverbot generates its own feedback based on previous responses. Every time a user asks a question, Cleverbot learns it and then chooses an optimal response based on past questions. It is estimated that since it went online, Cleverbot has had 7 to 8 billion interactions, each one being stored in a database (Existor, 2016). See Figure 3, a basic architectural overview of how Cleverbot works.
Siri, undoubtedly the most well-known form of AI, was first released as a beta in 2011. Since then, there has been the development of household bots in the shape of Amazon Alexa and Google Home, turning online text bots into tactile objects. On the 12th of April 2016, Mark Zuckerberg launched the Facebook Bot platform exposing the world to bots every day via Facebook Messenger (Constine, 2017).

Arguably, humans have an uncontrollable need to innovate. Cohen (2010) presents ten reasons in her academic paper ‘Top 10 Reasons Why We Need Innovation’ and number one is, “For business survival” (Cohen, 2010, p. 4). With the rapid increase of chatbots being utilised throughout society, many people query whether the technology is key to business survival, or whether it is simply innovation for innovations sake. It is nice to be able to ask Alexa to set a timer, or recommend a playlist, but is this what human beings really need Artificial Intelligence for? Or does it simply facilitate data protection and trust issues? (Jäntti, 2017). In recent years the use of AI, and specifically chatbots, has hit industry level (Williams, 2017). With large corporations such as Facebook, IBM, Microsoft and Oracle all releasing chatbot platforms. Naturally, this increase in use demonstrated their belief that chatbots are a big business (Loeb, 2017). These companies are specialist, highly informed and trained and have all chosen to adopt chatbot technology, but in terms of development is everything still slightly ahead of where the technology needs to be to gain full advantage (Gagliordi, 2017).

Both the benefits and drawbacks of chatbot technology are clear to see and will be discussed in more detail below and will be taken into consideration of the findings, results and ultimately conclusion of this project. By the end of this project it is hoped that there is a clear justification for the implementation of such technology and will supply a clear benefit to educational institutions, specifically third level universities.

2.3. Benefits

The use of AI to implement sophisticated chatbot systems has improved time-efficiency and created ease for everyday tasks carried out by consumers and suppliers alike. Conversational agents, have been around a while and have been automating mundane time-consuming tasks (Shaw, 2017). For instance, dealing with your shopping order or resetting your password. Often being designed with personalities and becoming more lifelike (Simonite, 2017). This is
where chatbots and AI has developed to in recent years. It has taken time-consuming, mundane tasks and implemented AI to automate this task and produce a worthwhile solution that benefits both the users and suppliers (Shaw, 2017). This is a perfect example of a use-case for an artificial support system, one that does exactly what is needed and doesn’t try to fool the user. The growth of SaaS (Software as a Service) and large technology companies releasing chatbot platforms has seen their rapid evolution in the past two years (Loeb, 2017).

2.4. Drawbacks

However, it is important to note that not all chatbots are advantageous. In the run up to the 2016 American election it is thought that up to one fifth of all comments made on Twitter were made by autonomous Twitter bots (Albright, 2016). The concern that robots will cause redundancies is perhaps a further reason why they have not been fully adopted. Once this technology is perfected, it can potentially be engineered and developed to perform tasks that are far from beneficial, with a recent report showing that if the interaction ends negatively up to 73% of users will not interact with the bot again (Eaton-Cardone, 2017). In 2014 bots outnumbered people on the internet for the first time, showing their rapid growth (Pullen, 2015). An article from John McCarthy claims that as much as 40% of the internet activity in 2016 originated from bots, according to a report from bot detection company DistilNetworks (McCarthy, 2017) see Figure 4.
2.5. Loss of jobs

A 2016 report from Deloitte and the University of Oxford predicts that by 2030 over 850,000 public sector jobs will be lost through automation (Smith, 2016). Griffin explains that electronic manufacturing company Foxconn are planning to automate and eliminate 12 million factory jobs and Fukoku Mutual Life insurance company were replacing its claims department with AI (Griffin, 2017). A report from PwC claims that 30% of jobs in Britain are potentially under threat from AI breakthroughs and advancements, (Elliott, 2017) see Figure 5. This dissertation aims to explore the use of a chatbot within higher education, these bots are in place to assist professors and lecturers. Bots within education are in place to take over repetitive tasks and help make a teacher’s work more meaningful (Srdanovic, 2017).
Figure 5 Guardian Automation Threats Graphic

Source: NS workforce jobs survey for employment shares (2016)
2.6. Uncanny Valley

Mori warned that robots should not be made too similar to real humans because such robots can fall into the ‘uncanny valley’, where too high a degree of human realism evokes an unpleasant impression in the viewer (Mori, 2012). Humans want to know what they are talking to, whether it is a human or a bot. In the past, these were easy to differentiate between, but with AI advancements it is becoming an increasingly blurred line. A 2012 study, ‘Social Cognitive and Affective Neuroscience’ found that humans experienced a ‘prediction error’ when presented with a robot that fluidly moved like a human but didn’t act like one, humans want to know a robot’s limitations (Wilms, et al., 2010). This is one of the reasons why humans have such a good relationship with Siri & Alexa. These examples are clearly bots with a persona in place that are not intended to mimic a human, their speech is robotic enough that it will never confuse it for another human in our bedroom (Waddell, 2017).

2.7. Chatbot persona

Remember how hated that paperclip on Microsoft Word became? (Waddell, 2017) see Figure 6 Chatbots are in serious danger of slipping into the uncanny valley, they may not be humanoids and tactile robots, but are being used to interact across human’s favourite forms of communication. If chatbot developers are not careful they’re developments will find themselves at an interval where their bot will not be able to pass the Turing Test, but could easily fool users (Tunkelang, 2016). It is seen as the industry standard that a bot should be funny and engaging without being a nuisance and straying too far from its purpose (Spectrm, 2017).
2.8. Chatbot – The new mobile application

A 2016 Gartner report predicts that app usage will plateau over the next few years with the market being saturated and new technologies emerging (Gartner, 2016). Chatbots are open ended and can be integrated with any number of services. As NLP (Natural Language Processing) and AI matures it means the bots can learn from their user where apps do not have this development option (Gartner, 2016). A 2017 Gartner report on future technologies has predicted that by 2021 more than 50% of enterprises will spend more per annum on chatbot development than traditional mobile application development (Panetta, 2017). After nearly 10 years of mobile application growth, they have largely stopped growing (Yuan, 2016).
2.9. Rise of messaging apps

As Figure 7 demonstrates, non-messaging applications are declining, with app retention suffering. Within 90 days 95% of apps lose their users (Sabry, 2016). The main problem is that the market is flooded, too many apps are competing for the same market. Messaging apps are taking over because of their ability to integrate multiple components. A 2016 report by Kleiner Perkins Caufield Byers (KPCB) on internet trends shows that the younger generation are pushing for this trend (Meeker, 2016) see Figure 8.
2.10. Design considerations and framework

Martin, in his blog titled “Design Framework for Chatbots” talks about how vital it is to start your design considerations with a robust framework or you may fall into an un-organised trap (Martín, 2017). Skorniakov writes about how through the use of AI and chatbots, boring and lifeless branded websites can be transferred into exciting and personal interactions (Skorniakov, 2016). Skorniakov goes on to talk about some important design considerations.

1) Bots must be intuitive, if the user cannot determine how to navigate the bot, it negates the purpose of implementing it in the first place;

2) Bots need the right conversational flow and the user needs to be engaged;

3) Do not bombard the user with features, release each one gradually (Skorniakov, 2016).

Saiyed talks about how humans come pre-programmed with the ability to communicate, “the human body comes pre-installed with all the tools to help humans communicate—Speak, See, Hear, and Gesture through expression and movement”. In contrast, bots do not have these qualities and must engage with human expression where possible (Saiyed, 2017).
2.11. Student – university communication

There is a clear link between communication and learning, according to the Oxford English dictionary, the word ‘communication’ means: the act of imparting, especially news (Oxford English Dictionary, 2017). Teachers and lecturers are constantly imparting new knowledge and information on students (Prozesky, 2000). An ease of communication is vital to help satisfy a student’s learning needs. A 2010 report from The University of Manchester claimed that dissatisfaction with communication was clearly a key factor to the poor levels of student satisfaction and urgent overhaul was needed to help improve this (Waddington, 2010).

Aparajeya of toppr.com talks about how silence from a student does not always mean lack of interest. Professors and lecturers need to reach out to their students as students can often feel they are overwhelmed if they send constant communications (Aparajeya, 2016). A Gallup study showed that 68% of millennials said that digital messaging was their preferred source of communication, with phone calls being intrusive, especially to unknown individuals (Putz, 2017). Putz goes on to discuss how email and telephone calls are the main sources of interaction for universities, leaving them firmly outdated when it comes to communication with millennials. Georgia State University implemented a chatbot to help increase student–university interactions. Within four months 63% of students had interacted with the chatbot, over 200,000 messages had been sent, estimating it would have taken a team of 10 full time staff to answer all these queries and it would have cost an estimated $200,000 (Putz, 2017).

2.12. Conclusion

The purpose of this literature review was to get an overview of the developments within artificial intelligence, specifically emerging chatbot technology and research the role that it plays in third level education. The end goal of this project is to present a solution to the current issue of insufficient communication between students and university. A 2002 paper by Xenos et al. looked into main factors leading to drop out rates in third level education. Of the 18.3% who dropped out due to problems with tutors, 40.0% was down to ‘No assistance with materials’, a further 25.0% was ‘Lack of support’ and 23.3% down to ‘Communication problems’ (Xenos, et al., 2002). These three issues, plus many more, fall directly into the functionality of chatbots and will be discussed further on in this project as a bot is developed.

The majority of students that are currently at university can be categorised as Generation Z, these are people born from 1995 and onwards (Berkup, 2014). A generation that hasn’t
known a world without mobile phones, the internet and instant access to information when needed, they crave constant and immediate feedback (Looper, 2011). As of September 2018, the beginning of the new university academic year, the main entry students into UK universities will come from students born in 1997, this project aims to find a solution to help this generation to live their university lives through the only way they know, and at the same time helping universities adapt to technologies that can benefit both staff and students.
3. Methodologies

3.1. Introduction

Having established a theoretical outlook of this dissertation, it is important to discuss the methods that will be used to underpin the research and support the arguments presented in this dissertation. The data will be discussed in what form it has been collected, it’s prevalence and procedures followed. Carrying out surveys to gather data from a large cross-section of users of the bot will give this research project a backbone that cannot be abnegated, followed by a survey to review the processes that the bot can complete and its engagement rates.

“*The purpose of research is to discover answers to questions through the application of scientific procedures*” (Kothari, 2004).

The two main types of research that the research project will be focusing on is “Qualitative” and “Quantitative”. Qualitative research is based on the quality of collected data, using in depth interviews to gain a high quality of information (Patton, 1990). While quantitative research methods are used when collecting large quantities of data to gather an insight of a broad data set (Cavana, et al., 2001).
Table 1 Features of Qualitative & Quantitative Research

<table>
<thead>
<tr>
<th>Qualitative</th>
<th>Quantitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>The aim is a complete, detailed description.</td>
<td>The aim is to classify features, count them, and construct statistical models in an attempt to explain what is observed.</td>
</tr>
<tr>
<td>Researcher knows roughly what they need.</td>
<td>Researcher knows exactly what they are looking for.</td>
</tr>
<tr>
<td>Early project phase.</td>
<td>Latter project phase.</td>
</tr>
<tr>
<td>Design emerges as the study unfolds.</td>
<td>Study is carefully designed before data is collected.</td>
</tr>
<tr>
<td>Researcher is the data gathering instrument.</td>
<td>Researcher uses tools, such as questionnaires or equipment to collect numerical data.</td>
</tr>
<tr>
<td>Data is in the form of words, pictures or objects.</td>
<td>Data is in the form of numbers and statistics.</td>
</tr>
<tr>
<td>Subjective – data gathered has more meaning behind it.</td>
<td>Objective – quantity is more important than the quality.</td>
</tr>
<tr>
<td>Qualitative data is more complex, time consuming, and less able to be generalized.</td>
<td>Quantitative data is more efficient, able to test hypotheses, but may miss contextual detail.</td>
</tr>
</tbody>
</table>

(Huberman, 1994)

Table 1 Adapted from Miles and Huberman (1940, p.40)

The collection of primary data is intrinsic to this research project, with chatbots being relatively new in terms of popularity, especially at industry level its vital to gather insights
from the potential users of the bot. The secondary data that was found during this projects literature review gave this project a solid base in terms of understanding the fundamentals of the technology as well as important design considerations.

The below image shows the research onion that was developed by Saunders et al. (2007) and covers the stages that must be covered when developing a research strategy. Each layer of the onion describes a more detailed stage of the research process (Saunders, et al., 2009). Throughout the research in this project the layers of the research onion shall be adhered too to ensure complete and comprehensive research is carried out.

3.2. Initial survey

As this project is based upon the development and testing of a university chatbot, it is vital to collect relevant data from both students and staff members to determine what the key characteristics and functions of the bot must be. Thus, a survey has been designed as the best use to carry out such research. The survey will supply over 1500 data points once completed by a minimum of 70 students and should supply a solid base pointing the project in the right direction when it comes to initial design and development. A further 500 data points will be analysed once the survey has been complete by a minimum of 20 staff members. Ideally for
this project data from more than 20 staff members would need to be collected but due to limited numbers, unlike students, it may work out difficult. All of this collected data is important primary data that is vital to the development of this project. Without this, the development process would have to be entirely iterative, with constant evolutions from the prototype. As the primary data will give a base from where the design can begin it saves a great amount of time on the initial design.

3.2.1. Procedure
There are two individual surveys, both with similar questions with slight variance depending on whether it is a student or employee. As this bot is being specifically designed for university use, it will firstly be designed exclusively for Cardiff Metropolitan University use. This taken into consideration means that every subject that takes part in the research and study must be currently enrolled in Cardiff Metropolitan. All data collected will of course be kept securely using Qualtrics encrypted survey software to ensure complete subject anonymity. As a lot of the questions are regarding the understanding of chatbots and their supporting technologies it’s important to gather a large sample, instead of only students who study computer-based degrees.

3.2.2. Risks
The risk surrounding collecting data from too similar of a subject pool could potentially lead to skewed results. Students on computer-based courses are predicted to have a heightened sense for new and emerging technologies, thus will have more of an understanding when it comes to chatbots and related technologies. The same risk is possible when it comes to the surveying of staff, asking only staff from the business department may lead to the same skewed results. It is essential, that if this study is going to be truly accurate the data gathered must come from a truly representative spread of subjects.

3.2.3. Data
Once gathered, this data will be integral to the initial planning of the design and development of the bot. This data provides a direction for what until then will be a generic customer service bot. Above all this data will help show whether technology like chatbots can potentially be adopted by universities and educational institutions, it is vital to achieve a high adoption rate from both staff and students.
3.2.4. Ethics
The surveys ask a few personal details, for the students they are;
- Gender
- Age
- University degree
Staff members are asked;
- Gender
- Age
The subjects have, at any time an option to withdraw their survey and a full explanation to how their data is being used will be provided. The subjects will of course have to give consent and will be told this before they are engaged with the survey. The survey is completely voluntary and suitable for everyone as long as they are either a member of staff or student of Cardiff Metropolitan University and the survey adheres to the Equality Act 2010.

3.3. Follow-up Survey
Once the bot has been designed and developed based on the initial survey’s findings it will then be time to test the bot. It’s important to gather insights that can be used for potential future iterations of the bot. Engagement rates as well as popular and unpopular features will help produce the most useful and streamlined bot. This survey will be less structured and more about gathering a range of information that the user can provide once it has used the bot. For this reason, this data can be seen as more qualitative and thus it isn’t as important to gather information on mass. It’s important to ask a similar cross section of people that responded to the initial survey, these will be the target audience of the follow up survey.

3.3.1. Procedure
Testers will be invited to come and receive a demonstration of the developed chatbot. Chosen testers will be given a brief introduction to chatbots and artificial intelligence regardless of their experience level. Testers will then be shown the bot being used and a selected six functions will be demonstrated. The same six functions will be demonstrated to each tester as to attempt to gain non-biased results. The survey will be made up of five to ten questions, three to five initial ones before the demonstration begins and five following the demonstration.
3.3.2. Risks
As the testing will take place on a much smaller sample size, approximately ten, the greatest risk is not gathering substantial feedback from a wide enough cross-section of testers. The testers will be selected from different degree areas to negate skewed results of any kind.

3.3.3. Data
Once gathered, this data will be central to the final outcome of this project. This data and feedback will provide a clear and answer to the initial question posed within this project. Without the results from this follow up survey it would be impossible to fully determine if this sort of technology would be applicable to an educational institution.

3.3.4. Ethics
The surveys ask a few personal details, for the students they are;
- Gender
- Age
- University degree
Staff members are asked;
- Gender
- Age
- Degree taught
The subjects have, at any time an option to withdraw their survey and a full explanation to how their data is being used will be provided. The subjects will of course have to give consent and will be told this before they are engaged with the survey. The survey is completely voluntary and suitable for everyone as long as they are either a member of staff or student of Cardiff Metropolitan University and the survey adheres to the Equality Act 2010.
4. Findings and analyses

4.1. Introduction

This chapter of the research project is in place to present the findings from the two initial surveys, prior to development and post testing. The aim of the two surveys was to get a baseline design criterion for the university chatbot. Both practical uses and functions as well as design considerations such as the bots’ persona. These results were key to the development and design of the bot, and the findings will hopefully help with potential higher interaction, adoption rates and increased user satisfaction.

Unlike corporate companies who are implementing chatbots and trying to get them to market as quick as possible, this project has had sufficient time to produce a meaningful survey, gather the insights and create a functional bot that helps with real issues that both students and employees have.

The findings within this project is the most vital stage, it has helped within the development of the bot, and will also be intrinsic to the adoption rate of the bot and whether there is a use case for chatbots within a university environment. Without these findings the project would have no real meaning as it would be impossible to predict the adoption rates of the bot.

4.2. Student Survey

The student survey was distributed throughout the university, using email. A total of 100 respondents within a week’s collection that has a good range of students, coming from a total of 27 different courses. This was one of the most important aspects of the collected data, it was vital for the project findings that the data was collected from different degree areas to avoid skewed results. As the chatbots are a rather niche subject and technology, it was clear that if the survey was only distributed to degree areas related to computing they would have a much greater understanding than any other degree area.

4.2.1. Student field variance

As seen in the below figure, a large degree of respondents came from computing degrees, but not too many that the results will be skewed by this. The decision was made to sort the individual degrees into degree areas to create a cleaner and more legible results. With Cardiff’
Metropolitan University being split into two campuses, sports related degrees and other, the results were always going to have a high percentage of sports students. The other large degree area was business related degrees with the remaining 6% being made up from other degrees such as chemistry, early childhood studies and postgraduate certificate in education.

Figure 10 Q5 - What degree are you currently enrolled on?

Figure 11 Q5 - What degree are you currently enrolled on?
The two main goals of the survey were to find out;
   1. Whether students are satisfied with university communications
   2. Whether they would adopt chatbot technology as a solution

4.2.2. Student university communication

Question 7 in the survey asked;
   - How do you communicate with university?

The below result quite clearly shows that email and face to face are clearly the most popular.

![Bar chart showing communication methods and frequencies](image)

*Figure 12 Q7 - How do you communicate with university?*

The face to face option shows that these students only communicate when they are in university, looking at question 6, its asks;
   - How many days on average a week are you in university?

For the students that use face to face communication and are only on average in university 3 days a week, which was the mode finding. This is relatively limited communication considering how important communication, more specifically the ease of communication and its benefits in learning (Prozesky, 2000).
4.2.3. Student queries

Question 19 was intrinsic for gaining guidance and answers when it comes to the functionality and potential use of the bot;

- Of the below, what are the most frequent questions that you need to ask university?
The creation of a chatbot for questions and purposes directly assesses the problem of lack of communication, as discussed in the above literature review, just because students aren’t interacting doesn’t mean that they aren’t engaged (Aparajeya, 2016). A properly implemented chatbot could directly combat this problem, looking at question 19 it’s clear to see that assignment queries are the most frequently asked questions. Being chosen by 94% of students as their number one and number two query with their lecturers. These queries are often generic ones such as;

- What is the word count?
- When is the due date?
- What is the marking criteria?

These questions are ones that are the same for each student, and thus presents a perfect use case for a chatbot that can handle all these queries freeing up the time that it takes a lecturer to reply to these.

Assignment queries was closely followed by exam specific queries with a total of 45% of students choosing this as their second most common enquiry.

4.2.4. University website

Respondents of the survey felt that information on the university website was generally quite easy to find, as seen in the below figure, 71% found that information was either slightly easy or neither easy nor difficult to find. The university website is clear and concise and confirmed the idea that a chatbot is not needed for this sort of information, rather for when it comes to interactions between staff and students.

![Figure 15 Q8 - How easy is it to find information on the university website?](image)

4.2.5. Communication methods

A vital consideration when it comes to whether students will adopt chatbot technology or not is the forms of communication they use on their mobile device. Some channels haven’t yet been opened up to chatbot technology, such as WhatsApp, which is disappointing as out of the 100 respondents the highest percent use WhatsApp as their main form of communication.
Positively for this study though, Facebook Messenger was a close second with 34% and has an open chatbot platform, being the form of communication that the university chatbot will be designed on.

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<th>Count</th>
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</tr>
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<td>No</td>
<td>6%</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
<td>100</td>
</tr>
</tbody>
</table>

Even more positive for this study showed that out of the 100 students that answered the question regarding have Facebook Messenger installed on their mobile device, a landslide 94% said that they did. With the survey participants coming from a wide variety of students this a realistic percentage to represent all students.

4.2.6. Threat of artificial intelligence

One of the biggest reluctances that people have with AI, robots and chatbots is the potential threat they carry to their work and livelihood. There is a general perception that artificial
intelligence will cause widespread redundancies, with no real evidence to suggest this. Of the 74 students that responded to this question, 56 believe that AI will not cause redundancies in their field of study. A positive outcome and one that will greatly lead to the adoption of developing technologies like chatbots.

![Figure 18 Q16 - Do you believe chatbots & AI will cause redundancies in your field?](image)

Even more positive was the response when asked;

- ‘Would you feel comfortable communicating with a chatbot instead of a human if you were to receive the same information?’

With nearly 60% saying yes it once again leads this project to the conclusion that chatbot technology will be adopted and used in a university environment.

<table>
<thead>
<tr>
<th>#</th>
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<th>Count</th>
</tr>
</thead>
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<td>59.77%</td>
<td>52</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
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<td>35</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>87</td>
</tr>
</tbody>
</table>

![Figure 19 Q17 - Would you feel comfortable communicating with a chatbot instead of a human if you were to receive the same information??](image)

4.2.7. Chatbot personality

The final question within this projects survey for students was;

- Do you believe robots/chatbots should have a persona?
A very important finding when it comes to the creation of the bot and how much of a human personality it should adopt, with the responses split down the middle its clear to see that students don’t want to be fooled into thinking they are communicating with a human when they aren’t. A result that correlates with lots of literature that is already out there regarding the uncanny valley.

![Figure 20 Q21 - Do you believe robots/chatbots should have a persona? E.g. the Paperclip from Microsoft word, trying to come across as a human.?](image)

4.2.8. Student conclusion

With student use of the proposed chatbot being the highest proportion of use, it is vital that all the findings and considerations are taken into account. According to the website ‘What Uni?’ ([https://whatuni.com](https://whatuni.com)) Cardiff Metropolitan University has 8,230 undergraduates. Of which 60% of a surveyed cross section of students said that they would be happy to communicate with a bot over a human.

94% of the surveyed students already having the appropriate chatbot communication platform installed on their mobile phone. Meaning that the roll out of this technology could be easy and seamless, the initial interaction rate would be exceptionally high and if the experience is positive it lends itself to a high adoption rate.

The student survey establishes several things for the development of this project;
- The survey pool is large enough to represent the student population at Cardiff Metropolitan University
- Students communicate with lecturers primarily through email
- On topics that are largely automatable
- Student communication is lower than it should be
- There is a widespread and popular platform for a bot to be launched on that is accessible to high proportion of students.

The findings within this student survey has returned favourable results for the potential development of a university chatbot. Students seemed responsive to the idea of a chatbot and felt comfortable with the idea of communicating with a bot. The survey responses have aligned with supporting literature and have reinstated the main goal behind this project.

4.3. Staff survey

The staff survey was distributed throughout Cardiff Metropolitan University to current staff via email. The email asked for voluntary involvement in a survey to find out more about potential interaction rates with a potential university bot as well as staff-student communication frequencies. A total of 23 respondents of the survey were recorded, this is somewhat lower than the student responses but is a comparable percentage when the number of students to staff is analysed. The staff survey was also more information rich, asking detailed questions so the research was much more about quality than quantity like the student survey.

Once again due to the subject of this project being rather niche it was important to gather information for a wide variety of staff members. A large response from computer science-based lectures would most likely skew the results in the favour of the said chatbot. The data gathered form the staff survey was vital to not just the functionality and persona of the bot but also the evaluation of potential adoption rates. The survey was designed to not only find out how often and of what subjects the lectures communicated with the students with, but also as to whether lecturers would feel comfortable communicating with a bot.
4.3.1. Staff chatbot adoption

Of all 22 questions that were asked in the staff survey, the below result came out as probably the most important one. The adoption of a university chatbot is the most important result at the end of this project. The functionality of the bot can be of the highest standards, but if people refuse to adopt and use the bot then the potential investment of such a technology would be redundant.

The response to the question;

- Would you feel comfortable talking to a chatbot/robot instead of a human if they were to give you the same information?

As seen in figure 21 below, it shows that over 60% of staff respondents would be willing to at least try out chatbot technology if it was offered in a university environment where it could return the same answer as though they were talking to a human. With 43% saying they would definitely use it and 17% willing to give it a go at least once.

![Figure 21 Q17 - Would you feel comfortable talking to a chatbot/robot instead of a human if they were to give you the same information?](image)

The importance of this response cannot be understated and gives the use of a potential bot the upper hand with having to only win over 39% of the teaching population at Cardiff Metropolitan University.

4.3.2. Chatbot threat

As talked about in the above literature review, one of the main reluctances when it comes to chatbot adoption and artificial intelligence is the fear of redundancies. This question was posed to the lecturers at Cardiff Metropolitan University;

- Do you believe chatbots & AI will cause redundancies in your field?
According to the website “Will Robots Take My Job?” (https://willrobotstakemyjob.com), which uses data formed by Carl Benedikt Fry and Michael Osborne, there is only a 3.2% chance of complete automation when it comes to post-secondary teachers. Compare that to 65% when it comes to librarians it is no surprise that only 4% of the lecturers asked feared their jobs. They clearly believe that the service they are providing cannot be reproduced by chatbots / AI.

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>4.35%</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>30.43%</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Don't know</td>
<td>65.22%</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>23</td>
</tr>
</tbody>
</table>

*Figure 22 Q16 - Do you believe chatbots & AI will cause redundancies in your field?*

4.3.3. Student-staff communication

Another important aspect of this survey was to find communication methods and topics between staff and students. This was to ensure the bot was designed with the correct functionality and can carry out the tasks that are most needed by staff to help automate certain tasks.

Staff were first asked:
- Select the 3 most common queries you receive from students from the below list

With the list being:
- Exam queries
- Assignment queries
- Timetable queries
- General feedback
- Admin (Seminar groups, presentation times etc.)
The three leading queries according to research were;

- General feedback (28%)
  Information including feedback on exams, presentations, assignments and seminar work.

- Admin (26%)
  Enquiries regarding seminar groups, presentation times and mitigating circumstances.

- Assignment queries (24%)
  Information regarding assignment groups, marking criteria and due dates.

The response to this question followed by the following question;

- How many emails a day do you receive from students a day regarding the above subjects?
With 73% of university lecturers receiving from between 5-20 emails a day from students on topics that can be easily automated it shows clear grounds for the introduction of a university chatbot to help automate these tasks.

4.3.4. Staff-admin communication methods

The next question asked to the staff was based on the communication methods they have with the university itself. If this potential bot is to be rolled out for the use of both staff and students, then it is important that there is a specific use for both.

The below question was aimed at staff specific questions and their interaction with university admin.

- Select the 3 most common queries you have with university admin from the below list.

In the below figure 25, it shows clearly that three most common enquiries from staff to university admin are;

- Specific student issues 33.9%
- Student issues 30.51%
- I.T enquiries 30.51%

Once again, this outcome cements the issues that are most common with staff members and reiterates the use for a potential chatbot that can handle these sorts of issues.
4.3.5. University website

The final set of questions regarding functionality that were asked to the lecturers of Cardiff Metropolitan University were regarding the use and ease of use of the university website. Interactions and communications with university admin can be cut down when generic information can be found on the university website.

91% of the staff answered yes when they were asked;

- Do you often need to find information on the university website?

As seen below in figure 26.
With 91% of university staff regularly going to the university website to find information this lends itself to the use case of a university website and specifically a FAQ (Frequently Asked Question) section. This scenario would be useful for the large amount of staff who regularly search the university website and could now find the information by simply talking to a bot.

In the below figure it can be seen that only 17% of university staff answered yes to this question;

- How easy is it to find information on the university website?

A relatively low number considering how vital the university website is to when it comes to spreading important information for both staff and students.

![Bar chart showing responses to Q8: How easy is it to find information on the university website?]

Figure 27 Q8 - How easy is it to find information on the university website?

4.3.6. Chatbot platform

Finally, like all emerging technology it is about adoption rates and if an investment is being made into a new communication platform it must be ensured that users have the correct tools to adopt its use.

Of the 23 participants just over 13% answered Facebook Messenger to following question;

- What is your most used form of communication on your mobile phone?

As this is the only option of the below that has open APIs (Application Programming Interfaces) and a built-in platform for chatbot development, this is the platform that the initial bot will be built on.
Despite only 13% of university staff saying Facebook Messenger was the most used form of communication on their phone, in figure 29 it can be seen that nearly 74% of respondents said yes to the following question;

Do you have Facebook Messenger installed on your mobile phone?

Nearly a quarter of the cross section of staff at Cardiff Metropolitan University have Facebook Messenger installed on their mobile phone. This means this project has fantastic reach across the university when it is considered that in the student survey a massive 96% had Facebook Messenger installed on their devices.
Figure 29 Q12 - Do you have Facebook Messenger installed on your mobile phone?

4.3.7. Chatbot persona

The final question asked was in relation to the designing and personality of the bot. It is widely regarded that all chatbots should have some sort of personality when it comes to interacting with the user (Jongbloet, 2017). It is important to establish this with the potential users to ensure they are comfortable with interacting with the bot and that it does not fall into the uncanny valley. With 78% responding saying either yes or don’t care to the below question it is vital that the bot has some sort of persona.

- Should robots/chatbots have a persona? E.g. the Paperclip from Microsoft word, take the form of a human/character?
4.3.8. Staff conclusion

There are three boxes that must be ticked when it comes to designing a chatbot;
- Will the bot solve a problem?
- Are there users that will adopt the use of the bot?
- Is there a widespread platform that the bot can be used on?

Established from the staff survey is that Cardiff University lecturers are inundated with emails, up to and over 20 a day from students regarding somewhat repetitive topics. The integration of a chatbot with the university system could help solve the problem of university staff having to spend valuable time responding to these emails. As well as this issue, there is a clear ease of use issue with the university website, with 91% saying they visit it regularly looking for information but only 17% find it extremely easy to find information. With these two issues it is clear that there is a use-case and grounds for the integration of a university chatbot.

With 60% of the university staff responding saying they are comfortable receiving information from a bot there is a clear set of users for the said bot. With over 50%, as seen in figure 31 being over the age of 46 and above this will lend itself negatively to the adoption of new technology. Birren, Woods and Williams talk about how an older workforce is unable...
to process complex information processing tasks, with the same being said with emerging and developing technology. This having been said, Tracy L Mitzner et. al, talks about how older generations do believe that the positives outweigh the negatives in emerging technology, and the stereotype that older generations are unwilling to adopt new technology is untrue (Charness & Boot, 2009). A clear pool of users from the staff side of the university is present and makes a compelling argument for the introduction of chatbot technology.

Within the survey, questions 17 and 18 establish that there is a clear platform of which to build the chatbot on. With nearly three quarters of the university staff having Facebook Messenger installed on their mobile device. As a starting point to integrate this technology that can grow once established to several different platforms such as Slack, physical personal assistants like Amazon Alexa and Google Home or even integrated on the university website.

![Figure 31 Q2 - What is your age?](image)

21.74% 13.04% 34.78% 30.43%
5. Design Considerations

5.1. The Platform

Cardiff Metropolitan University bot is being built using Oracles IBCS (Intelligent Bot Cloud Service), a SaaS (Software as a Service) product that falls within their Mobile Cloud Service umbrella of products. Bots can be created for use with text and speech written in YAML. IBCS combines AI (Artificial Intelligence) and NLP (Natural Language Processing) powered by Neural Networks and Machine Learning. It allows for the seamless transfer from bot to human agent without having to change any interface as well as providing data rich graphics to help view user inputs and outcomes.

The use of Oracle IBCS allows the user to converse in a natural manner without having to specify key phrases, it guarantees a natural conversation flow in multiple languages.

5.2. Login / security

5.2.1. Moodle API

Cardiff Metropolitan University currently uses Moodle as a learning platform, which collaborates both students and lecturers. It provides secure storage as well as a personalised experience. Moodle is currently used to authenticate both students and lecturers, so they can gain information and communicate.

Through the use of a Moodle API (Application Programming Interface) within the university chatbot users can be authenticated to a level accepted at university standards.
Each time a user interacts with the bot they will be presented with the above login screen. The bot makes an API call to Moodle which redirects the user to the Moodle login, if the credentials are correct and accepted the user is then redirected back to the bot. With correct authentication the bot can now access the user’s data due to the access from the Moodle API. The bot can access profile of marks, assignment feedback and contact details as well as many other useful resources.

The security feature of this bot is the most important aspect of the design, without security and the safe storage and access of data, this whole project wouldn’t be possible as the security of data is of upmost importance.

Below is the snippet of code that is used to invoke the Moodle API.
login:

  component: "System.OAuthAccountLink"

  properties:

    prompt: "Please login now."

  authorizeURL:


  variable: "code"

  transitions: {}
5.3.  Bot flow

Once the user has been authenticated the bot then asks the user ‘What can I help you with?’, the user simple enters an utterance and using NLP the bot decides what intent is being asked.

In the below figure 34, the user can be seen to be starting an interaction with the bot. The bot returns the Greeting function. A Greeting intent is created, and a list of example utterances is given to help the bot learn. As seen figure 35 and figure 36 multiple different words and phrases can be used to being interaction with the bot, with even foreign languages being accepted and processed with the NLP.

<table>
<thead>
<tr>
<th>Bot</th>
<th>Intent</th>
<th>Q&amp;A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hi there,</td>
<td></td>
<td>Hi there, I am Edu, Cardiff Mets personal virtual assistant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Please login with your student/staff number:</td>
</tr>
</tbody>
</table>

*Figure 34 Initial interaction*

<table>
<thead>
<tr>
<th>Bot</th>
<th>Intent</th>
<th>Q&amp;A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Howdy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hi there,</td>
<td></td>
<td>Hi there, I am Edu, Cardiff Mets personal virtual assistant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Please login with your student/staff number:</td>
</tr>
</tbody>
</table>

*Figure 35 Alternative interaction*
It is at this stage in figure 37 below that the Moodle API is called for authentication. As the bot is a demo, the user has been prompted to login with its student number and Moodle password. Once the user has been authenticated and accepted, the bot welcomes the user and asks how it can be of further use. As the bot uses a Moodle API to authenticate the user it now knows exactly whether the user is a staff or a student, meaning it can draw relevant and personable information for each user.
It is now at this stage where the ML and NLP really play their part. The user is free to enter any free text and it is up to the bot to analyse the text and respond with an acceptable and intelligent answer.

The bot responses are built of two sections, a Q&A (Questions and Answer) section made up of all FAQs (Frequently Asked Questions) found on the university website and the answers and data that can be taken from Moodle via the API.

When a question is asked, the bot will work out whether there it is a direct question that needs to be answered using Moodle or whether it falls under the Q&A section. If its decision is split between the two, it will give the user a prompt of two options, one being View Answers which is the result of a Q&A.
Below in figure 39 the user has asked “What is my average mark?” with the correct syntax and thus there is only one correct answer and the bot returns an answer with the student’s average.

![Figure 39 Average mark query](image1)

### 5.3.1. Confidence threshold

When the student says only one word, “mark”, the bot believes that it sits within the intent ‘Average Grade’ but cannot be sure and offers the Q&A result as it believes that the user could also be asking something regarding a frequently asked question.

![Figure 40 Bot intelligence](image2)

As seen below in figure 41 the bot is 61.4% confident that the word mark is related to the ‘Average Grade’ intent, but because of the vast number of FAQs it can never be certain when just one word is asked. Below in figure 42, ‘View Answers’ was selected, and it shows that the word ‘mark’ is related to the FAQ where students often ask, “What if I fail an exam or year?” which is related to the marks a student receives.
In the below figure 43 the user has continued on from the Q&A with another free text question. As the user hasn’t ended the session they are still authenticated and can ask any questions. The user inputs “can I have assignment feedback”, it is a question asked with incorrect syntax, but the bot recognises the correct intent and gives the user the list of
modules they are currently taking. The data for the module list has been queried using the Moodle API.

![Image of module selection](image)

**Figure 43 Assignment feedback query**

The user here has selected the fourth option and returned to the user is full feedback that the module leader has left for each student.

![Image of feedback](image)

**Figure 44 Assignment feedback**

62% - Term ones assignment was clear concise and followed the brief. Marks were lost with lack of clarity with some of the images and you need to be a little bit more critical in your writing rather than summarising your work as your write. Overall I feel like you can achieve a higher grade in term twos assignment and no reason you can’t average a 1.1 overall in this module. If you want more feedback then please feel free to get in touch and we can discuss.

Regards, Stuart

The user has been switched to a staff member having ended the session and now logging in with the staff credentials and being authenticated through the Moodle API. The staff user has entered “mitigating circumstances”, as the user has been authenticated as a staff member, the
bot knows that this is within the ‘Student Issue’ intent with a confidence percentage of 82.8%.

![Confidence threshold](image)

Before proceeding the bot needs to know which student the staff member is querying about. The bot then queries Moodle to find all the information it has on the certain student.

![Moodle query](image)
In this example the staff member is marking the student’s final exams and feels that maybe their attendance could be a contributing factor to their grades. The staff user selects “Average attendance” and the bot returns the answer, seen below in figure 47.

![Average attendance](image)

Figure 47 Average attendance

It has taken the staff member less than 30 seconds from login to final answer to find what they are looking for, less time than it takes to turn on a computer and all from the convenience of their mobile device with all the security of using Moodle.

5.4. Agent transfer/Escape route

As the bot is being built on Oracle IBCS it comes with the ability to easily and seamlessly transfer from bot to human agent if the conversation needs to be upgraded for whatever reason. The user is prompted if the bot is unable to respond appropriately and is passed off to a human agent who is at a service desk ready to ask questions. Once the human has given a suitable response the human can then pass the user back to the bot to complete the interaction.

Research surrounding this project has shown this would be an ideal feature within a university environment, with arguably all universities having help desks, this is the sort of feature that would allow for ease of use.
5.5. Channel integration

The channel of communication chosen for this project was Facebook Messenger, due to having an open platform and its popularity it was seen as the natural choice. Research undergone in the initial survey showed that 94% of students and 74% of staff members had Facebook Messenger installed on their mobile device. With numbers as high as this, Facebook Messenger was the obvious choice of platform.

Oracle IBCS uses a secure webhook URL and a complex verify token from the platforms end to validate and ensure a connection for the bot. While Facebook supplies an access token and app secret to validate and secure from their end, both can be seen in figure 49. A webhook is a secure connection, an API that is established through a HTTPS URL and delivers data immediately.

Also seen in figure 49 is a session expiration setting, this is an important feature security wise as once logged in the user has access to a wide range of potentially sensitive information. Five minutes was the selected amount of time before the user is asked to re-authenticate themselves.
As seen below in figure 50, Facebook supplies an App ID and App Secret to ensure the webhook is communication with the correct Facebook page and application. Further down in figure 51 the bot is being configured using the webhook URL and the complex verify token. Once accepted the bot is ready and functioning.
5.6. Chatbot analytics

Facebooks developer page, developer.facebook.com offers access to all applications created on the Facebook platform. It is within here that Facebook also offers detailed analytics on created Facebook pages and applications.

As the Cardiff Metropolitan University Bot has not been made publicly available it only has one user. The analytics below seen in figure 52 and figure 53 show what is presented to the administers of the bot and gives clear and concise analytics such as unique users and API calls.
Figure 53 Analytics

As seen below in figure 54, once the analytics section has been expanded it shows a detailed breakdown on what sort of analytics are available. Analysis on active users, user retention, frequently asked questions, breakdowns and percentiles are all freely available and allows for administrators to gain valuable insight from their chatbot.
The Facebook platform doesn’t stop there in terms of add-ons and valuable insights. The Facebook platform allows for the addition of things such as web payments which has potential when it comes to a university bot for a number of different scenarios. As well as payments it allows for the integration of events, again helping to enrich student satisfaction and even potentially letting the university monetize its bot via advertising if they so wish. All of the additions can be seen below in figure 55 and figure 56.
Figure 55 Facebook extensions

- **Account Kit**: Seamless account creation. No more passwords.
- **Audience Network**: Monetize your mobile app or website with native ads from 3 million Facebook advertisers.
- **Instant Games**: Create a cross-platform HTML5 game hosted on Facebook.
- **Marketing API**: Integrate Facebook Marketing API with your app.
- **App Center**: Get your game discovered by being listed as a featured game on Facebook.
- **Web Payments**: Accept in-app payments through Facebook’s secure payment system.
- **Instagram**: Integrate your app with the Instagram API to let businesses use your app with their Instagram accounts.
- **Messenger Expression**: Let people on Messenger express themselves more creatively through your app.

Figure 56 Facebook extensions

- **App Ads**: Drive new installs to your app or engage existing users.
- **App Events**: Add events to your app to view analytics, measure ad performance, and build audiences for ad targeting.
- **App Invites**: Let people invite their Facebook friends to a mobile app in a personal way.
- **App Link**: App Links is an open cross-platform solution for deep linking to content in your mobile app.
- **Workplace by Facebook**: Make your workplace more productive and connected for quick, easy and effective communication.
- **Facebook Pixel**: Engage existing customers, find new customers, measure results, and drive conversions.
- **Instant Articles**: A new way for publishers to create fast, interactive stories on Facebook.
- **Pages APIs**: Publish and send content as a Page. Manage Facebook Pages from your app.
- **Sharing**: Enable people to post to Facebook from your app.
5.6.1. Other platforms
The potential extension of platforms to a mobile application based chatbot, or a website based chatbot are there and ready to go. Through the use of Oracle IBCS and the simplicity of the platform it takes very little time to verify a new platform. As Cardiff Metropolitan University has both a mobile application and a website these are two platforms that could be looked at if the initial integration with Facebook Messenger is successful.

5.7. Question and Answer function
As discussed above, the bot responses come from two areas. Information that can be taken via the Moodle API and the other is a Q&A (Question and Answer) that has been uploaded to the Oracle IBCS bot. This Q&A is based on the FAQ (Frequently Asked Questions) page that can be found on the Cardiff Metropolitan University website. Arguably the main reason anyone visits the university website is to find out and gain information. To have all these questions and answers within the bot takes out the wasted time it takes to search the website. A user can simply input the question they want answered and if it appears within the FAQ on the website, the bot can quickly and simply give them an answer.

As seen below in figure 57 the list of questions and answers are inputted as a CSV (Comma Separated Values) file and uploaded to the IBCS instance. They are separated into categories to help the bot differentiate each question and to also help recommend similar answers. Figure 58 shows how multiple Q&A’s can be added for different areas of knowledge, while figure 59 shows the intelligence the bot uses to ignore commonly used words that are used to form large quantities of sentences. This helps differentiate from Q&A question and a regular expression.
5.8. Chatbot persona

The following question was posed to both staff and students during the primary research for this project;

- Should robots/chatbots have a persona?  E.g. the Paperclip from Microsoft word, take the form of a human/character?

Over 61% of students and 78% of staff answered either yes or don’t care. These results showed that the chatbot being created should at least take some form of a character. The character that has been created to represent the chatbot is Alex the Archer. This persona plays on the already used figure of an archer to represent Cardiff Metropolitan, the name Alex was
used as its gender fluid. Alex the archer can be seen below in figure 60 with this image being used as the profile picture for the Facebook page. Figure 61 below shows the image being used for the cover photo on the Facebook and helps to portray the link between the bot and Cardiff Metropolitan University.

![Figure 60 Andy the Archer](image)

![Figure 61 Facebook profile](image)

The bot has some built in functions to help give it a more human and approachable feel, it understands the users name based on their Facebook profile, so it addresses them when applicable. It uses polite expressions like a human, and even comes out with the occasional joke depending on certain questions being asked as seen in figure 62.
5.9. Design conclusion

The design considerations of the bot are imperative to the adoption rates and the potential use of the bot. As outlined in the literature review, it is vital for chatbots to have a robust framework to avoid falling into an unorganised trap. The initial survey supplied a base for design taking into consideration the responses of all test subjects. It cannot be stated highly enough how important it is to have a well-designed chatbot, failure to listen to the target audience can result in limited adoption rates.
6. Results

6.1. Secondary qualitative survey

6.1.1. Introduction

With the chatbot having been designed with the considerations of the initial staff and student survey, the next stage was the testing and feedback of the chatbot. The findings from the second qualitative survey will help determine the success of this project. They will go a long way to determining whether the implementation of a chatbot within a university is something that will benefit both students and staff members. The desired result of the secondary survey is to have positive results for two main findings;

- Would the bot get use in both a staff and student environment?
- Would it simplify and increase enjoyment of both university and working life?

6.2. Qualitative testing method

6.2.1. Testing

Testers will all be given an introduction to chatbots and the technology regardless of their experience level. All testers will then be shown the same demonstration of the chatbot. The testers will be demonstrated six different examples of student/staff to bot interactions.

Next the testers will be read out the same script each, showing the same six bot functions;

“Thank you for taking part in this testing for this undergraduate dissertation, titled ‘Evaluation, development & testing of an educational support chatbot’. A chatbot is an automated intelligent system that uses artificial intelligence to simulate conversation with humans. The one you are about to see is a prototype for Cardiff Metropolitan University. The idea of this chatbot is to help aide student staff communication with students being able to access all the data that they have access to via Moodle and the university website.

As you can see the bot communicates via Facebook Messenger. The scenario for the use of this bot is a student/staff member looking to ask a university related question.

The user engages the bot by saying hello, the bot replies, welcoming the user and asking it to login with its student/staff number and password, the same as using Moodle. Once
authenticated, the user is now free to ask the bot its questions. Through the use of free text and natural language processing the student can ask the same question in numerous ways and hope to get the desired answer.”

The questions will be asked using different syntax with both punctuation and without, this will be explained to the tester, showing the NLP and the intelligence of the bot.

Testers will then be asked for feedback on their experience with the bot.

6.2.2. Students
Prior to the above script and testing, the student testers will be asked to complete a five-question survey.

Initial questions;
1. Gender
2. What age are you?
3. Year of study?
4. What do you study?
5. How familiar are you with chatbot technology? 1-10

Student testers will then be shown the bot being asked six questions that a student could potentially ask, this is to demonstrate to the tester it’s potential use. The questions that the bot will be asked are;
- Can I have assignment feedback?
- What is my next class?
- What is my average grade?
- What events are on this week?
- When is the next bus to town?
- Can I ask my lecturer a question?

Follow up questions;
1. Having seen the functionality examples, do you believe you would use something similar if it was available?
2. How much do you think this would simplify your university communications and learning? 1-10
3. Do you think you would visit the university website less if this was available?
4. Do you think you would visit Moodle less if this was available?
5. Given that the bot could potentially supply you with all the information from both the website and Moodle, can you think of any other functionality that would be useful? E.g. Weather forecast, bus timetable, city events.

1. Collect verbal feedback on the concept.

Testing concluded.

6.2.3. Staff

Prior to being read the above script, the staff testers will be asked to complete a three-question survey.

Initial questions;
1. Gender
2. What age are you?
3. What subject area do you teach?
4. How familiar are you with chatbot technology? 1-10

Staff testers will then be shown the bot being asked six questions that a staff member could potentially ask, this is to demonstrate to the tester it’s potential use. The statements that the bot will be asked are;
- Can I add assignment feedback?
- There is a broken computer in my room.
- How much is a student attending?
- How many holidays have I taken?
- When is the next bus to town?
- What is the weather like today?

Follow up questions;
1. Having seen the functionality examples, do you believe you would use something similar if it was available?
2. With students being able to use this bot to receive information such as marking criteria’s and feedback do you think this would help streamline communications with them?

3. Given that the bot could potentially supply you with all the information from both the website and Moodle, can you think of any other functionality that would be useful from outside the university? E.g. Weather forecast, bus timetable, city events.

4. Do you think you would visit the university website less if this was available?

5. Do you think you would visit Moodle less if this was available?

1. Collect verbal feedback on the concept.

Testing concluded.

6.3. Qualitative testing results

The purpose of this study was to fully determine whether chatbot technology had a place in educational institutions, leading to improved communication as well as satisfaction of both students and staff members.

6.3.1. Students

Results from the follow up survey of student testers had one sided and clear results in the favour of the introduction of an educational support chatbot. Of the ten participants that were asked for feedback after being shown a demonstration of how the bot would work, 100% said they would either definitely use (60%) or probably use (40%) a similar bot if it was made available.
With the cross sections of students coming from a total of nine different courses offered by Cardiff Metropolitan University the conclusion can be drawn that this is a fair result and not skewed by any particular course.

- What degree are you enrolled on?

Sports psychology
Software engineering
Dentistry
Sport & exercise science
S.C.R.A.M (Sports conditioning, rehabilitation and massage)
Accounting & Finance
Business Management
Business Information Systems
Events management
Software engineering

Figure 64 Q1 - Having seen the functionality examples, do you believe you would use something similar if it was available?

Figure 65 Q4 - What degree are you enrolled on?
When testers were asked on a scale of 0-10;
- How much do you think this would simplify your university communications and learning?

With 0 being not at all and 10 being very much so, the mean response was 6.6 with no responses being below five. The results of this question show that of the ten respondents 100% believed that the introduction of this technology would improve their use of Moodle, the university website and communications with the university by at least half. With 50% of respondents feeling it would improve their experience by 70%.

Testers were then asked;
- Do you think you would visit the university website less if this was available?
- Do you think you would visit Moodle less if this was available?

As seen below in figure 66 and figure 67 the testers believed they would considerably use both the website and Moodle less if a chatbot was introduced. With 100% saying they would definitely or probably visit the website less and 80% saying they would definitely or probably visit Moodle less.

<table>
<thead>
<tr>
<th>Definitely yes</th>
<th>Probably yes</th>
<th>Might or might not</th>
<th>Probably not</th>
<th>Definitely not</th>
</tr>
</thead>
</table>

Figure 66 Q3 - Do you think you would visit the university website less if this was available?
The final question that the testers were asked after they had experienced the bot was feedback on the functionality. The testers were shown two external functions that could be used within the bot, weather and bus timetable. The testers were then asked;

- Given that the bot could potentially supply you with all the information from both the website and Moodle, can you think of any other functionality that would be useful? E.g. Weather forecast, bus timetable, club events.

As seen below in figure 68 the results varied from each user with certain functionality requests appearing consistently. Of the suggested additions to the bot the most frequent occurrences were;

- BUCS (British Universities and Colleges Sport)
  - Fixtures
  - Teams
  - Information

- Computer availability

- Library information

- City events
  - Bars
  - Clubs
BUCS events, sports info, canteen menu's
Computer status(availability), SU events/bar deals
Computer availability, library books/availability, room booking
BUCS info, results needed to achieve certain grades, bus
BUCS fixtures
Library info - books availability etc., city events
City events, BUCS fixtures
Events on in Cardiff, Bus, Reporting defects on site
Events on in Cardiff, nightlife
Where to find food, Pubs & bars, University sports events

Figure 68 Q11 - Given that the bot could potentially supply you with all the information from both the website and Moodle, can you think of any other functionality that would be useful? E.g. Weather forecast, bus timetable, club events.

This was an important question to help the potential continued development of the university chatbot, as if the students aren’t gaining the information they most want/need then the bot will end up being redundant.

6.3.2. Student conclusion

The responses gathered have given absolutely zero doubt that if implemented, a chatbot would 100% get use from students. Not just use, but usefulness as well, with every single student asked responding positively to the potential impact it would have on both communication and satisfaction it leaves no doubt that this technology should be implemented within Cardiff Metropolitan University. With such comprehensive and positive results, it is reasonable to assume that similar results would be gathered no matter what third level educational institutions were assessed.

6.3.3. Staff

The results that came from the testing and follow up survey undertaken by staff participants were as positive in their outcomes as the students. Despite 100% of testers saying they would use or maybe use some part of the bot, as seen in figure 68, the staff testers were more forthcoming with constructive criticism. Picking functions of the bot that they would find extremely useful and others that they perceived that simply wouldn’t work. Of the ten participants that were asked, 90% said yes, they would use the bot and could see it clearly
fitting into their day to day working life. 10% of the testers claimed that they would use some limited functions of the bot but until a time that the bot was completely functional and properly tested they found it difficult to fully understand it.

One of the outstanding issues that would need to be thoroughly tested if the bot was to be fully implemented was whether the bot would help streamline communication between staff and students. With 20% of the staff members asked saying they believe it could cause confusion and add to the communication between the two parties it is vital that this is tested and that a definite answer is given.
Figure 70 Q5 - With students being able to use this bot to receive information such as marking criteria’s and feedback do you think this would help streamline communications with them?

![Pie chart showing responses to Q5]

Figure 71 Q3 - How familiar with chatbot technology are you?

As seen in figure 71 the correlation between chatbot knowledge and degree subjects taught fall heavily in favour of those in computer based subject degrees, computer science,
information systems and software engineering. It was vital for this follow up survey that a wide cross section of degree subject staff members was chosen as to avoid any bias. The average response for the 10 test subjects was surprisingly low when asked;

- How familiar with chatbot technology are you?

With the average being just 3 out of 10 and only 1 when the computer-based degrees were subtracted it shows that clearly the technology underpinning this concept is not understood, but like most technologies it doesn’t need to be understood to be adopted on a mass scale.

The follow up staff members had a 70/30 gender split and it is believed that this had no effect or bias on the outcome with the average chatbot technology understanding being 3.42 for the males that were asked and 2.33 for the females. With an equal age split across all the age categories as seen in figure 72, 60% coming from the first three age categories and 40% from the 56+ age bracket.

![Figure 72 Q2 - What is your age?](image)

6.3.4. Staff conclusion

With staff of Cardiff Metropolitan University having multiple systems when it comes to all facets of administration and communication it was predicted that the adoption of chatbot technology would be slightly less than that of students. With the main predicted scepticism coming from the merging of all different information channels.

There was indeed constructive criticism regarding the implementation of this sort of technology from the majority of test subjects with the recurring being the one of simplicity.
This concept will only work if it is adopted by users and staff members were amendment that they would use it as long as the functionality was working and not over complicated.

6.4. Staff versus student use

Despite the positive feedback from both student and staff testing, it was clear to see in the verbal feedback that the staff members have more of a concern regarding the functionality and use than students. As seen below in figure 73, 100% of students who tested the bot were 26 years old or less in age. This means that every tester was born in 1992 or after, they have grown up in an era of instant knowledge and gratification. Generation X and Generation Z are expectant of technology like this and show little concern over the potential failings and flaws (Looper, 2011). The majority of students currently studying at university would struggle to remember a world prior to Google. Therefore, little verbal feedback was collected from students regarding the potential failings of this bot, the chatbot is thus much more suited and will gather a higher adoption rate from the students.

That being said, the information gathered from the staff members around the use of the bot shows that staff adoption of this technology would occur. Staff members showed concern over functionality and whether it would further complicate communication between themselves and students. Staff members want a clear concise solution for the current issues they face in terms of timely administration tasks.

It is clear that there is not one solution for both staff and students but a hybrid approach that can satisfy both parties.
6.5. Conclusion

The overall answer to whether chatbot technology has a use within educational institutions is a resounding yes. A re-occurring question from test subjects whilst testing was, “why isn’t this implemented yet?”. Such positive trends in terms of chatbot adoption, satisfaction and communication points the recommendations of this project in only one direction.

A definitive 95% of testers, both staff and students responding with either definitely yes or probably yes as to whether they would use a similar chatbot if it was made available. This is as comprehensive as possibly imagined at the beginning of this project. The average response of students for how they felt this bot could help simplify communication and learning sits at over 60%.

Conclusions that can be drawn from the above findings are laid out quite evidently and provides a clear path going forward for future developments. Staff members want a solution for bulky and timely administration tasks with a chatbot being a perfect solution. Students seem willing to take this a step further and would adopt a whole new solution that goes beyond administration tasks.

Of course, there is areas for improvement with future work, but it can be seen that enough evidence has been presented, definitive evidence, to give clear grounds for the implementation of this bot.

With all these results taken into consideration it must clearly be a matter of when and not if this technology is implemented to help increase the university and working experience of both students and staff members respectively.
7. Conclusion

University and the qualifications gained from university degrees are arguably becoming imperative to future employment and personal development. With nearly half of Britain aged between 18-30 attending university the need for student satisfaction has become essential. As discussed in the above literature review, the 2010 report carried out by The University of Manchester showed that poor communication was the main reason for student dissatisfaction. With dropout rates throughout UK universities rising for the third year in a row there has never been a more paramount concern than student satisfaction (Barton, 2005).

7.1. Aims and objectives

The premise of this project was to find a solution for the current problem of student to university communication through the introduction of chatbot technology. Alongside increasing communication, it was seen that the introduction of such technology could benefit both staff and students and help increase interaction and satisfaction of both parties. As outlined in the literature review, there is a clear gap and lack of solution when it comes to student interaction and communication rates. The solution offered within this project supplies a resolution, but also a perfect use-case for the already developed chatbot technology.

7.2. Research questions

The aim of this undergraduate dissertation was to evaluate, develop & test an educational support chatbot, through extensive testing a multitude of research questions have been answered to give an overall consideration. The research within this project provided a complete 360-degree solution for a specific problem that has been an ever-present issue within university environments. The quantitative survey collected large measures of data to decipher whether this sort of technology could potentially be adopted in a university environment, as well as helping in the design of functionality and finding a platform that is applicable to both staff and students. The follow up qualitative survey, which was carried out after a group of both staff and students had experienced the use of a real bot and been exposed to its functionality gave clear and concise answers to the main question of this dissertation.

Key research questions answered within the project were;
- Is there a need for the introduction of chatbot technology?

Outlined very clearly in the literature review is that there is an evident issue when it comes to communication and its lack of between students and the university. The introduction of
chatbot technology combats, not all, but a high percentage of these issues and would go a long way to improving student satisfaction.

- What features will the student and staff population find useful in a chatbot?
Extensive testing gave both students and staff members the options to declare what their most frequent enquiries, issues and communications they have with the university. Communications were grouped into sections, showing a definitive answer as to which were the most important to be addressed and implemented. Additional functions were also asked to help with future developments.

- Can these features be built into chatbot technology?
Through the intelligence and simplicity of Oracle Intelligent Bot Cloud Service, almost any feature that could be thought of can be incorporated in minimal time. Through the use of APIs all functions on Moodle can be used, as well as the university website and additional systems that are used within the university.

- How effective is the chatbot from student and staff viewpoints?
The testing of the chatbot supplied comprehensive and positive feedback from nearly all test subjects. The technology is the perfect solution for a wide range of student issues and received 100% positive feedback for all functions that were demonstrated. The use of the bot for staff members would initially be best integrated with all administration tasks, with the bot receiving exceptionally positive feedback for these features. The university has numerous systems that all work in a different way and could potentially cause difficulties initially.

7.3. Limitations
The research carried out within this project was aimed at only students and staff of Cardiff Metropolitan University, future research may want to look at expanding this to several universities to come up with more concise or university dependant functions of the bot. Within the follow up survey both staff and students were asked about other potential functions of a similar bot, once again this research could be expanded to help with the development of a mature and highly functional bot.

7.4. Future work
The speed of which artificial intelligence is developing means that the iterations of future work in this field are endless. Recommendations for future work going forward based on the research and findings in this project would be to adopt the technology as soon as possible and from then on it is vital to keep up with the ever-changing world of artificial intelligence. As machine learning and natural language processing develops it is a reasonable presumption
that within the next 10 years communication between staff and students will be reduced to only the most vital subjects saving on time and productivity levels for both sets of users.

7.5. Final conclusion

As this research was carried out using a chatbot prototype, it is impossible to fully interpret whether this technology would be adopted until at one stage or another it is eventually implemented in a university environment and tested fully. However, the extent of testing for this prototype and concept went beyond the levels of an undergraduate dissertation and even industry level chatbot development and implementation. The testing that took place supplies a clear answer for both staff and students considerations. The results of multiple testing as well as an in-depth literature review leave very little doubt surrounding the outcomes of this project. The implementation of the tested chatbot would undoubtedly result in improved student satisfaction and aide the communication deficit that currently exists in third level education according to feedback collected.

The implications of these findings offer both a theoretical extension to the literature on artificial intelligence more specifically chatbots and their benefits once implemented in an educational environment. The findings show that the adoption of this technology is imperative to universities if they are looking to stay on the forefront of technology and continue to put student and staff satisfaction at the very pinnacle of their interests.
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9. Appendix

9.1. Student Surveys

Appendix 1 Q1 - Gender

Appendix 2 Q2 - Age
Appendix 3 Q3 - What year of study are you in?

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>15.15%</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>84.85%</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>99</td>
</tr>
</tbody>
</table>

Appendix 4 Q9 - Have you ever communicated with University via social media?

46% Yes 54% No

Appendix 5 Q14 - Have you ever knowingly communicated with a chatbot?
Appendix 6 Q20 - Do you believe that the university website is easy to navigate and find information?

9.2. Staff surveys

Appendix 7 Q1 - Gender
Appendix 8 Q2 - Age

Appendix 9 Q3 - How long have you been working in education?
Appendix 10 Q5 - How long have you worked at Cardiff Metropolitan University?

Appendix 11 Q6 - How many days a week are you in university?
Appendix 12 Q7 - How do you communicate with university admin?

Appendix 13 Q9 - Have you ever communicated with University via social media?
Appendix 14 Q13 - Do you know what a chatbot is?

35% Yes
65% No

Appendix 15 Q14 - Have you ever knowingly communicated with a chatbot?

- Yes: 60.87%
- Not sure: 26.09%
- No: 13.04%

9.3. Student survey

Students: Evaluation, development & testing of an educational support chatbot
Q1 Gender

- Male (1)
- Female (2)
- Prefer not to say (3)

Q2 Age

- 18 - 20 (1)
- 21 - 23 (2)
- 24 - 26 (3)
- 27+ (4)

Q3 What year of study are you in?

- First (1)
- Second (2)
- Third (3)
- Fourth (4)
Q4 What degree are you currently enrolled on?

________________________________________________________________

Q5 How many days on average a week are you in university?

- [ ] 1 (1)
- [ ] 2 (2)
- [ ] 3 (3)
- [ ] 4 (4)
- [ ] 5 (5)

Q6 How do you communicate with university?

- [ ] Email (1)
- [ ] University mobile application (2)
- [ ] Social media (3)
- [ ] Letters (4)
- [ ] Face to face (5)
- [ ] Other (6)
Q7 How easy is it to find information on the university website?

- Extremely easy (1)
- Slightly easy (2)
- Neither easy nor difficult (3)
- Slightly difficult (4)
- Extremely difficult (5)

Q8 Have you ever communicated with University via social media?

- Yes (1)
- No (2)

Q9 What is your most used form of communication on your mobile phone?

- Whatsapp (1)
- Facebook Messenger (2)
- Email (3)
- iMessage / Text message (4)
- Other (5)
Q10 Do you have Facebook Messenger installed on your mobile phone?

- Yes (1)
- No (2)

Q11 Do you know what a chatbot is?

- Yes (1)
- No (2)

Q12 Have you ever knowingly communicated with a chatbot?

- Yes (1)
- No (2)

Q13 Do you believe chatbots & AI will cause redundancies in your field?

- Yes (1)
- No (2)
- Don't know (3)
Q14 Would you feel comfortable communicating with a chatbot instead of a human if you were to receive the same information?

- Yes (1)
- No (2)
- Don't know (3)

Q15 Of the below, what are the most frequent questions that you need to ask university?

- Exam queries (1)
- Assignment queries (2)
- Timetable queries (3)
- Marking criteria (4)
- Admin questions (swapping seminars, groups, room number etc.) (5)

Q16 Do you believe that the university website is easy to navigate and find information?

- Yes (1)
- No (2)
Q17 Do you believe robots/chatbots should have a persona? E.g. the Paperclip from Microsoft word, trying to come across as a human.

- Yes (1)
- No (2)
- Don't care (3)

End of Block: Default Question Block

9.4. Staff survey

**Staff: Evaluation, development & testing of an educational support chatbot**

Start of Block: Default Question Block

Q1 Gender

- Male (1)
- Female (2)
- Prefer not to say (3)
Q2 Age

- 26 - 35 (1)
- 36 - 45 (2)
- 46 - 55 (3)
- 56 + (4)
- Prefer not to say (5)

Q3 How long have you been working in education?

- Less than 1 year (1)
- 1 - 5 years (2)
- 5 - 10 (3)
- 10 - 15 (4)
- 15 + (5)
Q4 How long have you worked at Cardiff Metropolitan University?

- Less than 1 year (1)
- 1 - 5 years (2)
- 5 - 10 years (3)
- 10 - 15 years (4)
- 15+ (5)

Q5 How many days a week are you in university?

- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
Q6 How do you communicate with university admin?

☐ Email (1)

☐ University mobile application (2)

☐ Social media (3)

☐ Letters (4)

☐ Face to face (5)

☐ Other (6)

Q7 Do you often need to find information on the university website?

☐ Yes (1)

☐ No (2)

Q8 How easy is it to find information on the university website?

☐ Extremely easy (1)

☐ Slightly easy (2)

☐ Neither easy nor difficult (3)

☐ Slightly difficult (4)

☐ Extremely difficult (5)
Q9
Have you ever communicated with University via social media?

- Yes (1)
- No (2)

Q10 What is your most used form of communication on your mobile phone?

- Whatsapp (1)
- Facebook Messenger (2)
- Email (3)
- iMessage / Text message (4)
- Other (5)

Q11 Do you have Facebook Messenger installed on your mobile phone?

- Yes (1)
- No (2)
Q12 Do you know what a chatbot is?

- Yes (1)
- No (2)

Q13 Have you ever knowingly communicated with a chatbot?

- Yes (1)
- Not sure (2)
- No (3)

Q14 Do you believe chatbots & AI will cause redundancies in your field?

- Yes (1)
- No (2)
- Don't know (3)
Q15 Would you feel comfortable talking to a chatbot/robot instead of a human if they were to give you the same information?

☐ Yes (1)

☐ No (2)

☐ Neither yes or no (3)

Q16 Should robots/chatbots have a persona? E.g. the Paperclip from Microsoft word, take the form of a human/character?

☐ Yes (1)

☐ No (2)

☐ Don't care (3)

Q17 Select the 3 most common queries you have with university admin from the below list

☐ Holiday requests (E.g How many holiday days so I have left) (1)

☐ I.T enquiries (Emails not working, projector broke etc.) (2)

☐ Student issues (Mitigating circumstances, change of seminar group etc.) (4)

☐ Specific student issues (Previous exam board outcome, student not attending etc.) (5)
Q18 Select the 3 most common queries you receive from students from the below list

- Exam queries (1)
- Assignment queries (2)
- Timetable queries (3)
- General feedback (4)
- Admin (Seminar groups, presentation times etc.) (5)

Q19 How many emails a day do you receive from students a day regarding the above subjects?

- 0-5 (1)
- 5-10 (2)
- 10-15 (3)
- 20+ (4)

9.5. Student follow up survey

Students: Follow Up
Q1 What is your gender?

- Male (1)
- Female (2)
- Prefer not to say (3)

Q2 What age are you?

- 18-20 (1)
- 21-23 (2)
- 24-26 (3)
- 27+ (4)

Q3 What year of study are you in?

- First (1)
- Second (2)
- Third (3)
- Fourth (4)
Q4 What degree are you enrolled on?

________________________________________________________________

Q5 How familiar are you with chatbot technology?

○ 0  (0)
○ 1  (1)
○ 2  (2)
○ 3  (3)
○ 4  (4)
○ 5  (5)
○ 6  (6)
○ 7  (7)
○ 8  (8)
○ 9  (9)
○ 10 (10)
Q6 Having seen the functionality examples, do you believe you would use something similar if it was available?

- Definitely yes (1)
- Probably yes (2)
- Might or might not (3)
- Probably not (4)
- Definitely not (5)
Q7 How much do you think this would simplify your university communications and learning?

- [ ] 0 (0)
- [ ] 1 (1)
- [ ] 2 (2)
- [ ] 3 (3)
- [ ] 4 (4)
- [ ] 5 (5)
- [ ] 6 (6)
- [ ] 7 (7)
- [ ] 8 (8)
- [ ] 9 (9)
- [ ] 10 (10)
Q8 Do you think you would visit the university website less if this was available?

- Definitely yes (1)
- Probably yes (2)
- Might or might not (3)
- Probably not (4)
- Definitely not (5)

Q9 Do you think you would visit Moodle less if this was available?

- Definitely yes (1)
- Probably yes (2)
- Might or might not (3)
- Probably not (4)
- Definitely not (5)

Q10 Given that the bot could potentially supply you with all the information from both the website and Moodle, can you think of any other functionality that would be useful? E.g. Weather forecast, bus timetable, club events.

________________________________________________________________

________________________________________________________________

________________________________________________________________
9.6. Staff follow up

Staff follow up

Q1 What is your gender?

- Male (1)
- Female (2)
- Prefer not to say (3)

Q2 What is your age?

- 26 - 35 (1)
- 36 - 45 (2)
- 46 - 55 (3)
- 56 + (4)
- Prefer not to say (5)
Q3 What subject area do you teach?


Q4 How familiar with chatbot technology are you?

- 0 (0)
- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 (7)
- 8 (8)
- 9 (9)
- 10 (10)
Q5 Having seen the functionality examples, do you believe you would use something similar if it was available?

- Yes (1)
- No (2)
- Maybe (3)

Q6 With students being able to use this bot to receive information such as marking criteria’s and feedback do you think this would help streamline communications with them?

- Yes (1)
- No (2)

Q7 Given that the bot could potentially supply you with all the information from both the website and Moodle, can you think of any other functionality that would be useful from outside the university? E.g. Weather forecast, bus timetable, city events.

________________________________________________________
Q8 Do you think you would visit the university website less if this was available?

☐ Definitely yes (1)

☐ Probably yes (2)

☐ Might or might not (3)

☐ Probably not (4)

☐ Definitely not (5)

---

Q9 Do you think you would visit Moodle less if this was available?

☐ Definitely yes (1)

☐ Probably yes (2)

☐ Might or might not (3)

☐ Probably not (4)

☐ Definitely not (5)

End of Block: Default Question Block
**Ethics approval code:**

**CARDIFF METROPOLITAN UNIVERSITY**  
**APPLICATION FOR ETHICS APPROVAL**

**PART ONE**

<table>
<thead>
<tr>
<th>Name of applicant:</th>
<th>Benjamin Scott</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisor (if student project):</td>
<td>Dr Simon Thorne</td>
</tr>
<tr>
<td>School:</td>
<td>Cardiff Metropolitan University</td>
</tr>
<tr>
<td>Student number (if applicable):</td>
<td>ST20066253</td>
</tr>
<tr>
<td>Programme enrolled on (if applicable):</td>
<td>Business Information Systems</td>
</tr>
<tr>
<td>Project Title:</td>
<td>Evaluation, development &amp; testing of an educational support chatbot</td>
</tr>
<tr>
<td>Expected Start Date:</td>
<td>01/12/2017</td>
</tr>
<tr>
<td>Approximate Duration:</td>
<td>20 weeks</td>
</tr>
<tr>
<td>Funding Body (if applicable):</td>
<td>N/A</td>
</tr>
<tr>
<td>Other researcher(s) working on the project:</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Will the study involve NHS patients or staff?  
No

Will the study involve taking samples of human origin from participants?  
No

Does your project fall entirely within one of the following categories:

| Paper based, involving only documents in the public domain | No  |
| Laboratory based, not involving human participants or human tissue samples | No  |
| Practice based not involving human participants (eg curatorial, practice audit) | No  |
| Compulsory projects in professional practice (eg Initial Teacher Education) | No  |

If you have answered YES to any of these questions, no further information regarding your project is required.
If you have answered NO to all of these questions, you must complete Part 2 of this form

In no more than 150 words, give a non-technical summary of the project

The project aims to evaluate, develop and test the use for an educational support chatbot with Cardiff Metropolitan University. Gathering data from both staff and students of Cardiff Metropolitan University the author will design a complete use case for the chatbot as well as developing one integrated with Facebook Messenger to test its usage. The author will do desk research to learn about existing chatbots, their uses, design methods and their history. The author will research why such a system hasn’t been introduced yet.

DECLARATION:
I confirm that this project conforms with the Cardiff Met Research Governance Framework

I confirm that I will abide by the Cardiff Met requirements regarding confidentiality and anonymity when conducting this project.

STUDENTS: I confirm that I will not disclose any information about this project without the prior approval of my supervisor.

Signature of the applicant: Date:

FOR STUDENT PROJECTS ONLY
Name of supervisor: Date:

Signature of supervisor:

Research Ethics Committee use only
Decision reached: Project approved
Project approved in principle
PART TWO

A RESEARCH DESIGN

A1 Will you be using an approved protocol in your project? No

A2 If yes, please state the name and code of the approved protocol to be used¹ N/A

A3 Describe the research design to be used in your project

Questionnaire:
- The researcher aims to gather the completion of 70+ questions to ensure the validity of the study and to gain a large amount of data.
- The researcher will use both written & online questionnaires to gather data from both staff and students of Cardiff Metropolitan University. The data shall be collected from the 15/12/2017 to the 15/2/2017.
- Participation will take five minutes to complete the questionnaire.

Sample:
- This study is open to any full-time member of staff from Cardiff Metropolitan university not just lecturers as well as any student that is in full time attendance of the university.
- Further participants may also be found using Snowballing Techniques, by asking participants to recommend someone as long as they are in full time study of the university or a full-time employee.

Online Questionnaire using Qualtrics
- The researcher aims to have 30 completed online questionnaires.
- The researcher has created an online username and password on the Qualitircs Website.
A qualitative questionnaire will only be sent out to university students who are in full time attendance of Cardiff Metropolitan university.

The participant will be told details of the study and its goals plus the participant must consent before completing the questionnaire.

The questionnaire will take 5 minutes to complete.

Sample:

Due to a large number of participants being from a similar area of study as the author will match with a number of students from diversified areas of study avoid skewed survey results.

Participants:

The types of samples chosen are to guarantee no discrimination against age, gender, race, disability etc.

All participants will be over the age 18.

Participant’s right to anonymity will be reiteration throughout the research process and they may withdraw their data at any point.

The researcher will only record age and gender of the participant.

Chatbot development:

The author will build a chatbot on Facebook Messenger using demo data with functions resulting from the collected data.

Once participants use the bot insights are collected based on what they select.

Giving results based on which components are most used

Analysis:

The quantitative data from the questionnaires & bot insights will be on the Microsoft Excel by the creation of graphs, tables and charts.

The qualitative data from the unstructured interview will be through observer impression of the specific use of the specific use of the data collected to help support the proposal.

Consent:

Consent from participants is required from the interviewees by the completion of the consent form before they can take part in the study.

A4 Will the project involve deceptive or covert research? No

A5 If yes, give a rationale for the use of deceptive or covert research

N/A

A6 Will the project have security sensitive implications? No

A7 If yes, please explain what they are and the measures that are proposed to address them
B PREVIOUS EXPERIENCE

B1 What previous experience of research involving human participants relevant to this project do you have?

None

B2 Student project only

What previous experience of research involving human participants relevant to this project does your supervisor have?

None

C POTENTIAL RISKS

C1 What potential risks do you foresee?

Chatbot Questionnaires

Face-to-face questionnaires may present risk to the researcher:

- People may feel intimidated & lie when asked the more technical questions as they may not understand.
- Struggle to find people to answer face to face

Chatbot development & testing

Chatbot development may present risk:

- Development takes longer than expected.
- Demo data may not show users a proper understanding of the project.

Data:

- Risk of confidential information being lost

C2 How will you deal with the potential risks?

Chatbot Questionnaires

- Make the questions as clear and concise for the participants.
- A consent form and project description will be attached to the questionnaires for participants to read to ensure they are fully aware of their participation.
- The researcher will ensure all questions are suitable and appropriate to ask participants.
- The participant will be notified that they have the right to withdraw their data at any time.

Chatbot development & testing

Chatbot development may present risk:
Participants will be made fully aware that their insights are being gathered by the chatbot as they interact.

The participant will have the right to withdraw their data at any point without penalty.

Data:

- All data is kept on a private password protected machine that only I have access to.

All participants will be notified that the researcher will have sole access to the data collected. Data used in the written report will be anonymised and the participants will be coded to safeguard from identification.

When submitting your application, you **MUST** attach a copy of the following:

- All information sheets
- Consent/assent form(s)

Refer to the document *Guidelines for obtaining ethics approval* for further details on what format these documents should take.
PARTICIPANT INFORMATION SHEET

Evaluation, development & testing of an educational support chatbot

Cardiff Metropolitan University Protocol Number: (if applicable)

Project summary
The purpose of this research project is to research, design, develop and test a support chatbot for use within an educational institution. Researching whether there is a use-case and how applicable it is.

Why have you been asked to participate?
You have been asked to participate because you’re a student or member of staff at Cardiff Metropolitan University.

Project risks
The research involves the completion of a questionnaire. We are not seeking to collect any sensitive data on you; this study is only concerned with your knowledge surrounding chatbots and other information that will guide the design of the chatbot. We do not think that there are any significant risks associated with this study. However, if you do feel that any of the questions are inappropriate then you can stop at any time. Furthermore, you can change your mind and withdraw from the study at any time – we will completely respect your decision.

How we protect your privacy
All the information you provide will be held in confidence. We have taken careful steps to make sure that you cannot be directly identified from the information given by you. Your personal details (e.g. signature on the consent form) will be kept in a secure location by the research team. When we have finished the study and analysed all the information, the documentation used to gather the raw data will be destroyed except your signed consent form which will be held securely for 5 years. The recordings of the focus groups/ interview will also be held in a secure and confidential environment during the study and destroyed after 5 years.

YOU WILL BE OFFERED A COPY OF THIS INFORMATION SHEET TO KEEP

If you require any further information about this project then please contact:
Simon Thorne, Cardiff Metropolitan University
Cardiff Metropolitan University email: SThorne@cardiffmet.ac.uk

Cardiff Metropolitan University
Ethics Committee
PARTICIPANT CONSENT FORM

Cardiff Metropolitan University Ethics Reference Number:

Participant name or Study ID Number: St20066253

Title of Project: Evaluation, development & testing of an educational support chatbot

Name of Researcher: Benjamin Scott

Participant to complete this section: Please initial each box.

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. [  ]

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. [  ]

3. I agree to take part in the above study. [  ]

4. I agree to the interview / focus group / consultation being recorded [  ]

5. I agree to the use of anonymised quotes in publications [  ] [  ]

or

I agree to my quotes being attributed to me

6. I would like my organisations’ name to be anonymised in all publications [  ] [  ]

or

I agree to my organisation being named in all publications

_______________________________________   ___________________
Signature of Participant                      Date

____________________________________
Name of person taking consent               Date

____________________________________
Signature of person taking consent