UNIVERSIDADE ABERTA

INSTITUTO
SUPERIOR TÉCNICO



# Interactive FAQ System in E-learning Environment Using Chatbot

**Anila Wesley**

**Master's in information and Enterprise Systems**
**(master's in association)**

**12/2020.**

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Dissertation supervised by Professor Doctor
Vitor Jorge Ramos Rocio.

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**Resumo**

Durante os primeiros dias na universidade em um ambiente virtual de aprendizagem, os alunos terão muitas dúvidas e confusão sobre o modelo pedagógico, notas de aprovação e vários outros fatores. Essas perguntas tendem a se repetir a cada ano e um tutor responde a essas perguntas individualmente. O aluno pode obter uma resposta após um número mínimo de dias. Para resolver este problema, pretendemos criar um chatbot para responder às FAQs durante os primeiros dias do semestre e fornecer o suporte necessário para os alunos durante a fase de transição. As vantagens deste chatbot é que ele pode atender os alunos instantaneamente 24 horas, 365 dias, independentemente do local, dia e fuso horário do aluno. Outra vantagem é que aumenta a interação, o que proporciona uma sensação de apoio aos alunos.

Chatbot é criado usando IBM Watson. Os diálogos necessários são alimentados no Watson na forma de intents. Em seguida, um sistema de diálogo é projetado para se comunicar com os alunos, conectando as intenções. Este serviço é então integrado ao ambiente virtual de aprendizagem por meio de um plugin para ajudar os alunos a obter respostas dentro do próprio ambiente de aprendizagem.

**Palavras-chave:** Agentes de Conversação ; Bot de FAQ ; Sistema de apoio ao aluno na educação ; chatbot

**Abstract**

During the initial days in the university in a virtual learning environment, students will have lot of questions and confusion on the pedagogical model, pass marks and several other factors. These questions tend to repeat every year and a tutor replies to these questions individually. The student will get a response after a minimal number of days from the tutor. To solve this problem, we intend to create a chatbot to answer the FAQs during their initial days of the semester and to provide the necessary support for the students during the transition phase. Advantages of this chatbot is that it can provide answer to students' queries instantly which is 24 hours, 365 days despite of the place, date and time zone of the student. Another advantage is that it enhances interaction which provides a feel of support to the students.

Chatbot is created using IBM Watson. The necessary dialogues are fed into Watson in the form of intents. Then a dialog system is designed to communicate with students by connecting the intents. This service is then integrated into the virtual learning environment using a HTML block to help students by providing them support within learning environment itself.

**Keywords:** Conversational Agents; FAQ bot; Student support system in education; chatbot.

**ACKNOWLEDGEMENTS**

First and foremost, I would like to thank the LORD ALMIGHTY for strengthening me to complete this dissertation despite of the struggles I went through the entire time.

I would like to express my sincere gratitude to my advisor Prof. Vitor Rocio, for his availability and guidance. The journey was never easy. But the advice from my supervisor has helped me a lot and he was ready and available to guide me in the right path.

I would like to thank my husband Wesley Mathew for all the encouragement and support that he has given me all the time, right from the beginning of the course till this time. I am grateful to my father and mother for their encouragement to pursuit what I like and insisting me to try my level best to achieve my dreams.

Anila Wesley

Lisbon, October 2020

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# CHAPTER 1

# INTRODUCTION

One of the cornerstones of the pedagogical model of Universidade Aberta is interaction. Improper and untimely interaction with the students can lead to isolation in a distance learning environment. During the initial days of the semester, students will have lot of questions and these questions tend to repeat. As a result, SITCON and Frequently Asked Questions (FAQs) area is formed in the University's portal. SITCON is a messaging platform which helps students to post doubts by selecting the area related to their query and then giving a description of their problem. This messaging platform will take a minimal amount of time to respond to all the individual student questions as the course coordinator or the secretary need to reply to the questions personally. Students can even look and find answers for their questions by reading through FAQs. But FAQs contain a lot of information and it is difficult to find a specific data from the provided list of FAQs.

### 1.1 Context

One of the main challenges, distance learning providers are facing is the drop out of students every year. The percentage of students leaving every year during distance learning ranges from 20 to 50 percent [14][16][24][39][45]. The difficulty of online education providers is to retain the students who have begun the course [40]. Main difficulty the online students have is the feeling of isolation due to less interaction compared to face to face classes [11][29]. Increased level of interaction and support provided for the students during the initial days can help to retain students [43].

Abrami and Bures [2] tells that some students in distance learning programs and courses report feelings of isolation, lack of self-direction and management, and eventual decreases in motivation levels. Even though the students require help; they tend not to approach for help as per the studies of Er et al. [23]. These authors examined college students' online help-seeking behaviour and found that students may avoid seeking help in order to uphold a positive social image. As a result, students tend to look for FAQs to find answers and help by their own way. FAQ contains repeated questions together with their answers which was first used in Usenet groups in 1982 [32].

During the initial phase, students require support and guidance in many areas mainly in the administrative process like admission procedures, pre-study advisory services and so on. It is also necessary to provide an environment where students feel at home with a sense

of being valued and they find the entire process manageable. Alan Tait [4] suggests that websites supported by call centres can provide the required student support. In the case of an online learning environment like Universidade Aberta has students from all over the globe. Students living in different time zones will find it difficult to contact the call centre outside office hours. Another disadvantage of such call centres is that the cost of calling to such centres can be high and unaffordable for students living in countries outside Portugal like Brasil or Angola.

To solve the drawbacks of the existing student support, we propose to implement a FAQ bot to provide initial support and guidance to students which is required during their initial days in the University. Extra effort and care are required to create this dataset so that it meets the needs of the students. The dataset can be improved only with testing and continuously adding the frequently asked questions from the students. Chatbot is implemented using IBM Watson Assistant. Watson Assistant is a computer system specifically built for answering questions. It is implemented using technologies like information retrieval, natural language processing, automated reasoning, knowledge representation, and machine-learning in the field of open domain question answering. It is used for quick AI-based solutions [9].

### 1.2 Problem

Universidade Aberta has implemented a unique virtual pedagogical model to provide high quality education to online learning students. This has helped students to study online together with a balanced professional and family life. Universidade Aberta offers virtual classroom with pedagogical instruments incorporated in it to provide interaction with teachers. Students can take advantage of this model to increase their knowledge whenever they are free to learn without geographic and temporal barriers. To introduce this model to the students and give them an insight about the structure and working of the pedagogical model, online adaptation module (MAO, *Módulo de Ambientação* ) is included in the beginning of the course. This information being passed on to the students in the initial days may lead to information overload, which in turn can trigger stress, confusion, pressure, anxiety and low motivation [24].

The students have access to the Frequently Asked Question (FAQ) area in the University Portal, if they have any concerns in using the model. Secondly, a messaging platform named SITCON is also provided in the virtual classroom. SITCON is a platform where the students can send their doubts in the form of a question and by selecting an area where they require clarification together with the description of the problem. The tutor will investigate these questions and they will send a reply to the students' questions. The main disadvantage of this system is that the student must wait for the response, and it takes minimal amount of time or days to receive the response. Second disadvantage is that the student feels lonely and disconnected due to lack of initial support. Another disadvantage as mentioned above is information overload.

To overcome all these disadvantages, we propose to create a chatbot which contains the details about the FAQs and its answers. The chatbot can provide an interactive FAQ which motivates the students. It can also provide a feel of companionship and support available all the time for the student. Garrison and Baynton [26] explain support as the resources which help the student to participate successfully in online education. Support provided at the right time removes the feeling of isolation that the student goes through during the initial phase.

### 1.3 Motivation of Work

Brandtzæg & Følstad has done a survey [13], where the users who had access to chatbot mentioned that they were able to obtain timely and efficient assistance or information. In the study the most frequently reported motivational factor is "productivity". The study done by Brandtzæg & Følstad in 2018 indicates that majority of the users reported that they used chatbot as it was effective and efficient in the productivity tasks like access to specific content or helping with administrative chores. The users mainly used chatbot for assistance and for obtaining certain information.

According to another survey done by chatbot.org in 2017 certain category of people mainly named as millennials and generation Z has rated chatbots 56% and 54% as "effective" and "very effective" respectively [17]. As per the survey done by Drift together with Salesforce, myclever and Survey Monkey Audience in 2018 the main benefits of chatbot

services are listed as 24-hour service by 64% of the users, instant reply by 55% of the users and answering simple questions by 55% [22].

The main motivation for this research is to integrate a chatbot named as UAbot (Universidade Aberta bot) into the virtual learning platform to provide timely help and support to the students during the initial phase of their studies in distance education. Universidade Aberta has implemented different means to provide help and support to the students. But the students must wait a marginal amount of time to receive the answers from the corresponding person. This research can help the students 24/7 around the globe as the helper is not a person, but a chatbot that interacts with the students. All in all, this research helps in advancements to be made to unlock the potential of chatbot in online learning environment.

### 1.4 Research Questions

Research questions have been formulated to solve the problem we have stated in the problem section above. The research questions are selected in such a way that it fulfils the objectives of the research and helps in delivering the work in a useful way with high quality. The research questions are mentioned below.

Research Question 1: Is the chatbot useful for the students in providing them initial support?

Research Sub Question 1.1: Is the chatbot helpful in answering their frequently asked questions?

Research Question 2: How helpful is the chatbot in reducing the workload of the tutor?

### 1.5 Organisation of Work

This dissertation is organized under 9 main chapters. In chapter 2, literature review is done. All the relevant previous work in this area is studied to form a basis for my research work. Chapter 3 gives details about the research methodology used for this research work. Chapter 4 is focused on the technical background which includes the different terminologies and it's meaning and role in this dissertation. Chapter 5 describes the architecture about the different components involved in the development and integration of chatbot for answering

FAQs. Chapter 6 discusses about system implementations and different technologies used in this development.

In chapter 7, the experiments done to gather the feedback from the users are described. While in chapter 8, the results obtained from the experiments are discussed and the conclusion together with the future are presented in chapter 9.

# CHAPTER 2

# RELATED WORK

## 2.1 Systematic Literature Review

A Systematic Literature Review (SLR) is a means of identifying, evaluating and interpreting all available research relevant to a research question, or topic area, or phenomenon of interest. This type of Literature Review helps to summarize the existing evidence concerning a technology and to identify gaps in the current research which helps to find areas for further study [7].

As per Kitchenham, the main features of a systematic review are described below. The systematic reviews start by defining a review protocol which mentions research question being addressed and the methods used for review. Systematic reviews are dependent on a defined search strategy which helps to find out as many relevant literatures as possible. The search strategy used for the reviews is documented so that everyone can find its completeness. A systematic review is a prerequisite for quantitative meta-analysis.

The steps included in the systematic review process are planning the review, conducting the review and reporting the review. In planning the review stage, definition of motivation, research questions, SLR objectives, inclusion and exclusion criteria are done. The review is conducted by selecting the primary studies related to this topic. The data is extracted using review protocol defined in the first step. During the last step of reporting, the results are reported after summarizing the extracted data.

## 2.2 History of Chatbots

Chatbots are computer programs which can converse with human beings via text or voice interactions [47]. The first, most famous, chatbot was created in 1964 and was named ELIZA, which can analyse the question entered by the user and then provided the required response by decomposing the input and applying certain rules [56] as shown in figure 2.1.

```
Human: You are like my father in some ways.
ELIZA: What resemblance do you see
Human: You are not very aggressive.
ELIZA: What makes you to think I am not aggressive
Human: You don't argue with me.
ELIZA: Why do you think I don't argue with you
Human: You are afraid of me.
ELIZA: Does it please you to believe I am afraid
```

Figure 2.1: An example conversation with ELIZA [25]

A psychiatrist named Kenneth Colby, at Stanford University created a chatbot named PARRY in 1972. This chatbot was created to simulate a person having paranoid schizophrenia. It was an advanced version of ELIZA and contained an embodied conversational strategy. PARRY was tested using Turing Test. A group of real patients and computers with PARRY was analysed by experienced psychiatrists. The doctors could identity the real patients only 48 percent of the time.

In 1995, Richard Wallace created a chatbot named ALICE using a programming language named AIML (Artificial Intelligence Markup Language) as shown in figure 2.2. It can communicate with the user by analysing user input with heuristical pattern matching rules. It checks the input of the user with predefined set of responses. It cannot answer those queries adequately, which are not listed in the predefined set. The knowledge base can be expanded using an XML dialect called AIML [55].

```
User: Hello ALICE
Alice: Hi there!
User: How old are you?
Alice: I am eighteen in computer years
User: Who is your father?
Alice: I was programmed by Dr.Richard S. Wallace
User: so you are a software program?
Alice: Interesting deduction. Thanks and you are a
delightful person too. Am I a software program?
User: wonderful! So what's your favorite food ALICE?
Alice: Yeah that's right! I require only electricity
```

Figure 2.2: A sample conversation with ALICE [5]

Then evolved a lot of chatbots in sorts of areas like health, business, education and so on. If we examine the history of chatbots, YPA is a suitable example for an FAQ bot. YPA is a chatbot which can provide users with information from the British Telecom's Yellow pages. The YPA is composed of many components namely Dialog manager, Natural language front-end, Query construction component and backend database. If there is no answer found, it starts asking user to obtain more information. The user can ask for a plumber with an emergency service, and the chatbot can reply with the required details [5].

In the area that we are researching more focus is given into educational chatbots. One of the major chatbot developed in educational area was Ms Lindquist which helped high school students to learn algebra. It was basically a course advising bot [30]. Ms Lindquist doesn't answer questions outside the course. For helping the students in their initial days at an online learning university a FAQ bot is necessary.

In 2011, IBM won the Loebner competition for Watson which is a question answering system developed in 2004. But now it has been enhanced to become a chatbot. In addition to more than 100 text processing methods, it uses ontologies such as DBPedia, WordNet, and Yago to enhance other techniques and to enable reasoning, which is similar to other new chatbot approaches [12].

A programming language called AIML is used by Mitsuku to reply to queries. It has an intelligence to respond with specific objects. It has won the Loebner Prize twice in 2013 and 2016 [6].

A chatbot based in website was developed to act as an automated online assistant. This was developed in a website that has a variety of products with lot of features. The chatbot will help the user in deciding the best suited product for him. It has a predefined set of responses and an independent database for products. So, the chatbot continues to work well with new products even without much change.[48]

The team led by Goel and Polepeddi, L. [27] has worked on the use of systems based on response and recommendation tools to answer student's questions in the forums of their online class of Artificial Intelligence based on Knowledge. The assistant has been named Jill Watson, based on the IBM Watson platform, which is perhaps best known as the computer that beat two Jeopardy champions. Jill was specifically developed to handle the large number

of forum posts by students enrolled in an online course that is a requirement to obtain a master's degree in science in the Georgia Tech computer program. Jill responds to FAQs in the forum. It keeps on checking for new updates every 15 minutes and replies to students. It basically deals with student introductions. These are basically teaching assistants and not FAQ bots.

Manipal University in India has implemented a chatbot to answer university related FAQs. It was basically designed to help the visitors with their doubts about the courses offered by the university. The chatbot was implemented using AIML and LSA. There are certain patterns cross checked based on the template. If the pattern is found, then answer is provided stored specifically for the pattern. If not, then default answer is returned to the user [34].

WeightMentor is a motivational chatbot that helps to lose weight. Users can communicate with this chatbot in natural language through facebook messenger. It is implemented using Dialog flow, NodeJS and PostgreSQL. To start the conversation with the user, it provides three options for the user to select namely Self report, Set/ review goals and Motivate me. WeightMentor uses a mixture of ordinary conversation and counselling conversation [49].

To guide and help the students during their transition phase, a chatbot was developed which resides in IM platforms. This chatbot has basic artificial intelligence and can assist students with the needful information [15]. One of the drawbacks of this chatbot is that it works only on mobiles and it is implemented in Kik messenger. Another drawback is that it cannot reply by images and usually provides a list of options to the students. They must select one of the options listed to communicate with the bot.

In 2018, Dehon et al. [21] created a chatbot named CVChatbot that was created to integrate the LMS Moodle with the facebook messenger app. This was evaluated with 17 students and the results were promising. This chatbot was created in the facebook messenger app to provide notifications to students about new events in the virtual learning environment. So, students have to add this chatbot as their contact in facebook messenger app. The main drawback of this chatbot is that, it doesn’t have an interface in the virtual learning environment itself. The students can communicate with the chatbot only through facebook

messenger app. Another drawback is that it acts basically as a teaching assistant and doesn't include administration related topics.

A chatbot named DINA – Dinus Intelligent Assistance was created for UDINUS university in Indonesia to respond to student's admission queries in their local language Bahasa Indonesia. This chatbot was created using Dialogflow and Node.js for processing the client side and server side requests [28]. In our research work, we are trying to implement the bot in PHP.

FIT-EBOT is a chatbot developed to act as an intelligent assistant to provide administrative and learning support to students. This chatbot is implemented using Dialogflow to answer frequently asked questions related to course, examination, alternative course, course material and so on. But the users can communicate to the chatbot only through a facebook page [33].

A chatbot was developed using IBM Watson to help students in a virtual learning environment. It was basically focusing on doubts regarding different courses, its inscription and so on. The users can communicate with the chatbot through facebook messenger like FIT-EBOT. The chatbot was integrated into Moodle as well. It was tested and 12 students responded to the survey. Based on the evaluation of the results, it turns out to be an excellent bot with improvements required in the quality of interactions [36]. UAbot is different from FIT -EBOT as it is implemented within the elearning environment itself to provide easy access to students.

CiSA is a chatbot implemented in a Korean university to help international students to have access to the basic information in English. Details about location of canteen, library and so on which is necessary will be provided by the chatbot. It also gives information about student events and activities which is otherwise difficult to know as most of the students speak Korean [31]. This chatbot deals with general issues and tries to help international students. But we focus on providing initial support to all the students. CiSA is also implemented in facebook but we intend to implement within the virtual learning environment.

Samuel, Boles, Wageeh, Luke, & Emily [19] has reviewed the existing chatbots in education which are basicaly two types: FAQ bot and short response quiz. The FAQ bot discussed deals with questions that are related to the course and used for knowledge retention

and help the tutor. This FAQ bot doesn't cover administrative issues or other questions during the initial days of the student in the university.

Medbot is a multilingual conversational bot for delivering telehealth in India to help patients have an increased access to healthcare knowledge and leverage the potentials of artificial intelligence to bridge gap of demand and supply of human healthcare providers. Due to COVID – 19 pandemic there is a fall in other acute illnesses being reported in India. The chat system was implemented by Dialog flow API which has a voice user interface also [10].

Penn Medicine has launched a chatbot to answer patients' questions regarding Covid-19. This FAQ bot was created by analysing the most frequently used questions obtained from 800 telephone encounters and 450 secure messages. The chatbot is regularly updated with the recent information available. Using Verily and Google cloud, a chat or voice is created to answer questions about Covid-19 symptoms and provide guidance. It is implemented using Dialog flow and available all around the world in 23 languages [54].

Symptoma is a symptom-to-disease digital health assistant to identify Covid-19 with regards to a diverse set of clinical cases and diseases like Covid-19. It can interact with free text input in 36 languages. This assistant is implemented as a web application in https://www.symptoma.com. It uses a predictive method by constantly mining the current literature and the knowledge base is updated real time. [42]

A summary of all the chatbot discussed above are mentioned below with a small description, purpose of chatbot, implementation method, deployed platform together with the area it is used in table 2.1.

| **Existing Chatbots** | **Released Year** | **Purpose of Chatbot** | **Method of Implementation** | **Deployed platform** | **Area** |
|---|---|---|---|---|---|
| ELIZA | 1964 | Enable natural language conversation between computer and human. | Keywords and Transformation Rules together form the script | Program operating in MAC system | Education |

| | | | | | |
|---|---|---|---|---|---|
| PARRY | 1972 | Simulate a person with paranoid schizophrenia | Advanced Version of ELIZA | | Health |
| ALICE | 1995 | Analyze user inputs using heuristical patterns | AIML | - | Education |
| Ms Lindquist | 2003 | Tutoring system | Model Tracing Paradigm | Website | Education |
| IBM Watson | 2004 | Question Answering System | IBM's DeepQA software and Apache UIMA | | |
| YPA | 2007 | Used to retrieve Information | Dialog manager, Natural Language processing | | Business |
| Mistuku | 2013 | Claims to be 18 year old female chatbot from Leeds | AIML | - | - |
| Chatbot in E-commerce website | 2015 | Automated assistant on an e-commerce website | Javascript, MySQL | Website | Busines |
| Jill Watson | 2016 | Teaching Assistant | IBM Watson | Elearning Environment | Education |
| Chatbot for University Related FAQ | 2017 | Answers to the FAQs related to university | AIML and LSA | - | Education |
| Weight Mentor | 2018 | Interact with users to help them maintain weight loss | Dialogflow, NodeJS, PostgreSQL | Facebook Messenger | Health |

| | | | | | |
|---|---|---|---|---|---|
| Chatbot created by Carayannopoulos | 2018 | Helps students during the transition phase | - | IM platforms | Education |
| CVChatbot | 2018 | Notifies students about modules created in virtual learning environment | - | Facebook | Education |
| DINA | 2018 | Responds to applicants corresponding for their issues before admission | Dialogflow | Website | Education |
| FIT- EBOT | 2018 | Lecturer and administrative assistant | Dialogflow | Facebook messenger | Education |
| CiSA | 2019 | Provide initial support to international students in English in a Korean university | - | Facebook | Education |
| Chatbot to support students about a particular course | 2019 | To provide clarify doubts to students about a Higher Education Course | IBM Watson | Facebook Messenger | Education |
| Medbot | 2020 | To facilitate telehealth | Dialog flow | - | Health |

| | | | | | |
|---|---|---|---|---|---|
| | | by providing primary healthcare, education, information and advice to chronic patients | | | |
| FAQ bot for Covid-19 | 2020 | To help patients understand the symptoms of Covid-19 and give them proper guidance | Dialog flow | - | Health |
| Symptoma | 2020 | Digitally screening citizens for risks of Covid-19 | Predictive Method | https://www.symptoma.com | Health |

Table 2.1: Summary of the chatbots discussed in background work.

### 2.3 Summary

As discussed above there are lot of chatbots already available which are tailored to achieve the specific purpose. Some bots like PARRY, Medbot, Weight Mentor and Symptoma are developed to help patients and guide them. While there are other bots implemented in the field of health like the FAQ bot developed during the outbreak of the pandemic to help patients understand whether they have Covid-19 symptoms. Certain bots like YPA were developed to help with the business by guiding customers and retrieve the information the users require.

Several other chatbots like Ms Lindquist, Jill Watson and FIT-eBOT were developed as tutoring bots to help students with tutoring and provide support in their learning modules. Chatbot created by Carayannopoulos and CiSA were designed mainly to answer students frequently asked questions but these bots were implemented in IM platforms like KiK messenger and facebook.

Eventhough, these chatbots are already developed and looks very similar to the one we are proposing, we focus on providing initial support to students by answering their FAQs. This is achieved by designing a FAQ bot using IBM Watson which already has inbuilt natural language processing and certain other features that enables easy implementations. The main difference of UAbot with the existing bots is that, we are implementing it within the elearning platform itself unlike IM platforms like other chatbots discussed in the above section. This feature of UAbot helps the students to find answers to their FAQs within the elearning environment itself. While in other bots, students must use facebook messenger or such platforms and have an account in it to clarify their doubts.

# CHAPTER 3

# RESEARCH METHODOLOGY

In this chapter, the methodology used in the research work is described. The scientific methodology used gives an idea about the steps involved in the entire work.

### 3.1 Design Science Research

The methodology used to develop a FAQ chatbot as part of this research is Design Science Research Methodology (DSRM). This methodology helps to create and evaluate IT artifacts which are intended to solve the problems identified within the organization. These artifacts are then represented in a structured form [3].

Hevner et al. provides the steps for performing Design Search Research to address important and relevant problems. The different steps involved are described below. First step being the Problem Identification and Motivation. In this step, the research problem needs to be defined. Then the solution for the problem has to be justified. As the research problem is defined, it can be used to develop an artifact, which can provide the solution. By justifying the solution researchers are motivated to work on the solution.

Second step is the definition of the objectives for a solution. The objectives of a solution for the identified problem must be defined based on the feasibility and the usefulness. Current solutions and the knowledge of the state of problems must be studied well to define the objectives for the solution.

Third step is Design and Development. An artifact needs to be created in this phase. It can be a construct, model, method or instantiations. The desired functionality and the architecture of the artifact must be determined in this phase.

Demonstration being the fourth step, uses the developed solution and demonstrate how it can be used to solve the identified problem. This can be achieved either by experimenting, simulating, by providing proof or other methods.

The next step being the evaluation. In this step, we need to observe and measure how well the artifact developed has supported the defined solution for the identified problem. In this activity, the obtained actual results are compared to the actual objectives of the solution. By comparing the results, we can have an idea whether the solution is feasible and useful.

Final step is communication. The problem and its importance, the artifact, its utility and novelty and its effectives to researchers and audiences has to be communicated. To achieve this step, the researcher should have knowledge in the disciplinary culture.

Then comes the process iteration, in which the entire process is iterated to achieve the expected results which is shown in figure 3.1.

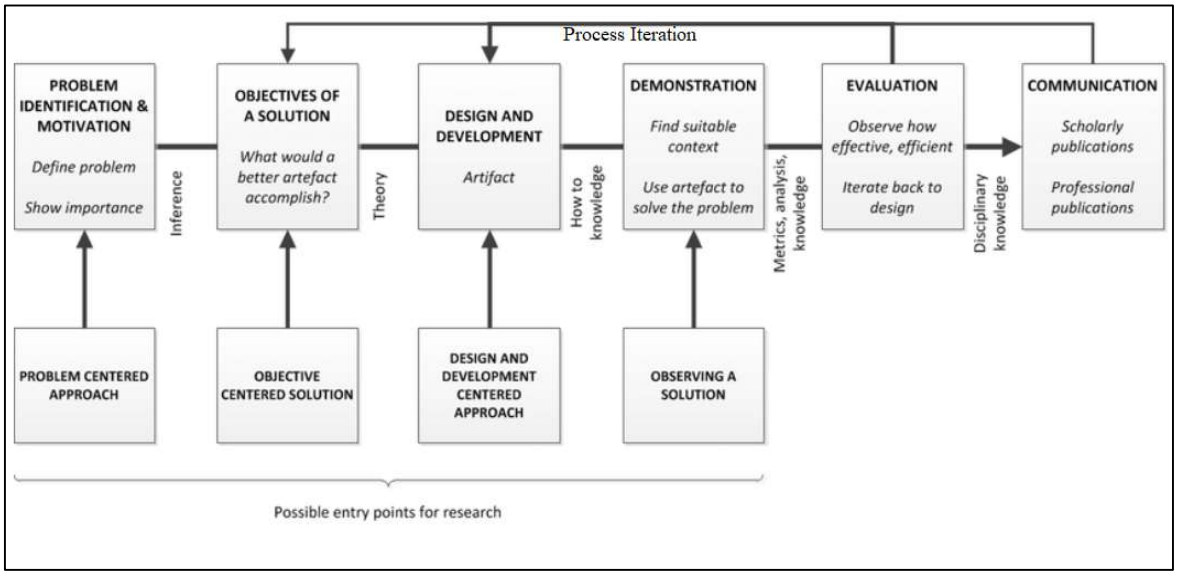


Figure 3.1: Design Science Research Process Model [46]

## 3.2 Description of the used methodology

The design science research model is used to achieve the goals of this research work. The different steps involved in this research work is explained in the context of the model below. The problem identified for this research work is the lack of proper initial support for new students in the virtual learning environments. Motivation behind the work was to provide the necessary for the students so that they have a smooth transition into the virtual learning environment.

The objectives of the solution are to create a chatbot to help answer students queries irrespective of the time zone and provide them the required support together with helping the tutor to reduce their workload. In the design and development step, we have decided to create HTML block in the virtual learning environment to integrate the FAQ chatbot developed using IBM Watson.

The developed solution is then demonstrated in a real time learning module for the students to interact and have the experience of interacting with it. Based on the experience, the students are asked to provide feedback and comments to improve the chatbot. The feedback is then evaluated and analysed by qualitative method which is given clearly in figure 3.2.

After evaluation of the results, the entire process from design and development to evaluation is repeated with some modifications in the design phase. As part of our research work, we had two process iterations in total by modifying the FAQ chatbot. According to the suggestions and results obtained at the end of first iteration the chatbot was modified in the design to accommodate the changes and suggestions given by students. In the second iteration, the chatbot is modified and then given for demonstration to the students. The results are then evaluated by statistical and qualitative analysis.

The results obtained from the analysis is then communicated. As part of our research work, communication is performed by the dissertation which is submitted as part of the course.

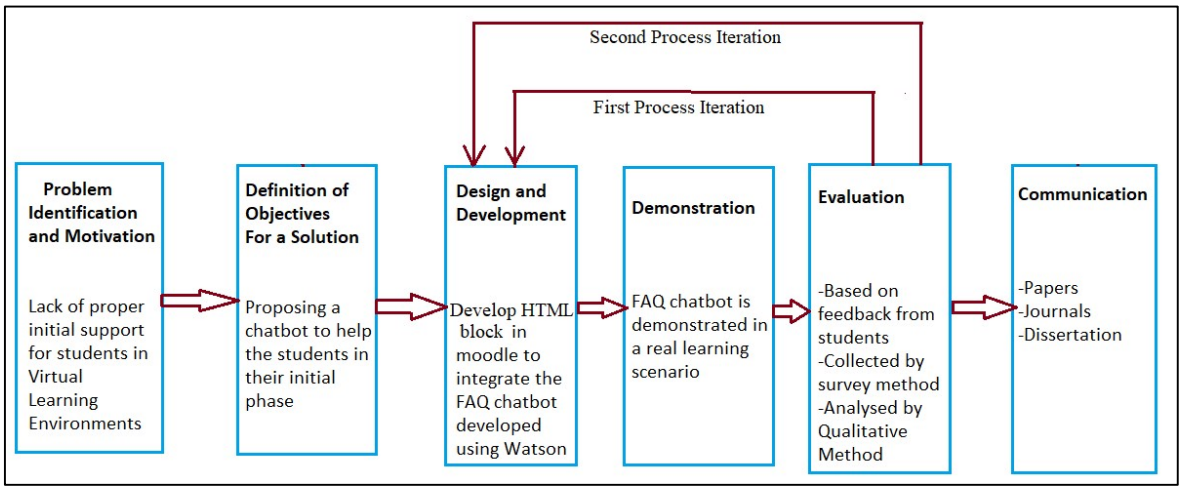


Figure 3.2: DSR Model applied in our research work

# CHAPTER 4

# TECHNICAL BACKGROUND

### 4.1 Chatbots

The Oxford English Dictionary has defined a chatbot as follows [66]:

**chatbot** (n.): *A computer program designed to simulate conversation with human users, especially over the Internet.*

In other words, a chatbot is a virtual assistant, which can stimulate a conversation using text messaging and more likely to replicate Short Message System (SMS) [53]. A chatbot is also an artificial intelligence (AI) based software program that is capable of simulating conversations in natural language with the user through messaging platforms, websites and phone applications [6][48]. The interaction with a chatbot usually starts with a greeting or an introduction from the chatbot. The conversation continues once the user starts asking questions and then the chatbot responds to the student [35].
As per Schlicht [51], a bot can basically be of two types: (i) rule-based, in which there are certain principles already created. The bot can respond only according to the principles and its intelligence confines to the specified rules. This type of bot is incapable of responding to queries which are not already mentioned. (ii) Based on Artificial Intelligence (AI) techniques, which keeps on learning based on the interactions. Natural Language Processing (NLP) is used in this type of bots to ensure that the responses are correct and dynamic.

A simple test has been defined by Alan Turing which is named as the Turing Test back in 1950 in which a human being has to judge whether the entity, he is interacting with text is a computer program or not [1]. The main intention of this test is to ensure that the knowledge of the chatbot is vast enough so that one can ask anything for example, Alexa or anything related to a specific topic for example customer service chatbot for a bank. Alexa is virtual assistant artificial intelligence technology developed by Amazon. It can perform a wide range of tasks like voice interaction, making to do lists, providing weather so on and so forth [68].

Lot of companies have taken effort to develop AI bots, which includes IBM. This company has taken lot of effort in developing its Artificial Intelligence platform called IBM Watson. It aids in developing applications for different business models which includes chat robots which uses NLP and helps to have natural language interactions with humans [34].

Loebner competition [57] is an annual competition in artificial intelligence that awards prizes to the computer programs which responds more like humans during the interaction with the judges. This competition is very similar to the standard Turing Test. In 2011, IBM won this Loebner Competition for Watson and has gained visibility by its performance in winning over the best two human players in Jeopardy program, an American television gameshow.

Taking into consideration it's recognition and Natural Language Processing together with AI techniques, we intend to use IBM Watson to develop an interactive FAQ Bot for Universidade Aberta naming it as UAbot. The main intention of UAbot is to answer students frequently asked questions and providing them the initial support required during the initial days in a virtual learning environment.

### 4.2 Chatbot Conversation Framework

Chatbots can be of different types based on knowledge domain, service provided, goals, input and responses generated. These chatbots are categorised based on the type of questions that the chatbot can answer.

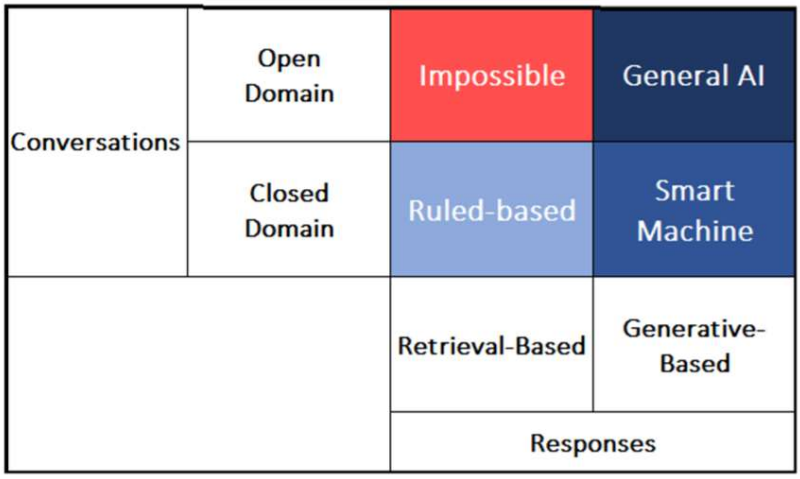


Figure 4.1: Chatbot Conversation Framework [67]

### *4.2.1 Knowledge Domain*

Knowledge domain refers to the dataset which the chatbot access. There are two types of knowledge domain namely open and closed domains.

In the open domain knowledge base, chatbots can address general queries and respond accordingly to those questions. Users are free to ask any kind of information. It is not mandatory to ask questions for a well-defined goal or intention as shown in figure 4.1. As there are infinite topics and facts, it can be a challenging problem for open domain base chatbots.

While in the closed domain knowledge base, chatbots respond to questions about a specific domain, usually it focuses on one sector and fail to respond to questions from other domains. These type of chatbots has limited functionality and addresses business needs.

### *4.2.2 Service Provided and Goals*

Service based chatbots are those that offer interpersonal, intrapersonal and inter agent services. These chatbots offers certain services which are really required in certain scenarios and it can do it effectively and efficiently. Goal based chatbots are designed for satisfying specific requirements. The informative, task based, and conversational agents are categorised under chatbots which are goal based.

### *4.2.3 Input and Response*

The other category of chatbot depends on the input and response generated. These type of chatbots accepts input in natural language and then process it and generate response in natural language. Chatbots of this type can be named as hybrid as they use natural language understanding and rules to process the input and generate the corresponding response [44]. There are basically two ways to generate a response. Responses can be either obtained from Retrieval Based system or Generative Based System as shown in figure 4.1.

### *4.2.4 Retrieval Based System*

A heuristic method is followed by retrieval models to obtain a predefined response/ answer. The heuristic can be use either a simple rule-based expression or a complex machine learning classifier. The advantage of such a system is that it is easier to implement them as

they do not require huge data [18]. Second advantage is that, it won't make grammatical mistakes and can be used to provide rigid business dialogue flows.

#### *4.2.5 Generative Based System*

In this system, the models are not relied on pre-defined responses, they generate new responses from models. Generative models are completely based on Machine Translation Techniques. The translation techniques are not used to translate between languages instead it translates from an input utterance to an output response using "sequence-to-sequence ML models". The limitations in data conversations at some companies makes the generative model difficult to implement.

### 4.3 Natural Language Understanding

Natural Language Understanding is a branch of Artificial Intelligence (AI) that can understand the input from the user which is made in the form of sentences and turns it into structured information. NLU includes a set of text analytics features that can be used to extract meaning from unstructured data. It's application is widely distributed into the fields of automated reasoning, machine translation, question answering, text categorization, large-scale content analysis and so on [59].

### 4.4 IBM Watson

IBM Watson Assistant provides a flexibility of using upto 10,000 messages upto one month completely free, has great compatibility compared to other platforms and is super easy to use. Some of the interesting facts are listed below

- Intents are recognised with Artificial Intelligence
- Dialogues can be easily edited using text, options, images and so on.
- Availability of inbuilt content like skills or intents.
- Google Analytics dashboard with history of user conversations stored upto seven days.

Watson also allows development of integrated AI conversational bots that can be deployed on any channel, including smart phones, websites and so on. It is also supported

by thirteen languages. It also stores conversations and learn to improve the interaction with the users. These stored conversations can be used as a repository of data for future references and to implement more questions into the knowledge base according to the student preference.

As mentioned earlier, we have chosen IBM Watson to implement the chatbot that meets our needs. Watson is a hybrid chatbot, that uses a different approach than the traditional one. It uses search and chatbot technologies into a single user interface based on a typical search paradigm. The existing search system has a robust keyword-based search engine that uses Apache Solr [69][70] and has been fine-tuned to stand on its own as a solution. On this foundation, we surface Watson Assistant along with the results from Solr. This “hybrid search” approach aligns user expectations to what they can expect with a traditional search engine. However, when trained on a specific intent, Watson Assistant, being fully capable of understanding natural language as well, is capable of responding to the user with something they did not initially expect, an answer to a question that might go beyond what a traditional search engine could deliver or a self-service form.

There are many advantages to this approach. Using a traditional search paradigm as the foundation, search results are always returned, but Watson offers a solution only when it has been specifically trained for it. This is extremely helpful for scaling up the Watson component over time with more training. While traditional chatbots degrade to search, the hybrid search approach evolves to become smarter over time as it is trained on more solutions [58].

### 4.5 Generic Workflow

A user communicates with the chatbot through the chat client. Once the query is submitted, the chatbot sends it to the machine learning Natural Language Processing (NLP) engine. The NLP returns the entities which in turn helps in finding the relevant data. The obtained data is then sent back to the chatbot. Then this data is converted to an appropriate response and given back to the user through chat client as shown in figure 4.2.

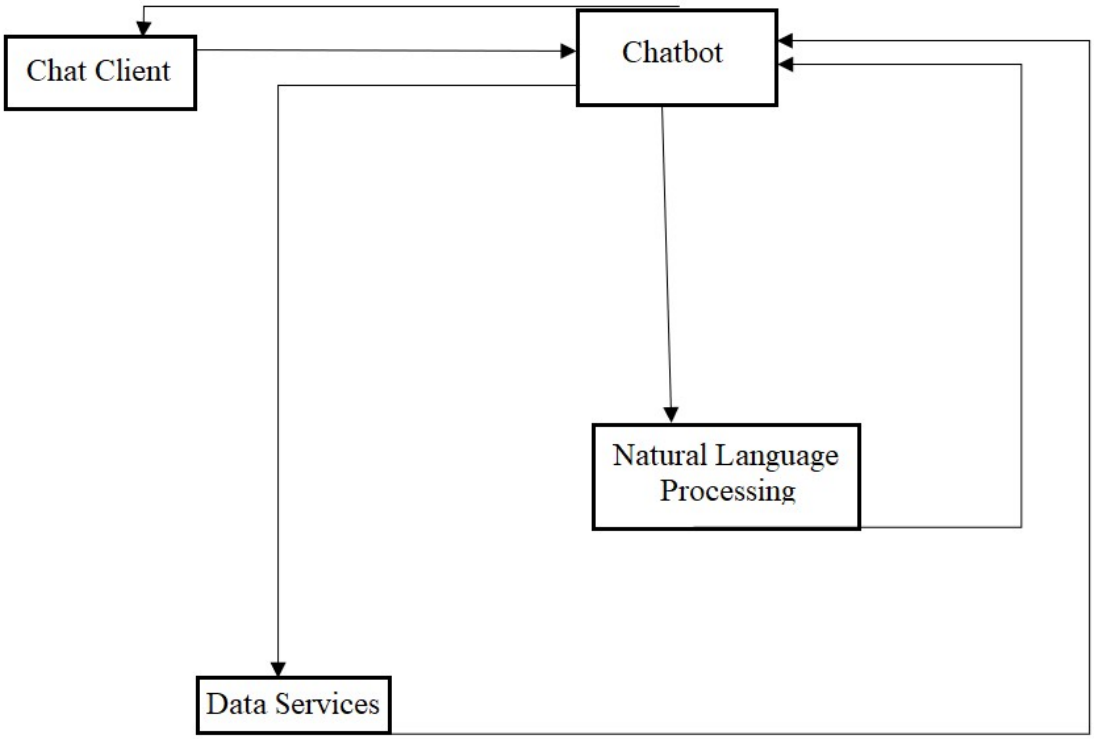


Figure 4.2: Generic Chatbot Workflow [8]

### 4.6 Approach

One of the main approaches used in implementing a chatbot is choose a domain and make it a domain specific bot. Specific bot yields better efficiency than a generic bot as the data set is predefined and the bot needs to answer within the dataset [30]. When the user query is insufficient to answer it successfully, the chatbot must be inquisitive. So that, the chatbot asks questions proactively in order to mimic a human interaction.

Once the chatbot is opened, the chatbot initiates the conversation by greeting the user and giving an introduction about itself. Then it waits for the user's question. Once the question is received from the user, it checks for the intents in the question. If it is successful in finding a match for the intent in the chatbot knowledge domain, then it generates the response which is already specified for that intent. If it doesn't find a matching intent, then it generates the default response.

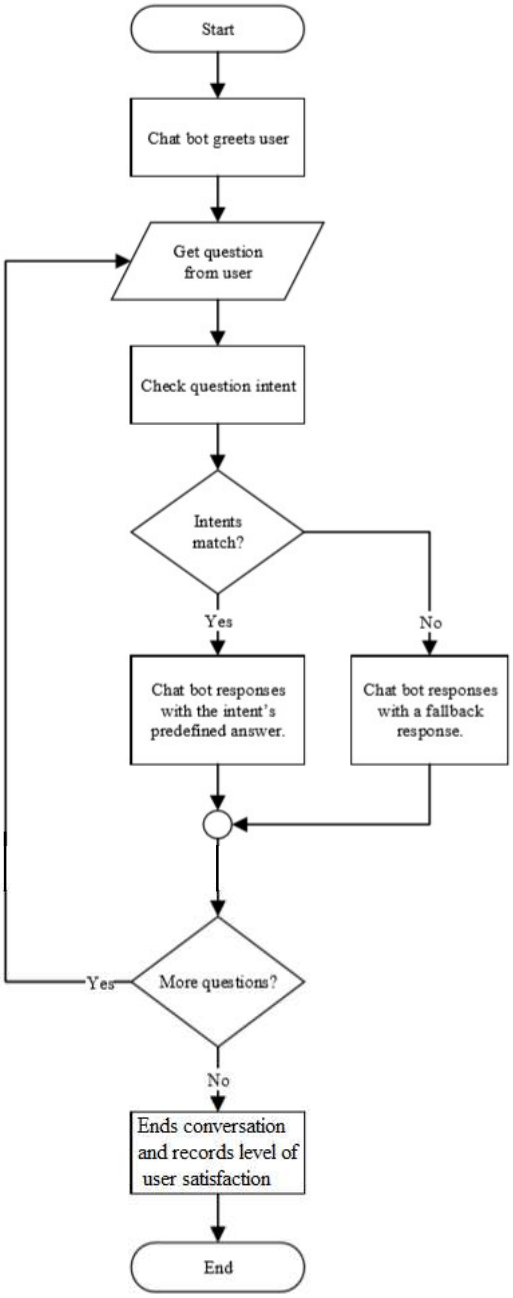


Figure 4.3: Conversational Flow of the chatbot [50]

The chatbot then waits to see whether the user have more questions. If yes, the entire process continues from gathering the question till generating the response. If the user confirms the end of conversation, then the chatbot bids goodbye and enquires the overall satisfaction level of the user. The detailed flow of the conversation is shown in figure 4.3.

# CHAPTER 5

# UABOT ARCHITECTURE

The “UAbot” chatbot is developed to be a conversational bot to interact with the first semester students in bachelors’ course. This chatbot was implemented in the *Módulo de Ambientação* (bootcamp training module), as this module gives an insight about the functioning of UAb, it’s learning and assessment model, location of tests, schedule of the test, enrolments and certificates.

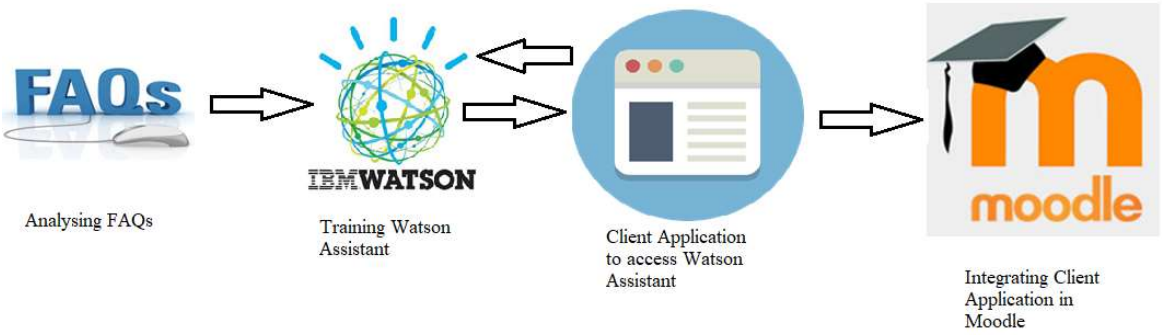


Figure 5.1: Components used in this work with it’s connection

The entire architecture of the system developed includes 4 main components. To develop UAbot and integrate it into the elearning platform, lot of analysis and preparation is required. The entire development is a step by step procedure and should be prepared with utmost care. First step in creating a UAbot is defining the goals that needs to be achieved by the bot. The main goal of the bot is to provide initial support to the students by answering FAQs.

To train the bot to answer FAQs, a list of previously asked questions needs to be analysed. Based on the analysis, the final data to train the chatbot is defined. Once the data is finalised, IBM Watson Assistant needs to be fed with all the data with the corresponding responses. Then the bot created needs to be tested and trained to fine tune the results.

A client application is then created to communicate with the conversational agent. It is developed to provide a user interface for the students to send their queries and receive the responses. Once the client application is ready, then it needs to be integrated in the eLearning platform. This integration makes it easier for the students to use the UAbot within the eLearning platform. All these steps involved in the development of UAbot is shown in figure 5.1 and described in detail in the coming sections.

### 5.1 FAQ Analysis

The main objective of this dissertation is to create an interactive FAQ to support the students. To start with the entire procedure, initially the list of FAQs needs to be analysed thoroughly and modified to train the Watson chatbot. We have obtained the FAQ list from the pedagogical council which is provided in the appendix. There are 36 questions in total in the regular FAQ list. 26 questions are grouped in 3 main categories and remaining 10 questions are separated from the main category. The 3 main categories are

- Avaliação contínua, e-fólios, exame final
- Avaliação final presencial, recursos, etc
- Inscrição/matrículas (informação portal uab)

The remaining questions doesn't come under these main categories. Appropriate keywords for all categories are identified and fed into the chatbot as intents. 21 intents were created with the identified keywords. The answers for these questions are modified to provide as responses to each intent identified. The mapping of the responses with the intents are done in the dialog tree maintained within the chatbot. Extra care was taken to rephrase the answers for each question due to space constraint in the chatbot.

### 5.2 Conversational Chatbot

Based on the popularity of IBM Watson Framework in the Artificial Intelligence Industry and it's wonderful features, we have chosen it to develop the conversation bot. IBM Watson also offers a free plan, doesn't need coding to configure and includes NLP intent classification with conversation management. In addition, the chatbot can be built in IBM Cloud platform and was easier to deploy and manage it without installing other software which would in turn be a heavy work for the project. The steps involved in building IBM Watson is given in detail in the table 5.1 [43].

| N° | Building steps |
|---|---|
| 1 | Go to the IBM Cloud catalog and select the Apps Cloud Foundry platform category. |
| 2 | Decide the most appropriate programming language for this application. |
| 3 | Proceeded to develop a chat interface on the deployment platform. |
| 4 | Again, go to the IBM Cloud catalog and select the Watson platform category. |
| 5 | Choose Conversation API and create a service instance. |
| 6 | With the initialized service, click Launch tool to create Workspace (choose name and language). |
| 7 | Configure the Intentions (represents the purpose of a user's input), Entities (represents a term or object that is relevant to your intents and that provides a specific context for an intent.) and Dialog (branching conversation flow that defines how your application responds when it recognizes the defined intents and entities). |
| 8 | Train the cognitive chatbot with the option "Try it out". |
| 9 | Finally, connect the Conversation API with the developed interface; take into account the API credentials for the use of cognitive service. |

Table 5.1: IBM Watson Chatbot Building Steps

The chatbot created as part of this dissertation is named as “UAbot”, which is expanded as Universidade Aberta Bot. The important components of UAbot are Natural Language Processing (NLP) Engine, intent, entities, dialog and context.

### 5.2.1 Natural Language Processing (NLP) Engine

Natural Language Processing is a crucial entity of chatbots. NLP is a type of “program” designed to help computers to read, analyse, understand and derive meaning from natural human languages in a way that is useful. In short, NLP is a way to help machines understand human language. It consists of a data store and a knowledge store. Data store contains all the conversation logs and analytics, which will help in analysing the data and aid to improvements. While the knowledge store contains all the information required to respond to user’s queries. The architecture of natural language processing (NLP) engine is demonstrated in detail in the figure 5.2.

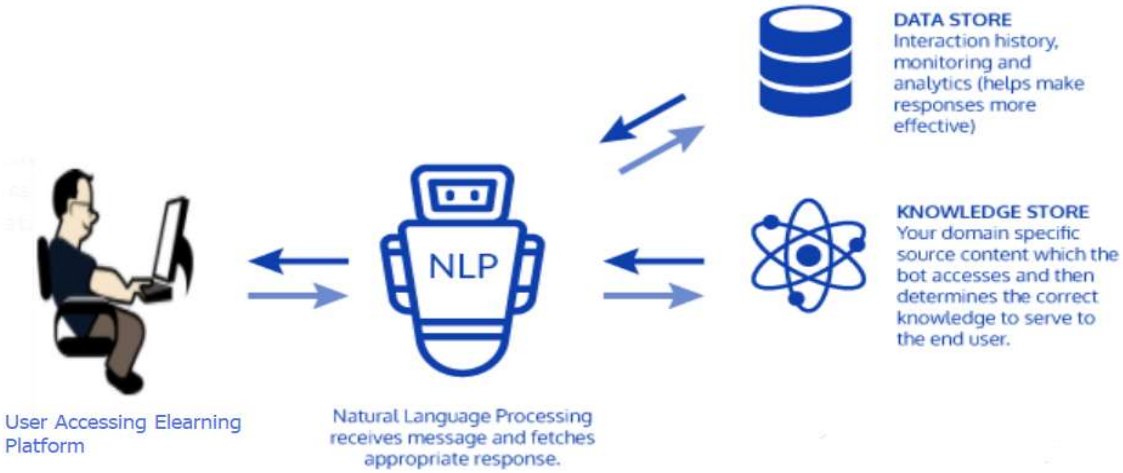


Figure 5.2: General Architecture of NLP

NLP engine is the core component that interprets human language to structured inputs that the system can process. NLP engines have advanced machine learning algorithms incorporated to identify user's intent and then matches them to the corresponding list of available actions that the chatbot can support. The success of a chatbot is completely dependent on the right NLP engine [60].

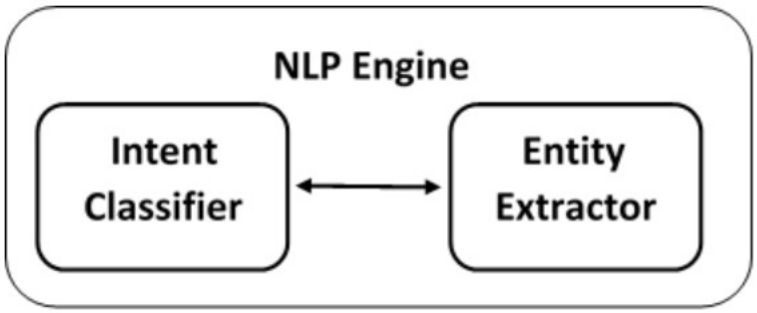


Figure 5.3: Architecture of NLP engine used in IBM Watson

The architecture of NLP engine as shown in figure 5.3, comprises of two components namely Intent Classifier and Entity Extractor. The first component being Intent Classifier. An intent classifier accepts the user's input, understands it and matches it to one of the intents that the chatbot supports. A classifier is used to categorize pieces of data which means a

sentence can be mapped to several different categories based on the keywords present in that sentence. Many options are available for developers to achieve this namely pattern matching, machine learning algorithms and neural networks.

The second component is entity extractor. An entity extractor helps in extracting the key information from the user's query. Specific information like name, date, address, type of problem and so on will be identified [60].

### 5.2.2 Intent

An intent corresponds to the intention of the users interacting with the chatbot. It is defined for each type of request the application supports. Alexa, Dialog flow, Watson and so on have NLP engines that requires different ways to phrase an intent to work accurately to understand the users' request. Watson prefers at least 5 examples for each intent to get best results.

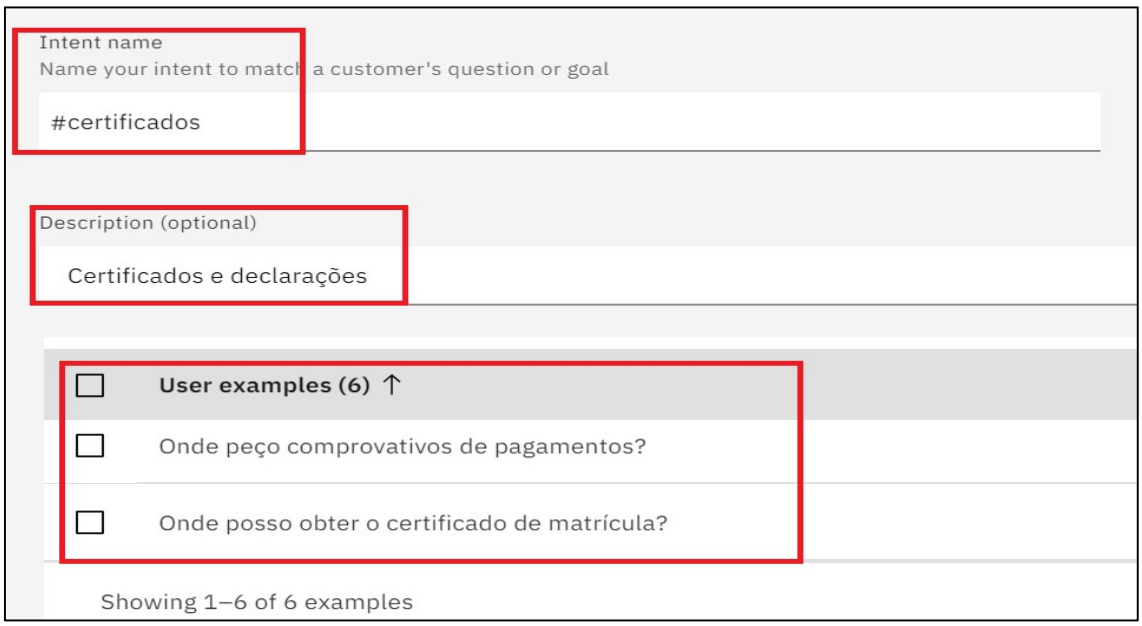


Figure 5.4: Creating an intent #certificados and providing 6 examples

Intents are recognised by thoroughly analysing the FAQ list provided by the MAO (*Módulo de Ambientação*) team. The main keywords are identified and added to the intent by providing 5 examples for each intent. Figure 5.4 is one such keyword identified, and an

intent is created which is named as “certificados”. Likewise, 21 intents are added in UAbot with more than or equal to 5 examples. The screenshot of the intents created are shown in figure 5.5.

| Intents (21) | Description | Modified | Conflicts | Examples |
|---|---|---|---|---|
| #avaliacao | Workflow de avaliação | 2 months ago | 4 | 13 |
| #calendarizacao_provas | Como poderei saber a calendariz... | 2 months ago | 1 | 7 |
| #certificados | Certificados e declarações | 2 months ago | | 6 |
| #cla | Centros Locais de Aprendizagem | 2 months ago | | 6 |
| #classificacoes | Notas de avaliação contínua | 2 months ago | | 6 |
| #creditacao_efolios | Creditação/validade dos e-fólios | 2 months ago | | 6 |
| #escolha_UCs | Escolhas de disciplinas a inscrever | 2 months ago | | 5 |

Showing 1–21 of 21 intents 1 1 of 1 pages

Figure 5.5: Intents used in UAbot

### 5.2.3 Entities

Entities are used to help NLP engine identify more details in the user’s query. This would enable the NLP engine to provide tailored responses to each user. Combining both intent and entity from the user’s query gives the advantage of providing very specific and precise responses to the user. As UAbot is in it’s initial prototype, the responses are usually generic and it act as a guide to help them find answers for their queries. User specific answers are not provided through UAbot so entities are not used in this scenario.

### 5.2.4 Dialog

A dialog defines the flow of the conversation and the response of the chatbot according to the intents and entities identified. For each intent, a dialog branch is created to provide the corresponding response. The nodes in the dialog tree are triggered based on the user input. A dialog tree is created by inserting conditions and specifying appropriate

responses for each intent identified as shown in figure 5.6. During first iteration, 23 dialog nodes were created in the dialog tree and 35 dialog nodes during second iteration.


Figure 5.6: Dialog created for the intent Certificados

Dialog tree created for UAbot has included the intents identified and corresponding responses are fed for each intent. A part of the dialog tree is shown in figure 5.7 as it a big one and difficult to show the entire tree.

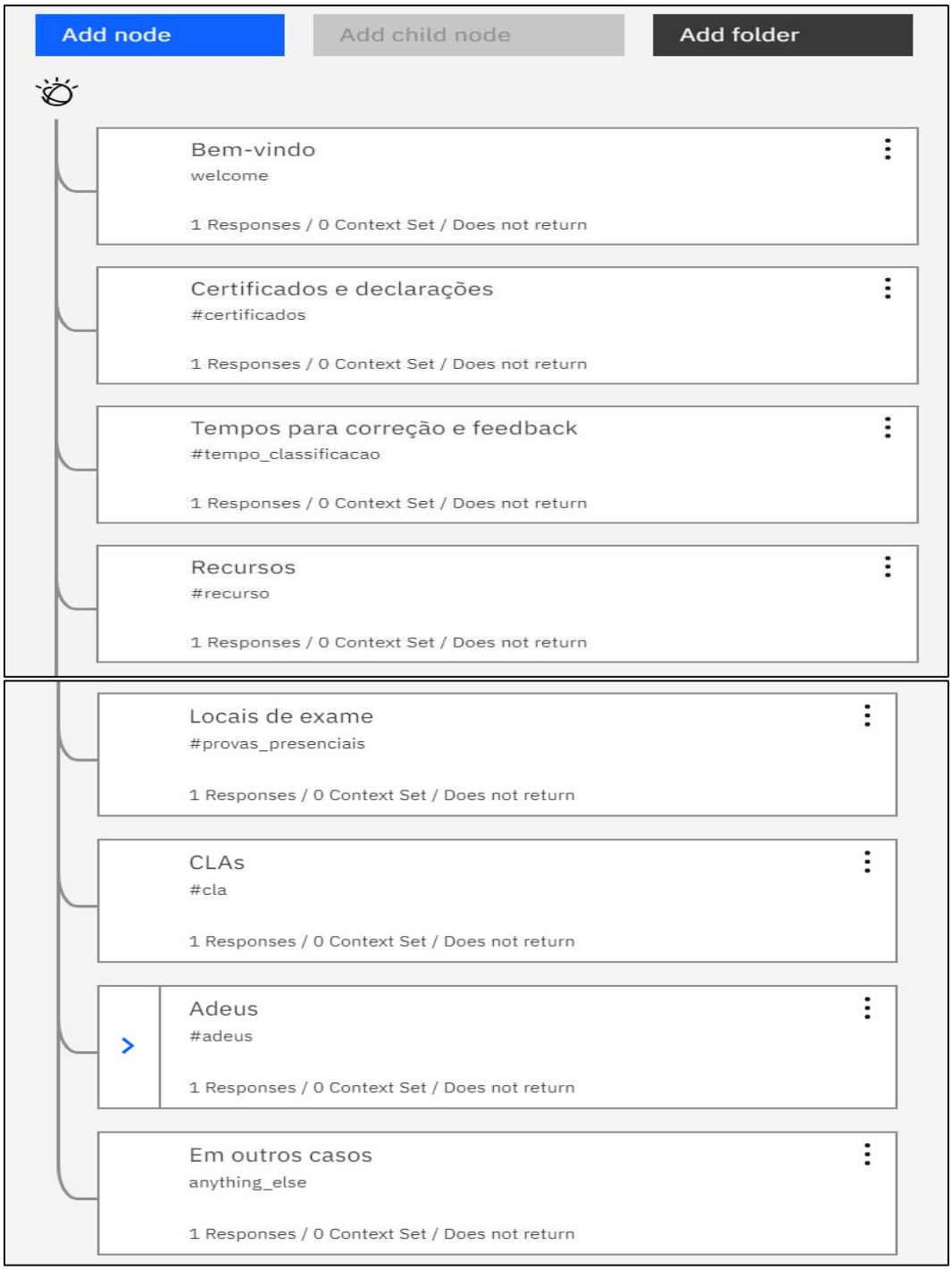


Figure 5.7: A part of the dialog tree used in UAbot

The dialog tree has nodes which is categorised into the following sections.

*Introduction:* This section includes an introduction about the purpose of UAbot and the areas in which the bot can help the students. The details stored in this node is displayed immediately the user opens the bot, which is basically the first interaction with the user.

*Greetings:* This part of the dialog tree greets the user when the user starts the conversation with a greeting which includes hi, good morning and so on. The bot responds by asking how it can help the user.

*Queries:* In this section, the response to all the intents created are specified. Each intent corresponds to the queries of the users. The answer to each query is different and it is specified in the dialog tree. These answers can be sentences which is a direct reply to the students' query. The answer can also be either a link to a page with more details for students' reference or an image with more explanation.

*Exceptional Case:* This node in the dialog tree is created to provide response to user when the query doesn't match any other nodes. In this node, it asks the user to rephrase the question as the bot doesn't understand the users' query.

*Feedback:* This section of the dialog tree is used to gather the feedback in 5 point likert scale from the user at the end of the conversation where 1 being strongly dissatisfied and 5 being strongly satisfied. Once the user specifies the feedback, the bot says bye and wishes a good day.

### 5.2.5 Context

Context is specified for each node in the dialog tree to recognise the background of the conversation of the user with the chatbot. Context helps to pass the collected information between the dialog and the application code. It also stores information and passes it to different dialog nodes. Context is described as a JSON entry within the node. Each conversation has its own context, which evolves as the conversation progresses. It is cleared at the end of the conversation. Context is used in the application interface created for moodle. It helps to navigate through the conversation and provide the precise response to the user corresponding the user's query. The figure 5.8 shows the context editor for one of the nodes in the dialog tree. In this case, it is the default context, and it can be even edited to serve special purposes.

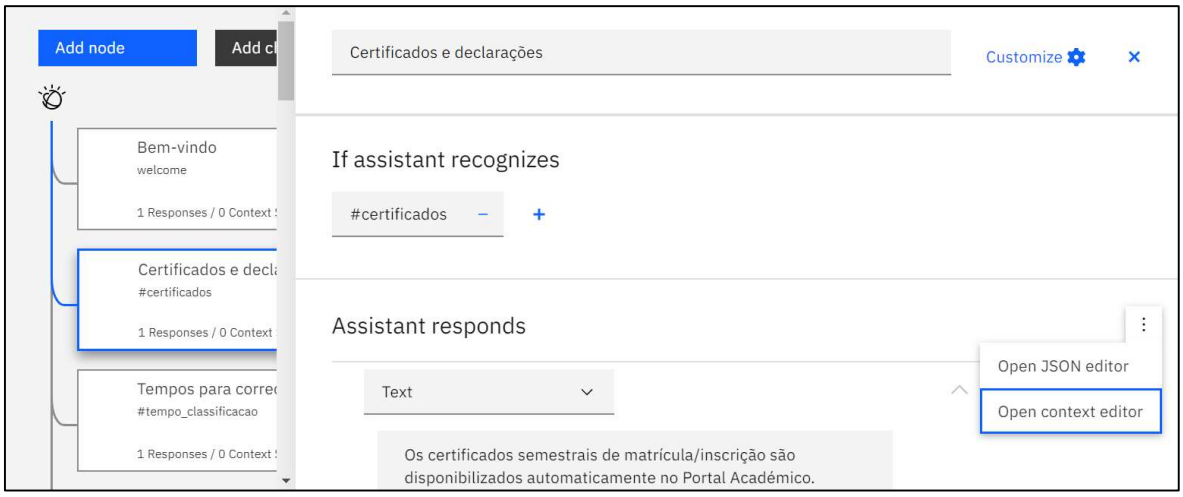


Figure 5.8: Context editor for Intent Certificados

### 5.2.6 Train the Bot

When the knowledge base of the bot is created and developed, the bot is getting trained simultaneously in the background. Training happens even when some changes are done in the knowledge base or the dialog tree. The figure 5.9 shows how it gets trained.

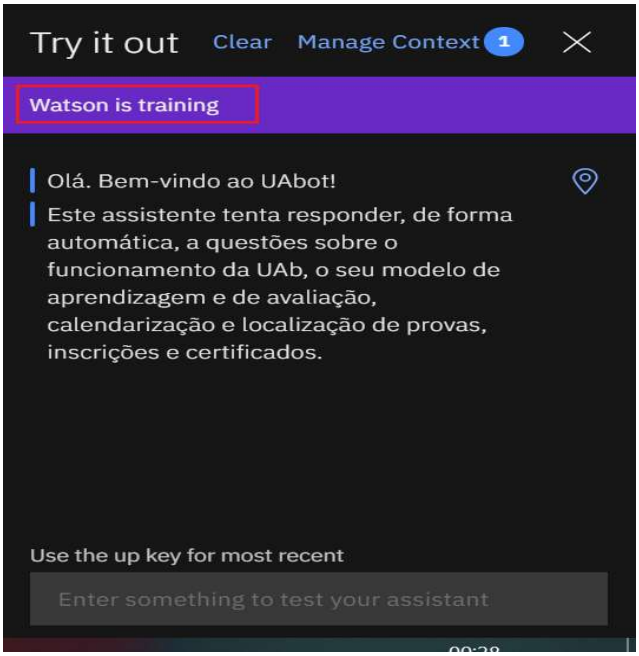


Figure 5.9: Bot is getting trained

An option called “Try it out” helps the developer to test the bot immediately within the developing environment so that any scenario can be tested while developing itself. It is not necessary to wait till the development is over. It offers an environment that helps in performing unit test for each intent or entity. Once the bot is finished training, it shows a message as shown in the figure 5.10. After the training is completed, the last change made in the knowledge base will be available in the “Try it out” panel.

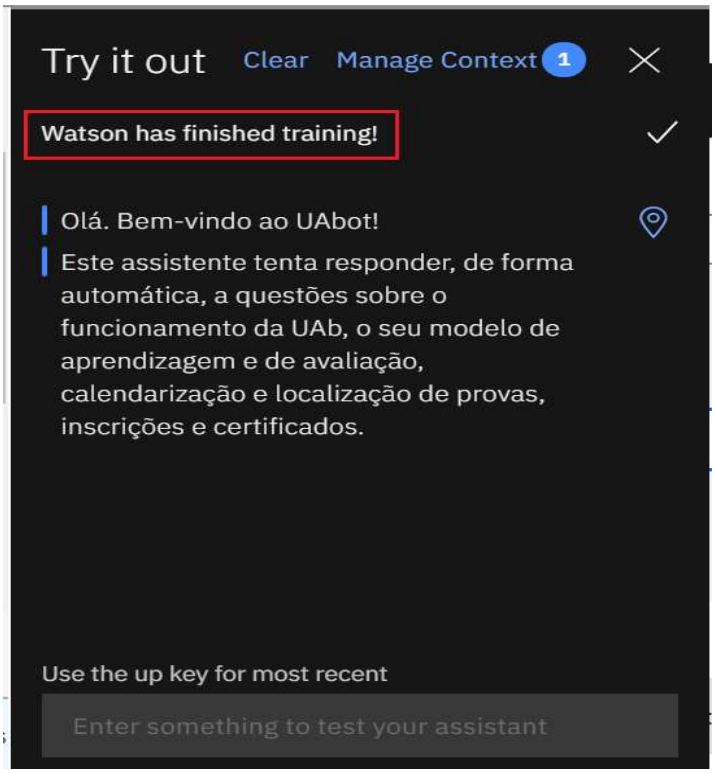


Figure 5.10: Bot finished training

## 5.3 Build a Client Application

Once the dialog skill is created with all the intents then conditions are defined to provide responses for each of the intents. The dialog skill can be downloaded in json format. An assistant is then created to connect the dialog skill, which is already finalised. Then, a client application needs to be developed to interact with users and communicate with the Watson Assistant Service.

### 5.3.1 Service Information

To have access to Watson Assistant service REST APIs, the client application which was developed needs to be able to authenticate to IBM Cloud and get connected to the right assistant. The service credentials and the assistant ID needs to be inserted into the application code to have access to the assistant. These credentials and ID can be found out by viewing the API details for the assistant, we intend to connect. Figure 5.11, shows the path to access the API details while figure 5.12 provides the Service Credentials and the assistant ID.

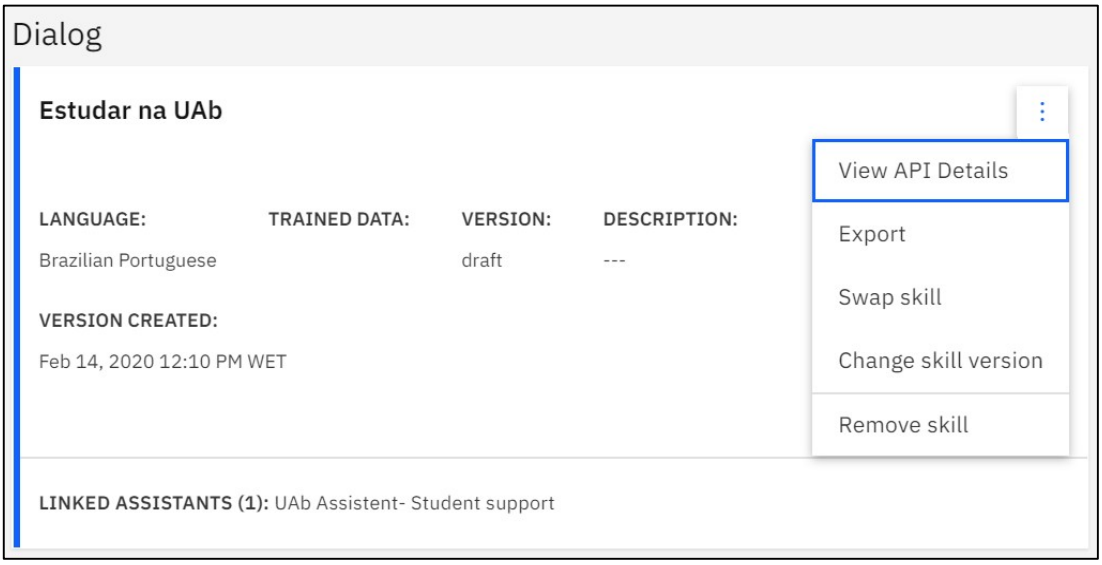


Figure 5.11: Path to access API details

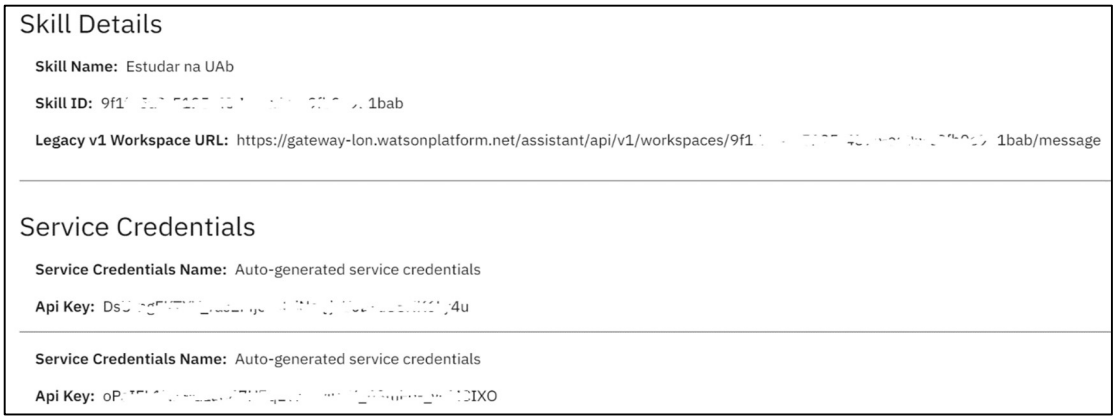


Figure 5.12: Skill details and service credentials

### 5.3.2 Communication with Watson Assistant Service

To establish the connection with the Watson Assistant service is simple. Watson provide SDKs for certain programming languages like Java, Python and so on. To attain our research goal, Watson Assistant needs to be integrated into the elearning platform used in Universidade Aberta. The elearning platform used is moodle which is written in PHP. Inorder to integrate SDK in PHP was required and it was not readily available. So we have written the corresponding code in PHP as it was not readily available.

The first step is to create a wrapper for the Watson Assistant service. The wrapper is an object that we will use to send input to, and receive output from, the service. When the service wrapper is created, the authentication credentials from the service key is specified, as well as the version of the Watson Assistant API we are using.

After creating the service wrapper, we use it to create a session and send a message to the assistant. We then print the response text to the console, and finally we delete the session. Assuming everything works as expected, the assistant returns the output from the dialog, which is then printed to the console. If the output is obtained correctly. Then, the output tells us that we have successfully communicated with the Watson Assistant service and received the welcome message. Now a user interface is required to process user input.

### 5.3.3 Processing User input to detect intents

To process user input, we must add user interface to our client application that is being built. The application begins by sending an empty message to the assistant to start the conversation. It then displays any intent detected by the dialog along with the output text, and then it prompts for the next round of user input. The Watson Assistant service is correctly recognizing the intents, and the dialog will return the correct output text (where provided) for each intent.

### 5.3.4 Using the Version 1 API

IBM Watson Assistant has two versions of API namely version 1 which is denoted as V1 and version 2 which is denoted as V2. We are using the version 1, V1 API of Watson Assistant Service, it can directly communicate with the workspace, bypassing the orchestration and state-management capabilities of the assistant. But the client application

must manage the state information using the context. Client application must maintain the correct context by saving the context received with each response and sending it back to the service with each new message request. One of the peculiarities of V1 API is that the v1 message method always returns the context with each response [61].

## 5.4 Integration of Client Application in Moodle

We are integrating the chatbot into the moodle to allow students to communicate with it. This gives the students opportunity to use the chatbot without using any other platforms. It is an added privilege, that their doubts can be cleared then and there in the elearning platform itself. The integration includes two parts, namely developing an interface and integration in moodle. These are described in detail in the below sections.

### 5.4.1 Interface Development

We are developing a simple interface for the chatbot. This is achieved by developing a page in HTML with javascript and CSS to improve usability. It is developed to include the client application already implemented, which is described in the last section. The communication with chatbot by sending message and receiving the response is carried out through the client application from the HTML page.

### 5.4.2 Integration in Moodle

After the interface is developed, it needs to be incorporated in the elearning environment for the students to have access to the chatbot. In our case, the elearning environment we are using is moodle. To incorporate the interface in moodle, we intend to add a HTML block. Link to the HTML page already developed will be provided in the HTML block with some modifications so that is appears as a button to the students. This HTML block is created in bootcamp online training course as shown in figure 5.13 to help the students in providing the support required.

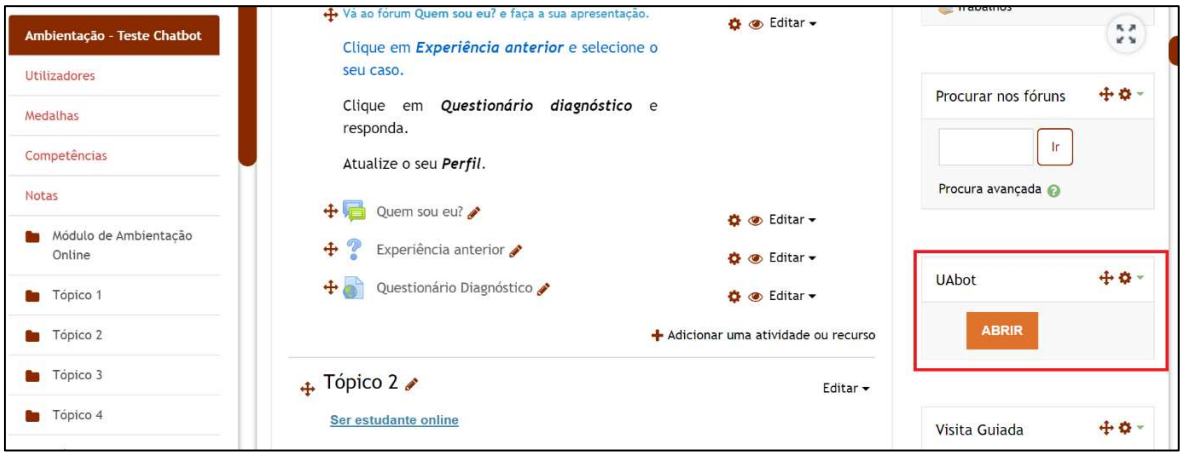


Figure 5.13: UAbot added in HTML block within moodle

# CHAPTER 6

# SYSTEM IMPLEMENTATIONS

This chapter describes about the system implementation and how it is used in developing the code for this dissertation. Each section is separated and then given a detailed explanation of technologies used to provide an insight into the technical details.

## 6.1 Chatbot

The work of implementing the chatbot in Moodle has used several languages. This section will give a detailed description about different languages used for different purposes. The chatbot developed for answering FAQs is developed using IBM Watson Assistant. The main software used by Watson is IBM's DeepQA Software and Apache UIMA (Unstructured Information Management Architecture) framework implementation. For coding, the system has used many languages like JAVA, C++ and Prolog [37] [52] [62].

## 6.2 Other Components

### 6.2.1 User Interface

For the users to interact with the chatbot, an interface is developed. This will act as a front end for the users to input their queries. The interface is developed in HTML, CSS and Javascript that helps in natural conversation flow between chatbot and students. Ajax was used to communicate to and from the chatbot without the need for a postback or complete page refresh. The user interface is hosted in a server "tutorial-virtual.uab.pt", which is then made available for the students to send their questions.

Hypertext Markup Language (HTML) is a standard markup language for documents which must be displayed in a web browser. HTML can embed programs written in languages like javascript and CSS. HTML provides a way to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and other items [64].

Cascading Style Sheets (CSS) is a language designed to enable the separation of presentation and content, including layout, colours and fonts. This separation can help in improving accessibility to content, by providing more flexibility and control in the specification of presentation characteristics [65].

Javascript is a high-level programming language which can be used both on client-side and server-side. It is used in many web applications to make web pages more interactive. Main advantage of javascript is that it can be used to modify website content and make it behave in different ways based on user's actions.

### 6.2.2 Client Application Design

The chatbot service was developed in IBM Watson and it is available in IBM cloud. To communicate with the chatbot from moodle, an API needs to be developed. A custom client API was developed for this purpose in PHP. For accessing Watson Assistant from client API, Workspace id and password is required. Once the access is granted then client API communicates with Watson by sending across the context and student's query in JSON format.

### 6.2.3 Moodle Integration

The user interface already developed needs to be integrated in moodle for the students to access it within the elearning platform. Inorder to integrate a HTML page in moodle, a HTML block is included in that specific course. A button is provided in the HTML block to link the HTML page as shown in figure 6.1. Bootstrapping is included in the block to aggrandize the button.

```
1  <div class="editor-indent" style="margin-left: 30px;"><div class="editor-
   indent" style="margin-left: 30px;"><div class="editor-indent" style="margin-
   left: 30px;"><div class="editor-indent" style="margin-left: 30px;"><div
   class="editor-indent" style="margin-left: 30px;"><button style="align-centre"
   class="btn btn-primary" data-toggle="modal" data-
   target="#myModal">ABRIR</button></div></div></div></div></div><div
   class="modal fade" id="myModal" tabindex="-1" role="dialog" aria-
   labelledby="myModalLabel" aria-hidden="true">
2    <div class="modal-dialog">
3      <div class="modal-content">
4        <div class="modal-header">
5          <button type="button" class="close" data-dismiss="modal" aria-
   hidden="true">×</button>
6          <h4 class="modal-title" id="myModalLabel">UAbot</h4>
7        </div>
8        <div class="modal-body">
9            <iframe src="https://tutoria-virtual.uab.pt/chatbot/index.html"
   allowtransparency="true" width="550px" height="500px" frameborder="0">
   </iframe>
10       </div>
11       <div class="modal-footer">
12         <button type="button" class="btn btn-default" data-
```

Figure 6.1: A part of the code used for inserting the chatbot in moodle

Once the HTML page is integrated in moodle in the specified course, it is available for students for clarifying their doubts. Students can access the chatbot by clicking the button provided and then input questions as free text or keywords in the dialog box. Then they will receive the response immediately. UAbot is opened as an iframe within the course in which it is integrated. Figure 6.2 shows the screenshot of a sample interaction with UAbot.

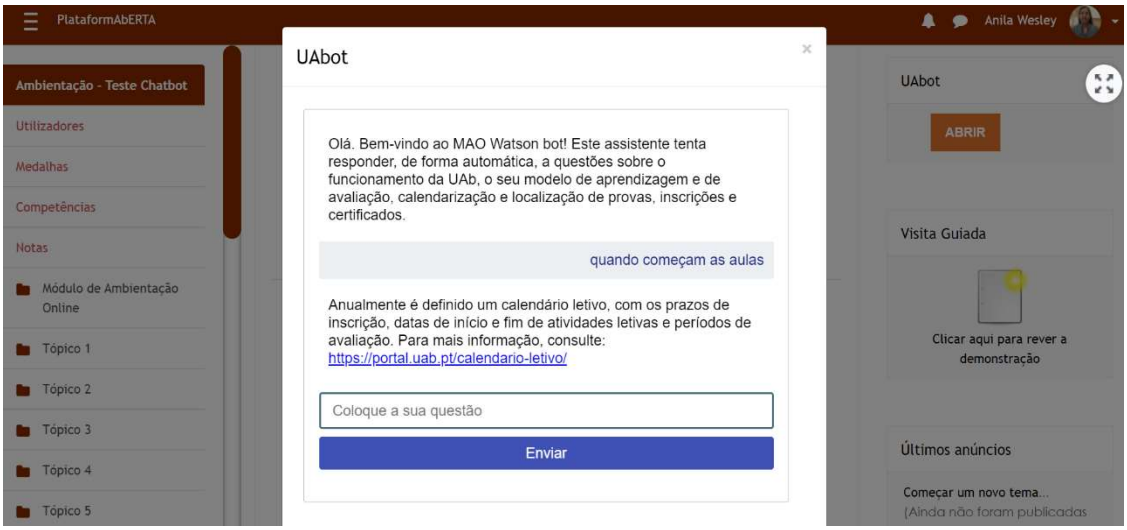


Figure 6.2: UAbot interaction in a sample course

# CHAPTER 7

# EXPERIMENTS

After the chatbot was developed and integrated in Moodle. It was made available for the students to access it. To collect the feedback from the users (which is students), an online survey was prepared with questions to analyse different criteria's like usefulness and interaction. The survey also had questions to understand the user satisfaction and to collect additional comments to improve the chatbot. Main motive of the survey is to understand whether the chatbot has met the expectations of the users and to improvise it with the necessary changes.

### 7.1 Users

During the first iteration, UAbot was implemented in 12 MAO courses. 647 students had access to this course. A questionnaire was provided at the end of the course to provide their feedback and experience about the assistant. 60 students provided their feedback by selecting answers in 5- point Likert Scale.

During the second iteration, UAbot was integrated into the coordination course of computer science. 744 students had enrolled to this course. The students' response was recorded using survey method. 43 students have provided their feedback.

Survey was conducted using google forms and the link to the survey was provided in the courses in which UAbot was integrated. The main intention of the survey was to collect students feedback and suggestions after using the assistant. By analysing the recorded response, we will have an idea whether our research goals are met properly.

The survey was composed of 10 questions which needs to be answered in 5-point Likert Scale. Those questions were framed to capture feedback about learnability, usefulness, simplicity and interaction as shown in table 7.1. In addition to the 10 questions, it contained two more questions. One to record the number of questions the users asked to receive the response and the other to capture their comments to improve or change.

| **Aspects Checked** | **Questions** |
|---|---|
| Learnability | Do you have to learn a lot of things to understand how to use the chatbot? |
| Simplicity | Was the chatbot easy to use? |
| Usefulness | 1. Did the chatbot gave you the initial support to understand the functions of UAb? |

| | |
|---|---|
| | 2. Did the assistant answer your queries correctly?<br>3. Was the chatbot useful in answering your queries than looking for answers in FAQ list?<br>4. Was the chatbot useful in finding answers for your questions? |
| Interaction | 1. Do you like interacting with the assistant?<br>2. Do you like to continue to use the assistant after MAO? |
| Satisfaction | 1. Would you recommend this assistant to your colleagues in UAb?<br>2. Are you satisfied with the overall performance of the assistant? |

Table 7.1: Questions in the survey categorised based on the aspects

Analysing the figure 7.1 for percentile agreed on different aspects we can find that almost all the aspects had an improvement in the second iteration except in 3 scenarios. First one being the learnability. In learnability, we are checking whether the students need to learn about how to use the bot before using it in the elearning module. Analysing the percentile agreed, we understand that learnability has decreased tremendously during the second iteration compared to the response during the first iteration, which is a great improvement. This indicates that the students agree that they don't need additional guidelines or information to use UAbot.

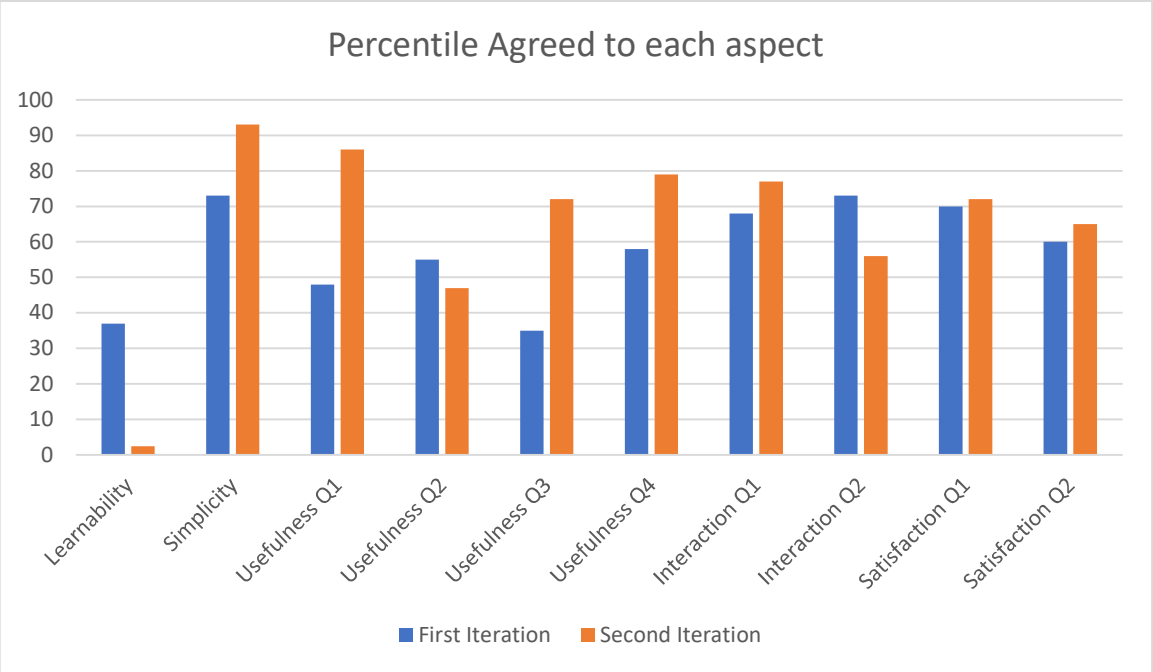


Figure 7.1: Percentile Agreed by students to the aspects checked

Second question which didn't had an improvement in the second iteration is regarding usefulness and the question was whether the chatbot was able to answer their questions correctly. As it is a bot, there is a general tendency to expect that it would answer for all the questions the students have. As a result, the expectations from the users is too high. But in UAbot, our focus was just FAQs. The users' opinion was generally distributed with neutral opinion and disagree due to this high expectation.

The last question which had a contradictory response was in the question which was used to check the interaction. The question was checking with users whether they would like to continue to use UAbot after MAO. UAbot was mainly focusing only on FAQs which the users have during the initial days. As they complete MAO, they will be familiarised with the functions of UAb and the pedagogical model. As a result, students' opinion can vary from each student depending upon how familiarised they get with the functions of UAb.

Except these three questions mentioned above, there was considerable improvement in the results after the second iteration compared to the results, we obtained during the first iteration as shown in figure 7.1. Chatbots will perform well if the database is updated continuously with UpToDate details.

By analysing the feedback from the students, we understood that they like the chatbot and they are satisfied with it's response to their questions. The students agree that it is easy to use and they prefer to use it even after this module ends. They even assured to recommend this chatbot to their friends. They were able to find answers to their questions using UAbot.

But the students had a neutral response about the chatbot's help in finding answers to the frequently asked questions. Equal number of students agreed and disagreed that UAbot can provide the initial support for the students regarding the functioning of Universidade Aberta. Responses from the users, points to the fact that it is an initial version of the chatbot and requires lot of improvement to perform well and according to the expectation of the users.

### 7.2 Expert Users

The feedback from the expert users is also collected through interviews. Expert users in this scenario are tutors who are responsible for answering student's queries which are submitted either through email or forums. The main advantage of interviews is that we can understand the interviewee's opinion more with their tone in language and they can express their views completely without the constraint of words or choosing between the options provided which happens with surveys.

The interview was focused to understand whether the chatbot was helpful in reducing their workload. The questions prepared for the interview included 9 questions, in which few were focused on effectiveness and efficiency while some others were focusing to collect their general feedback to understand whether the initial support provided by the chatbot was enough for the new students in UAb. The last question was to collect their feedbacks to improve our UAbot.

### 7.3 Training UAbot

During the first iteration, UAbot was created by extracting useful information from the FAQ list Universidade Aberta already had. The FAQ list was carefully analysed to gather information to train UAbot with the required intents and then to form a dialog tree which

provides responses to the corresponding intents. Questions which can be categorized together was grouped into a single intent and the answers were also reframed so that it can be provided within the small space provided by UAbot. During the first iteration, assistant had just 21 intents and 23 dialog nodes, which are the important modules that helps in communicating with the users. The figure 7.2 shows the screenshot of the details of UAbot used for first iteration.

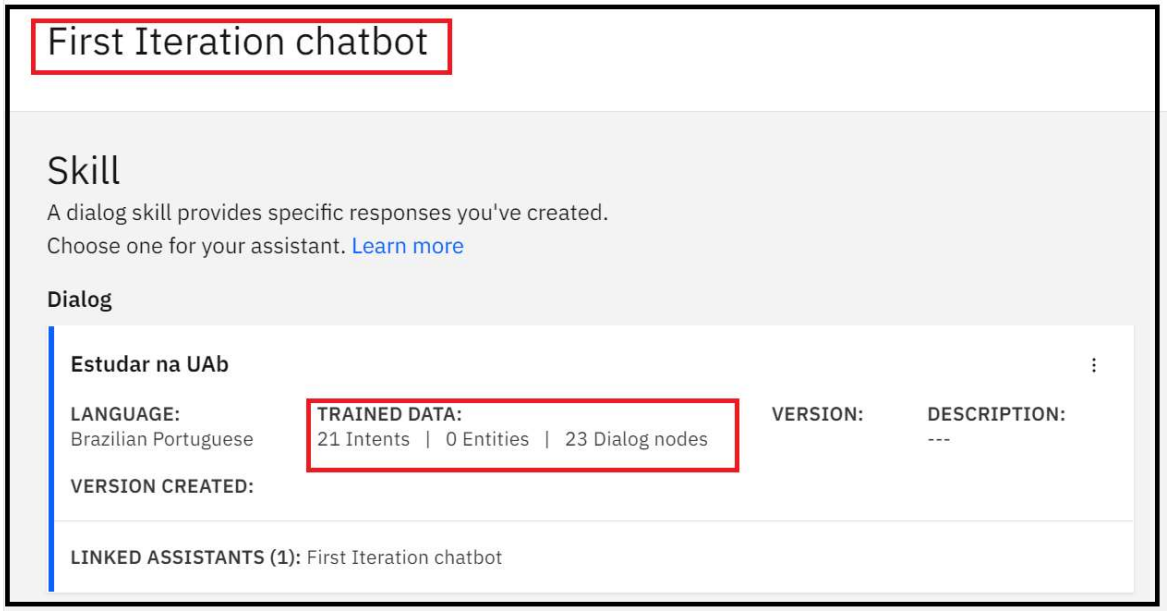


Figure 7.2: Details of UAbot used in first iteration

It was important to train UAbot to include more data so that students will be able to find answers for more questions. After the first iteration, all the questions were recorded, and it was thoroughly studied to understand the repeated questions which the chatbot were not able to answer. The questions were categorized into relevant questions, irrelevant questions and wrongly answered questions.

Questions that are valid to the context of UAbot that is, frequently asked questions by students during the initial days at the university are considered as relevant questions. The answer to these kinds of questions exists in the database and UAbot can retrieve it and send to the user. While an irrelevant question is one that is not related to something that the student has to address during the initial days at the university. Such questions are not included in the database of UAbot. Wrongly answered questions include questions where the bot was unable

to provide the right answer to the students, eventhough it is included in the database and questions which are valid, but answers are not included in the database. The table 7.2 shows further details about the list of questions asked by the students and its categorisation.

| **Relevant Questions** | **Irrelevant Questions** | **Wrongly Answered Questions** |
|---|---|---|
| Quando inicia o 2º semestre? | És humano? | Puc |
| Local de exame | Licenciatura em ciências sociais? | Como utilizar os foruns |
| Modelo de aprendizagem | Jantar | Como enviar e-folio |
| Calendário | Grupo de trabalho a | Cartão de aprendizagem |
| Certificado matricula | Que cor é o amarelo | Cartão de estudante |
| Preciso de uma declaração | Devemos utilizar o novo acordo ortográfico? | Equivalência |
| Provas de nivel | Onde aceder a manuais de estudo | Biblioteca |
| Plano de ambientação | Mini Glossario | Propina |
| Quando são os exames | H5P | Quantos anos tem a UAb? |
| Quantas unidades curriculares posso estar inscrita? | Turnitin | |
| O que são créditos | Quanto é 1 +1? | |
| Qual avaliação mínima de um efolio | | |
| Plano da Unidade Curricular | | |
| Como tirar o comprovativo de matricula? | | |
| Como obter uma decalração | | |

Table 7.2: Short glimpse of the questions from the students after first iteration

After proper analysis, the chatbot was modified so that it will be able to answer more wrongly answered questions correctly. Figure 7.3 shows log results after analysing the questions based on different categories during the first iteration. Database of the chatbot was extended to include details about UAb, library, payments and so on. The corresponding answers were also fed in the dialog tree for these identified questions.

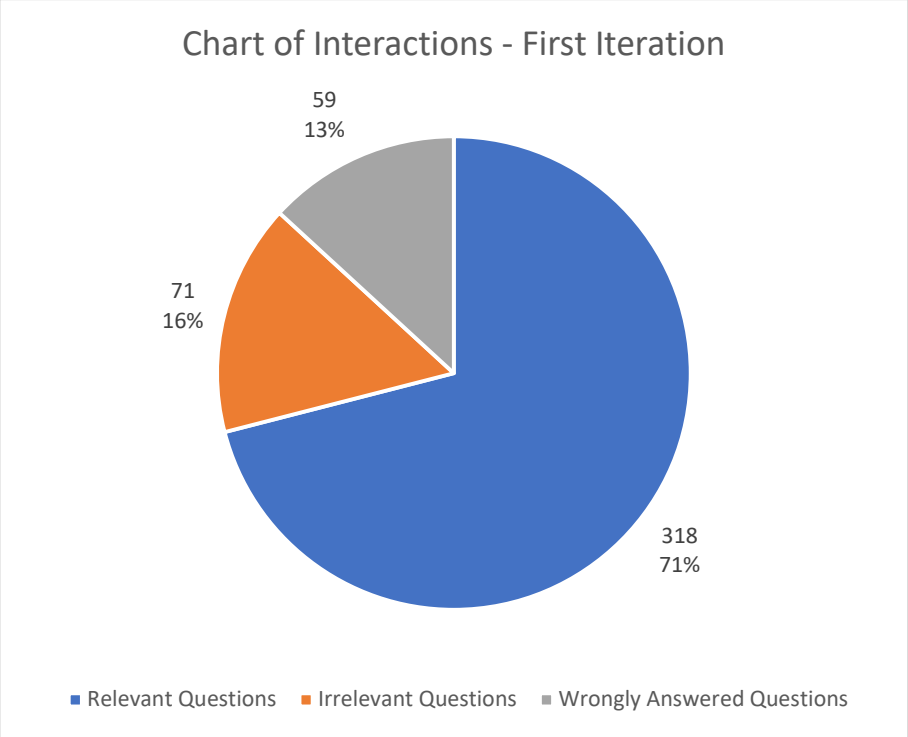


Figure 7.3: Chart displaying log details of questions asked by students in first iteration

After the modification on the chatbot database, UAbot has 33 intents and 35 dialog nodes. As a result, the bot was able to communicate more effectively compared to the first iteration. Wrongly answered questions were included into the database of the bot, which were added as intents in IBM Watson Assistant. The responses to these questions were added in IBM Watson Assistant in the dialog tree which now has 35 nodes. Figure 7.4 shows the details about the UAbot modified after first iteration. This bot was used during the second iteration.

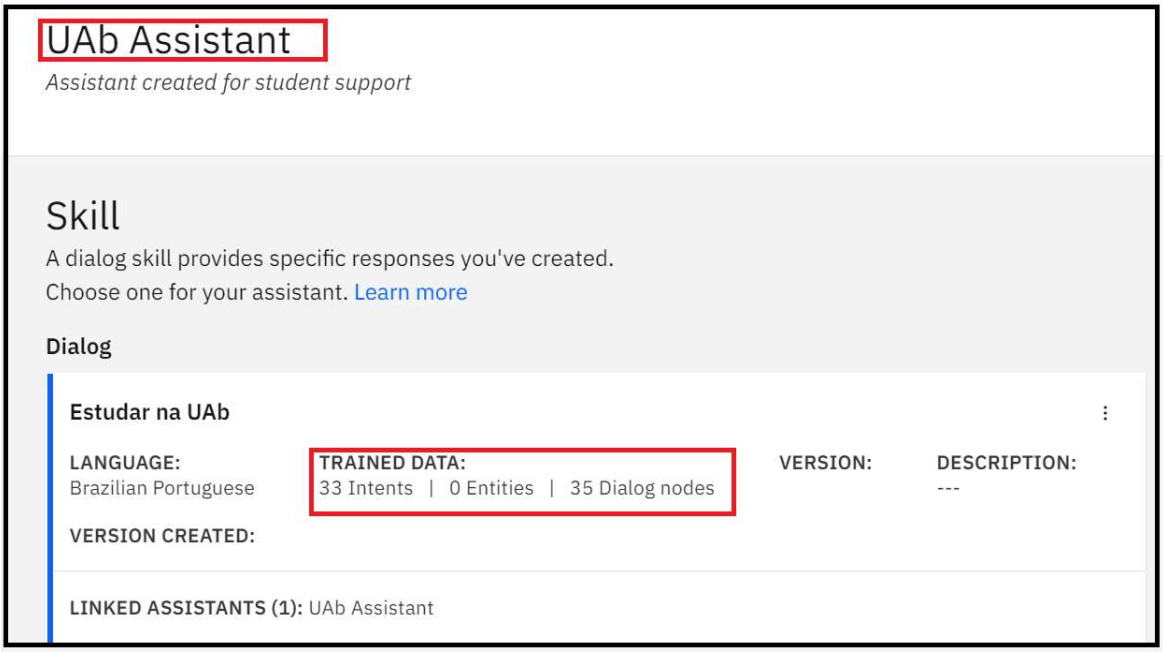


Figure 7.4: UAbot used in the second iteration with more intents

The log was analysed again to find more details about the list of questions asked by students. These questions were then categorised to relevant questions, irrelevant questions and wrongly answered questions. The log results are analysed to find whether there is an improvement in the bot. We found that wrongly answered questions has reduced from 13% in first iteration to 2% in second iteration which is a great improvement. Analysing the results about relevant questions, it was found out that during first iteration 71% questions were relevant questions. While in second iteration, relevant questions have increased to 73% as shown in figure 7.5. After closely examining these logs, we can conclude that the changes made after the first iteration has helped UAbot to perform better in answering more questions correctly. Reduction in wrongly answered questions points to the fact that UAbot was able to retrieve available data from database to answer almost all relevant questions.

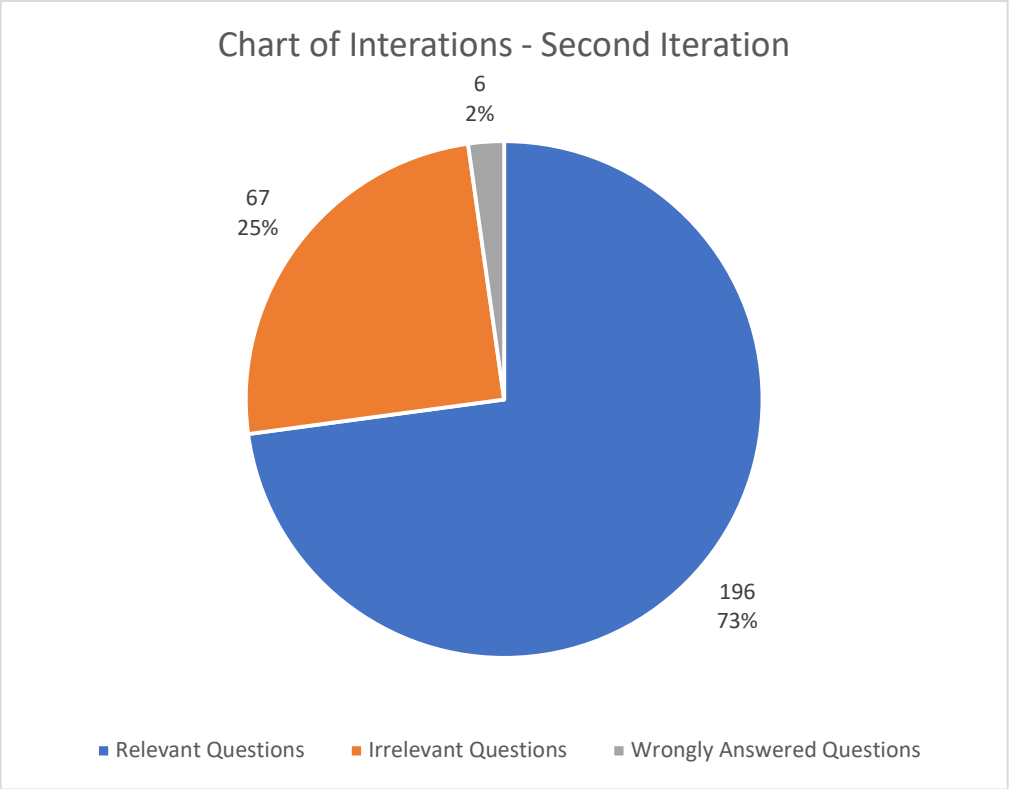


Figure 7.5: Log details of questions asked by students in second iteration

# CHAPTER 8

# RESULTS

In this section, the data obtained through survey and interviews are discussed and results are analysed using statistical and qualitative analysis.

### 8.1 Survey Results

The end users of UAbot, which are mainly students, provided their feedback and suggestions by answering a set of questions provided in the form of a survey. The questions of the survey are given in detail in the experiments section. We are going to discuss the analysis of the results in this section.

To analyse the results gathered through survey, we are following the same method followed in Ravel [20], a MAS based platform to handle real situations by making chatbots as real time finance advisors. Mainly the calculations are done based on the following formula [63] in which CV refers to coefficient of variation.

$CV=\frac{\sigma}{\mu}$

where:

$\sigma$=standard deviation (SD)

$\mu$=mean

During the first iteration, 68% students agreed that they liked to interact with the assistant having a standard deviation as 11.54 together with CV as 0.96 and 60% students agreed that they are satisfied with the overall performance of the bot with standard deviation of 9.2 and CV as 0.76. While after the second iteration, the percentage of students who agreed that they like to interact with the assistant has increased to 77% having a SD of 10.07 together with CV of 1.17 and 65% students have agreed with their satisfaction in overall performance of the bot having a SD of 7.44 and CV of 0.86 as shown in table 8.1.

| | First Iteration | | | Second Iteration | | |
|---|---|---|---|---|---|---|
| Aspects Checked | Percentile Agreed | Standard Deviation | Coefficient of Variation | Percentile Agreed | Standard Deviation | Coefficient of variation |
| Likeness to interact with UAbot | 68% | 11.54 | 0.96 | 77% | 10.07 | 1.17 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Overall performance of UAbot | 60% | 9.2 | 0.76 | 65% | 7.44 | 0.86 |
| Initial support provided by UAbot | 48% | 6.84 | 0.57 | 86% | 9.85 | 1.14 |
| Usefulness of UAbot in answering FAQs | 35% | 8.50 | 0.71 | 72% | 6.88 | 0.80 |

Table 8.1: Values derived for different aspects

The focus of this dissertation was to find out whether UAbot was able to provide initial support required for the students and to help the students in finding answers to FAQ in an interactive way. In first iteration, only 48% students have agreed as shown in figure 8.1, that the UAbot was able to provide necessary initial support they required about the functioning of Universidade Aberta with SD as 6.84 together with CV as 0.57. While after the second iteration, the percentage of students agreed that UAbot can provide the initial support required to them has increased to 86% having a standard deviation 9.85 and CV of 1.14.

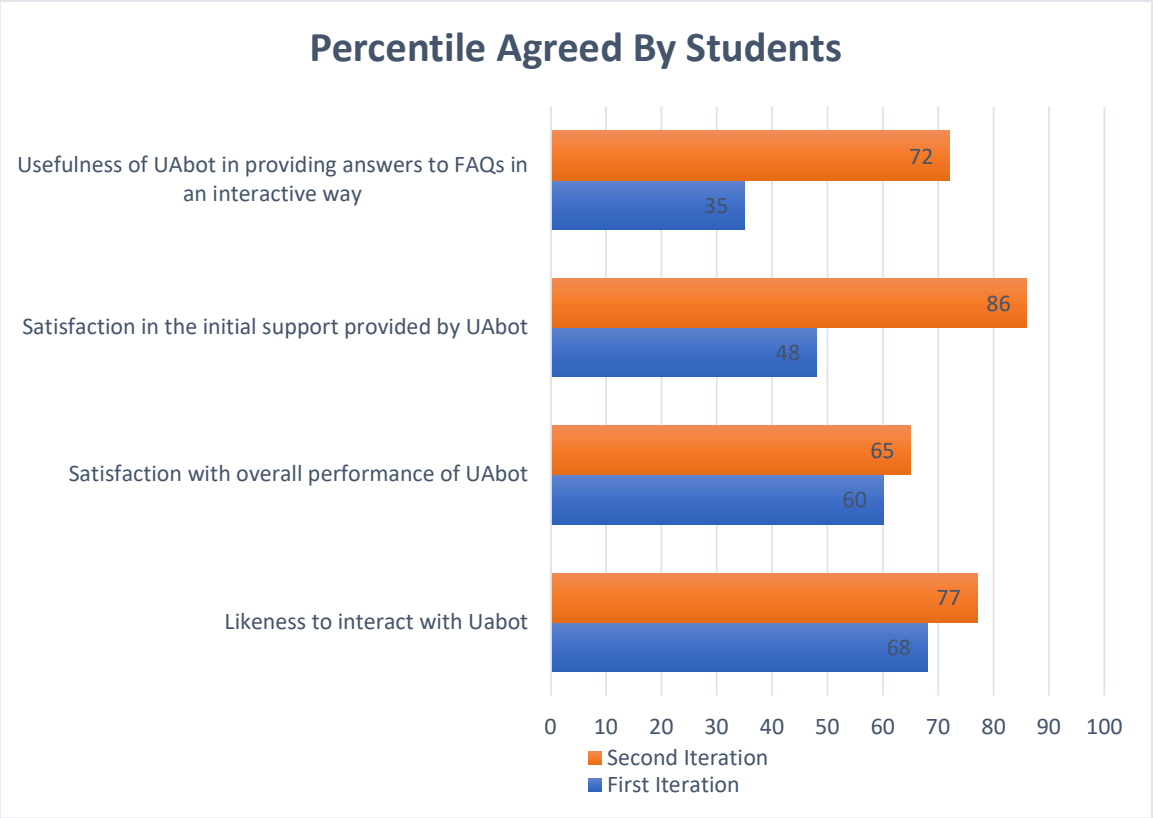


Figure 8.1: Percentile agreed for different aspects during first and second iteration

During the first iteration, only 35% students have agreed that UAbot is more useful in providing answers to their questions rather than looking for answers in FAQ list with SD of 8.50 and CV of 0.71(shown in figure 8.2). After the database of UAbot was modified and put to test, 72% students agreed that UAbot was more interactive and helpful in providing them answers for their frequently asked questions rather than searching for answers in the FAQ having a SD of 6.88 and CV of 0.80.

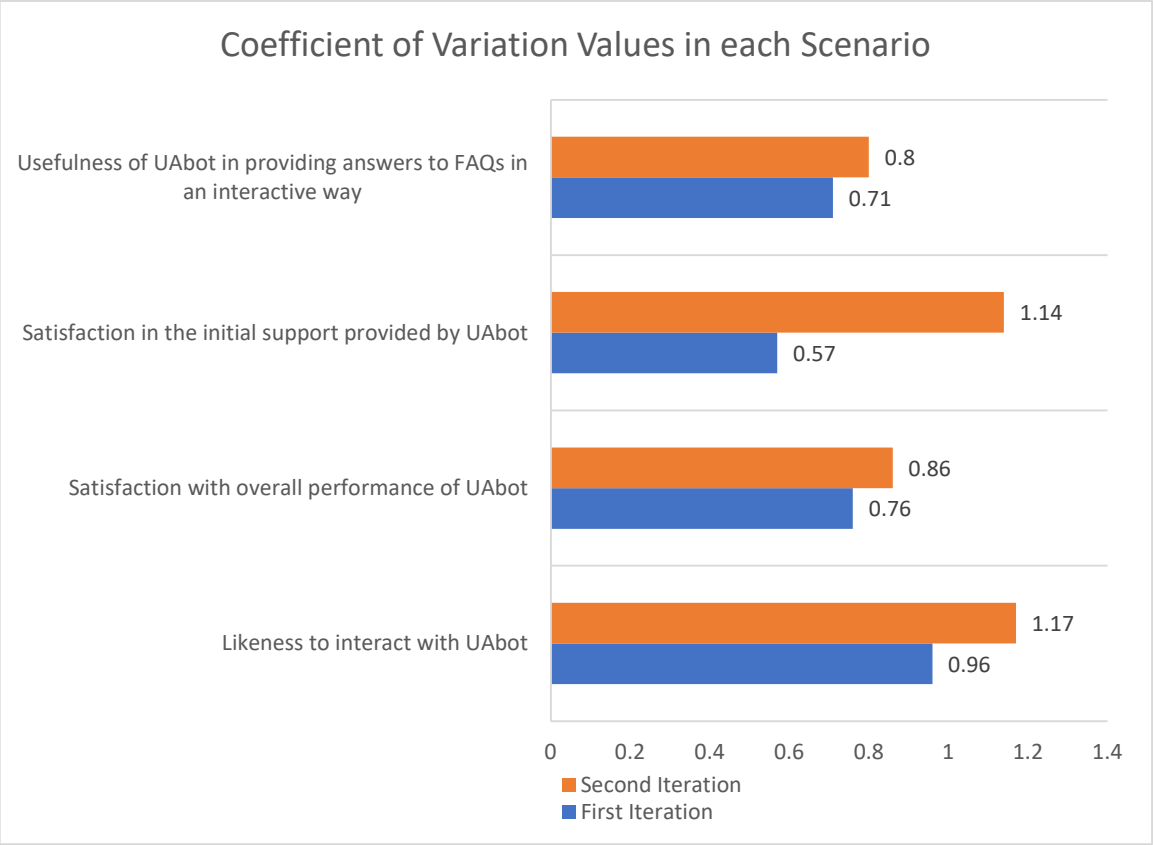


Figure 8.2: Coefficient of Variation obtained for each question

### 8.2 Interview Results

Interview was conducted to gather responses from expert users. In our scenario, the expert users are the tutors who respond personally to the queries that the students have. 3 tutors were interviewed to find their responses after using the chatbot. The main objective was to find whether the chatbot can reduce the workload of the tutors. 2 tutors completely agreed that this chatbot can reduce their workload compared to previous years, as it can answer frequently asked questions. The other tutor disagree that the assistant helped in reducing the workload this year, as it was implemented only after few days the MAO has started. She also commented that the chatbot would have certainly reduced the workload, if it was implemented from the beginning of the course as students have lots of doubts during the initial days.

Two tutors also agreed that the chatbot can provide the initial support that the students require as most of the questions will be administrative issues which can be easily

answered by the chatbot. But one tutor commented that as most of the students in Universidade Aberta are older students, they require a tutor in addition to the assistant to provide them the right support in the initial phase. Two tutors were satisfied with the overall performance of the bot while one tutor was not satisfied with the performance of the bot mentioning that it needs lots of improvements especially in user interface part and the database needs to be expanded to perform well.

All the tutors agreed that the chatbot can be used in a course as well by including specific course related topics. All of them united in the opinion of recommending this bot to other tutors, if the database can be modified with additional information. Regarding the efficiency of the chatbot, the opinion of the tutors was varying as one agreed it is efficient while one disagreed and the other person had neutral opinion about it. As it was the first prototype, the chatbot had lot of problems in it's efficiency and will be improved only after continuous modifications and additions to the database of the bot.

There were many suggestions for the improvement of the bot. One of the tutors suggested that the keywords that is used to find the right answer from the database needs to be expanded by providing more synonyms so that the user will get right answers easily. Another tutor suggested that the data set of the chatbot needs to be enhanced to improve it's performance. Another suggestion was to improve the graphical user interface to attract more students to add more administrative questions to provide additional support to students.

# CHAPTER 9

# CONCLUSIONS AND FUTURE WORK

### 9.1 Conclusions

We have successfully integrated a chatbot into the elearning environment of Universidade Aberta to help students in their initial days at the university. The students will have lot of questions about the functioning about the university, pedagogical model and so on. The aim of the chatbot is to provide more interactive support to distance learning students to find answers to their FAQs. The main appeal of a bot is that it is instantly available 24/7 to provide support to students 365 days irrespective of the time zone the student is.

One of the main research questions is to check whether the chatbot was useful for students in providing them the initial support required. Certain experiments were carried out with students and their feedback was recorded using surveys. Based on the analysis of the data derived from the experiments, we can conclude that UAbot integrated into moodle is useful in providing initial support. Even the expert users agreed that the UAbot can the provide the initial support required for the students.

Another objective of this dissertation was to answer students' frequently asked question in an interactive way. The frequently asked questions were added into the database of IBM Watson Assistant which was then integrated into the elearning environment to provide access to students. This helped the students to have access to UAbot to find answers for their FAQs. After analysing the feedback from students and expert users, we can confirm that UAbot provided an interactive way to find answers to FAQs.

The last main objective of this research work is to find whether the chatbot was helpful in reducing the workload of the tutor. The tutors were interviewed to find their feedback after the UAbot was implemented. The tutors liked the chatbot and was satisfied with the overall performance of the UAbot. They also agreed that chatbot was helpful in answering students' questions which in turn has reduced the workload of the tutor.

UAbot created using IBM Watson Assistant with an inbuilt database of FAQ list has helped to develop a chatbot to achieve the goal of this dissertation. The integration of UAbot to moodle was also successful as the students were able to interact with it with the elearning module itself. The bot was able to help students out of working hours as there are students who accessed the bot at odd times like 1:30 am and 11:20 pm.

### 9.2 Future Work

UAbot is just an initial version of creating a bot to answer students' FAQs and requires a lot of improvement in different areas to have the performance of a commercial chatbot which we can see in certain sites. A bot can perform well only if it is updated on a day to day basis with the latest details available.

The main future work for this bot is to incorporate the suggestions of the students who have used UAbot. Students suggested that they prefer UAbot to be incorporated as a popup at the bottom of the page to facilitate usability. As answers for certain queries links were provided so that students can find a detailed answer for their question. Once the link is clicked it is opened on the same chat window. But students prefer to have the link opened in a new page. One of the main suggestions from the students was to provide an option to contact a human tutor within the chat window itself in case it doesn't have the right answer for the students' query.

Tutors also had suggestions to improve the performance of UAbot. One of the main suggestions from the tutors were to improve the graphical user interface of the bot to make it more attractive for the students. They also suggested to add more synonyms for searching the keywords within the bot to find answers for students' questions. Another suggestion was to enhance the dataset of the bot and continuously update the bot so that it will be able to answer more queries precisely.

The bot can also be modified so that it will be able to communicate to students in multiple languages with an option to choose the language in the beginning of the communication.

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# APPENDICES

## Appendix I – Programs developed for research.

### Code for Moodle

```
<div class="editor-indent" style="margin-left: 30px;"><div class="editor-indent"
style="margin-left: 30px;"><div class="editor-indent" style="margin-left: 30px;"><div
class="editor-indent" style="margin-left: 30px;"><div class="editor-indent"
style="margin-left: 30px;"><button style="align-centre" class="btn btn-primary" data-
toggle="modal" data-target="#myModal">ABRIR</button></div></div></div></div></div><div
class="modal fade" id="myModal" tabindex="-1" role="dialog" aria-
labelledby="myModalLabel" aria-hidden="true">

  <div class="modal-dialog">

    <div class="modal-content">

      <div class="modal-header">

        <button type="button" class="close" data-dismiss="modal" aria-
hidden="true">×</button>

        <h4 class="modal-title" id="myModalLabel">UAbot</h4>

      </div>

      <div class="modal-body">

          <iframe src="https://tutoria-virtual.uab.pt/chatbot/index.html"
allowtransparency="true" width="550px" height="500px" frameborder="0"></iframe>

      </div>

      <div class="modal-footer">

        <button type="button" class="btn btn-default" data-
dismiss="modal">Fechar</button>

       </div>

    </div>

    <!-- /.modal-content -->

  </div>

  <!-- /.modal-dialog -->

</div>

<!-- /.modal -->
```

### Api.php

```php
<?php
if(isset($_POST['message'])){
// Unique identifier of the workspace.
$workspace_id = "f2b45b77-e5ca-4d0f-b0e4-4ce5a7bde0a3";
// Release date of the API version in YYYY-MM-DD format.
$release_date = '2019-02-28';
// Username of a user for the service credentials.
```

```
8.  $username = 'apikey';
9.  // Password of a user for the service credentials.
10. $password = "GylnwpLvNdaJUQ11WTQH4i73ydr5NRzDXUDP9oPnbxlf";
11.
12. // $iam_apikey="GylnwpLvNdaJUQ11WTQH4i73ydr5NRzDXUDP9oPnbxlf";
13.
14. // Make a request message for Watson API in json.
15. $data['input']['text'] = $_POST['message'];
16. if(isset($_POST['context']) && $_POST['context']){
17. $data['context'] = json_decode($_POST['context'],
    JSON_UNESCAPED_UNICODE);
18. }
19. $data['alternate_intents'] = false;
20. $json = json_encode($data, JSON_UNESCAPED_UNICODE);
21.
22. // Post the json to the Watson API via cURL.
23. $ch = curl_init();
24. curl_setopt($ch, CURLOPT_SSL_VERIFYPEER, false);
25. curl_setopt($ch, CURLOPT_RETURNTRANSFER, true);
26. curl_setopt($ch, CURLOPT_URL, "https://gateway-
    lon.watsonplatform.net/assistant/api/v1/workspaces/".$workspace_id.'/mess
    age?version='.$release_date);
27. curl_setopt($ch, CURLOPT_USERPWD, $username.":".$password);
28. curl_setopt($ch, CURLOPT_POST, true );
29. curl_setopt($ch, CURLOPT_HTTPHEADER, array('Content-Type:
    application/json'));
30. curl_setopt($ch, CURLOPT_POSTFIELDS, $json);
31. $result = trim( curl_exec( $ch ) );
32. curl_close($ch);
33.
34. // Responce the result.
35. echo json_encode($result, JSON_UNESCAPED_UNICODE);
36. }
```

Index.html

```
<!DOCTYPE html>
  <html>
    <head>
      <title>Chatbot Test APP</title>
```

```
    <script
src="https://ajax.googleapis.com/ajax/libs/jquery/1.11.0/jquery.min.js"></scri
pt>
  <!--  <script src="chatbot.js"></script>-->
  </head>
  <body>
    <main>
      <h1 align="center">Chatbot Test APP</h1>
  <div id="messages">

         <div id="watson" class="watson">
       <div class="chatdata" id="chatbox">
              <div class="area" id="chat">
              </div>

       <div>
         <form id="message" class="message">
          <input type="html" id = "data" name="data" value="data"
placeholder="Enter your message">
          <button type="submit">Send </button>
        </form>
       </div>
         </div> </div></div>
    </main>
  </body>
</html>
<script >
// Backend URL.
var apiUrl = "api.php";
// Variable for the conversation state.
var context = "";

$(function(){
  // Initialization of the chatbot.
  chatbot("");

  // Send a Message, When the form will be submitted.
  $("form").submit(function(e){
    // Prevent the form submission.
```

```
    e.preventDefault();
    if($("input").val()){
      // Send the message.
      chatbot($("input").val());
      // Display the message.
         //jQuery("#chat").append("<div class=\"data chatbot\">Please enter
something to proceed.</div>");
              //     $(".chatdata").animate({scrollTop:
$("#chat").height()});
              //     });
     $('#chat').append("<div class=\"data user\">"+$("input").val()+"</div>");
        $(".message").animate({scrollTop: $("#chatbox").height()});
       jQuery("#message #data").focus();
    }
  })
})

// A function for sending message to the backend and getting result.
function chatbot(message){
  $.ajax({
    url: apiUrl,
    type: 'post',
    dataType: 'json',
    data: {
      message: message,
      context: context
    },
    //timeout:10000
  }).done(function (response) {
    // Check the result.
    console.log(response);
    if(response.error){
      // Failed at getting result.
      // Display a error message.
     // $('#chat').append('<p>A communication error123 occurred.</p>');
        jQuery("#chat").append("<div class=\"data chatbot\">" + response.error
+ "</div>");
                                    return false;
    }else{
```

```
      // Succeeded at getting result.
      // Clear the input element.
      $("input").val("");

 if (JSON.parse(response).output.generic) {
      if (JSON.parse(response).output.generic.length > 0) {
         for(k=0; k<JSON.parse(response).output.generic.length; k++){
        switch (JSON.parse(response).output.generic[k].response_type) {
          case 'text':
            // It's a text response, so we just display it.
                     $('#chat').append("<div class=\"data
chatbot\">"+JSON.parse(response).output.generic[k].text+"</div>");
            //console.log(JSON.parse(response).output.generic[0].text);
            break;
          case 'image':
                $('#chat').append("<img src
=\""+JSON.parse(response).output.generic[k].source+"\"/>");
         break;
        }
      }
    }
       }

       $(".message").animate({scrollTop: $("#chatbox").height()});
         // Upodate the conversation state.
           context = JSON.stringify(JSON.parse(response).context);
         var messageChatbot  = "<div class=\"data chatbot\">";
                     messageChatbot        += response.output.text[0];
                            messageChatbot        += "</div>";
                            $(".message").animate({scrollTop:
$("#chatbox").height()});
                            jQuery("#message #data").focus();
       //updatestate();
       }
  }).fail(function () {
    // Display a error message.
    $('#chat').append('<p>A communication error occurred.</p>');
  });
```

```
}
</script>
 <style>
            .watson{
                        border: 1px solid #B0BEC5;
                        border-radius: 3px;
                        height: 50em;
                        max-height: 410px;
                        padding: 1em;

                        max-width: 300px;
                        margin: 0 auto;

                        display: flex;
                        flex-direction: column;
                        justify-content: space-between;
                    }

                    .watson .chatdata{
                        box-sizing: border-box;
                        overflow: hidden;
                        overflow-y: auto;
                        height: 100%;
                    }

                    .watson .chatdata .area{
                        display: flex;
                        justify-content: flex-end;
                        flex-direction: column;
                        min-height: 100%;
                    }

                    .watson .chatdata .data{
                        border-radius: 2px;
                        box-sizing: border-box;
                        padding: .65em;
                        margin-top: .5em;

                    }

                    .watson .chatdata .data:first-child{
                        margin-top: 0;
```

```
}

.watson .chatdata .data.user{
	background-color: #ECEFF1;
	color: #1A237E;

	text-align: right;
	transform-origin: 0% 100%;
	-webkit-transform-origin: 0% 100%;
	-moz-transform-origin: 0% 100%;
	-o-transform-origin: 0% 100%;
	-ms-transform-origin: 0% 100%;
}

.watson .chatdata.data.chatbot{
	background-color: #FF5722;
	color: white;
	font-weight: bold;
	margin-left: 30%;

	transform-origin: 100% 100%;
	-webkit-transform-origin: 100% 100%;
	-moz-transform-origin: 100% 100%;
	-o-transform-origin: 100% 100%;
	-ms-transform-origin: 100% 100%;
}

.watson form.message{
	padding: 0;
	margin-top: 1em;
}

.watson form.message input{
	border: 2px solid #476A7B;
	border-radius: 3px;
	padding: .5em .8em;
	font-size: 16px;
	display: block;
	box-sizing: border-box;
	width: 100%;
}
```

```
.watson form.message input:focus{
        border: 2px solid #1A237E;
        outline: none;
}

.watson form.message button{
        background-color: #3F51B5;
        border: none;
        border-radius: 3px;
        display: block;
        padding: .5em 1em;
        width: 100%;
        font-size: 16px;
        color: white;
        margin-top: .5em;
}


/**Animação de message**/

@keyframes popupmessage{
  0% {
        transform:  scaleX(0.30) scaleY(0.30) ;
  }
  100% {
        transform:  scaleX(1.00) scaleY(1.00) ;
  }
}

@-moz-keyframes popupmessage{
  0% {
        -moz-transform:  scaleX(0.30) scaleY(0.30) ;
  }
  100% {
        -moz-transform:  scaleX(1.00) scaleY(1.00) ;
  }
}

@-webkit-keyframes popupmessage {
  0% {
        -webkit-transform:  scaleX(0.30) scaleY(0.30) ;
  }
```

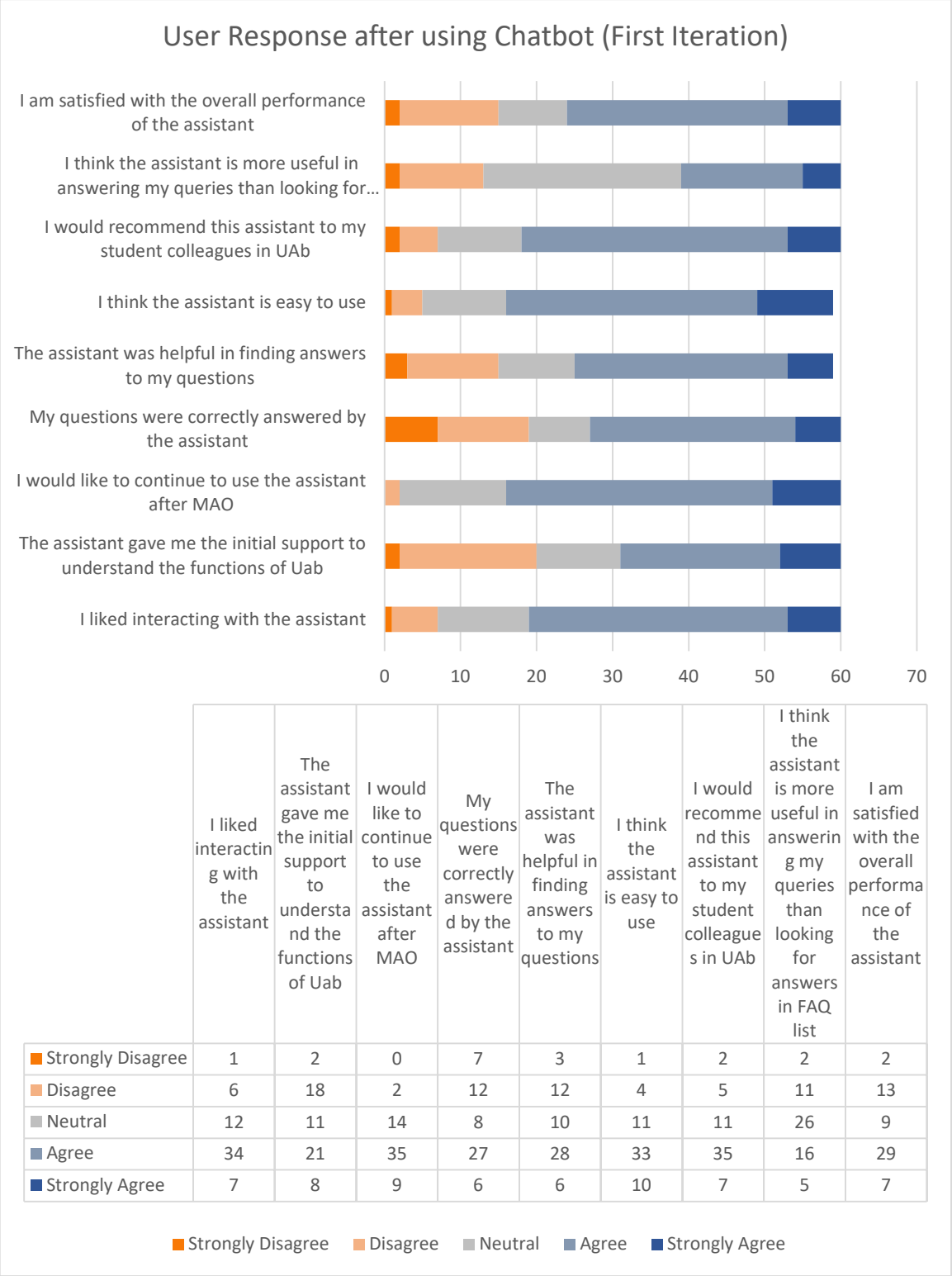
```
        100% {
            -webkit-transform:  scaleX(1.00) scaleY(1.00) ;
        }
    }

    @-o-keyframes popupmessage {
        0% {
            -o-transform:  scaleX(0.30) scaleY(0.30) ;
        }
        100% {
            -o-transform:  scaleX(1.00) scaleY(1.00) ;
        }
    }

    @-ms-keyframes popupmessage {
        0% {
            -ms-transform:  scaleX(0.30) scaleY(0.30) ;
        }
        100% {
            -ms-transform:  scaleX(1.00) scaleY(1.00) ;
        }
    }
</style>
```

## APPENDIX II: Results

1. User Response after first iteration

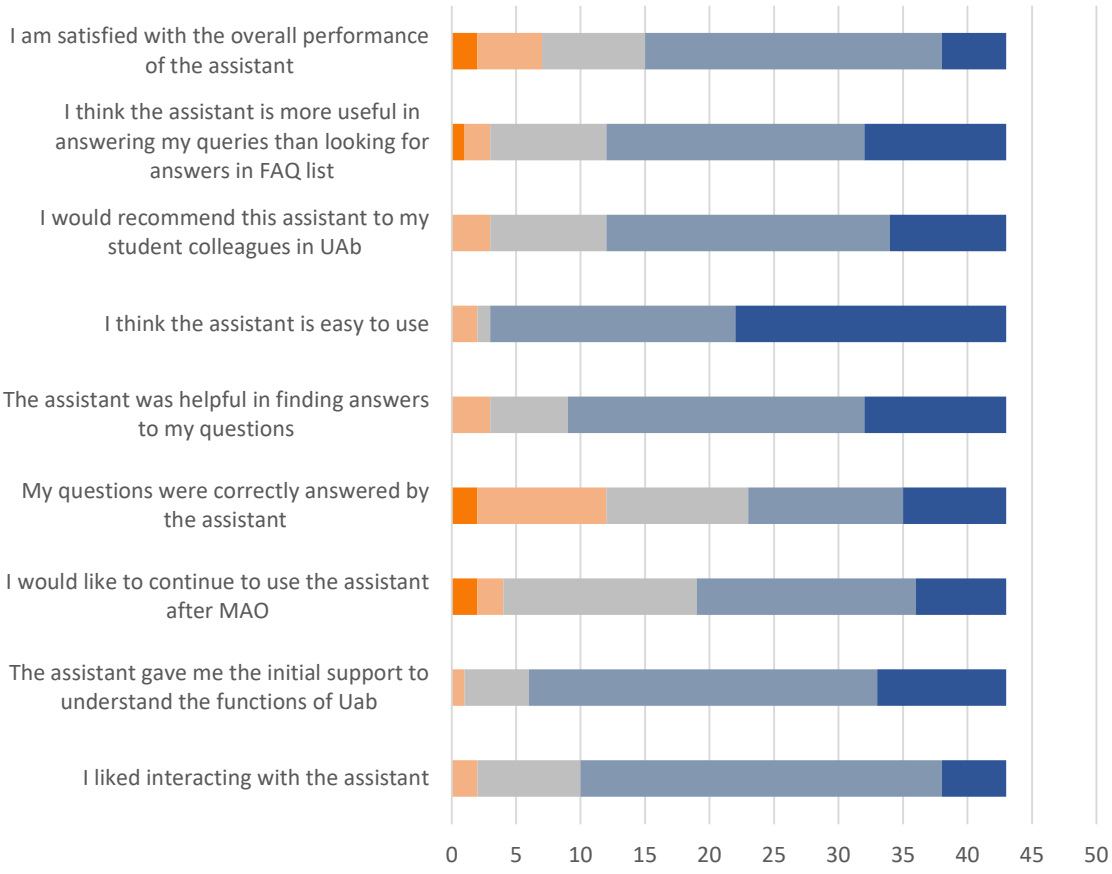



| | I liked interacting with the assistant | The assistant gave me the initial support to understand the functions of Uab | I would like to continue to use the assistant after MAO | My questions were correctly answered by the assistant | The assistant was helpful in finding answers to my questions | I think the assistant is easy to use | I would recommend this assistant to my student colleagues in UAb | I think the assistant is more useful in answering my queries than looking for answers in FAQ list | I am satisfied with the overall performance of the assistant |
|---|---|---|---|---|---|---|---|---|---|
| Strongly Disagree | 1 | 2 | 0 | 7 | 3 | 1 | 2 | 2 | 2 |
| Disagree | 6 | 18 | 2 | 12 | 12 | 4 | 5 | 11 | 13 |
| Neutral | 12 | 11 | 14 | 8 | 10 | 11 | 11 | 26 | 9 |
| Agree | 34 | 21 | 35 | 27 | 28 | 33 | 35 | 16 | 29 |
| Strongly Agree | 7 | 8 | 9 | 6 | 6 | 10 | 7 | 5 | 7 |

2. Values Derived from the user response after first iteration.

| Questions | Median | Standard Deviation | Total agree % | Total | CV (Coefficient of Variation) |
|---|---|---|---|---|---|
| I liked interacting with the assistant | 7 | 11.54123 | 68% | 60 | 0.961769 |
| The assistant gave me the initial support to understand the functions of Universidade Aberta(UAb) | 11 | 6.841053 | 48% | 60 | 0.570088 |
| I would like to continue to use the assistant after MAO | 9 | 12.53794 | 73% | 60 | 1.044829 |
| My questions were correctly answered by the assistant | 8 | 7.771744 | 55% | 60 | 0.647645 |
| The assistant was helpful in finding answers to my questions | 10 | 8.681014 | 58% | 59 | 0.735679 |
| I think the assistant is easy to use | 10 | 11.2321 | 73% | 59 | 0.951873 |
| I need to learn a lot to things, to understand how to use this chatbot | 13 | 3.098387 | 37% | 60 | 0.258199 |
| I would recommend this assistant to my student colleagues in UAb | 7 | 11.86592 | 70% | 60 | 0.988826 |
| I think the assistant is more useful in answering my queries rather than looking for answers in FAQ list | 11 | 8.508819 | 35% | 60 | 0.709068 |
| I am satisfied with overall performance of the assistant | 9 | 9.208692 | 60% | 60 | 0.767391 |

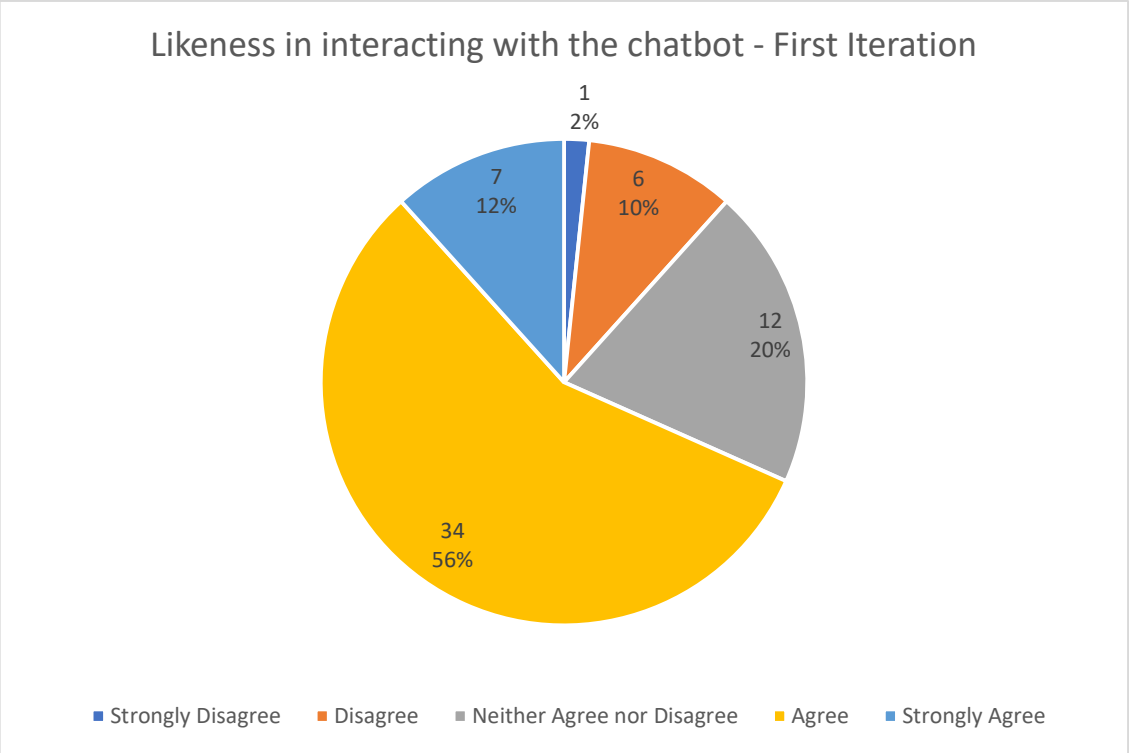
3. User Response After Second Iteration

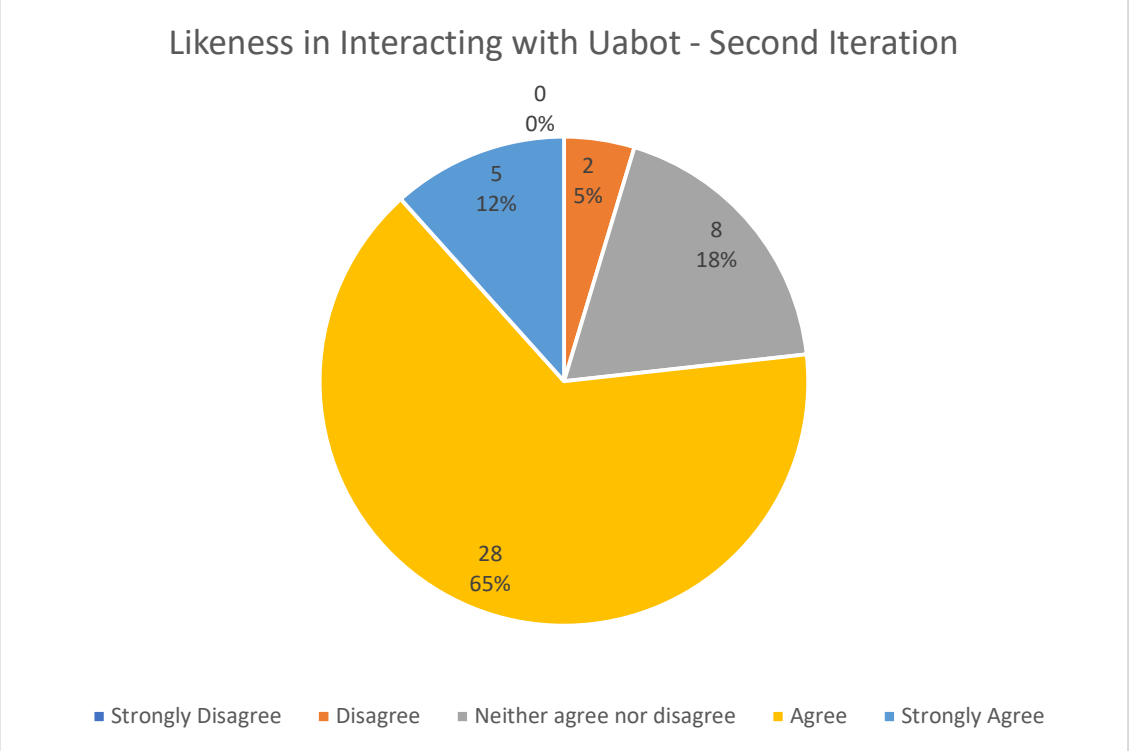


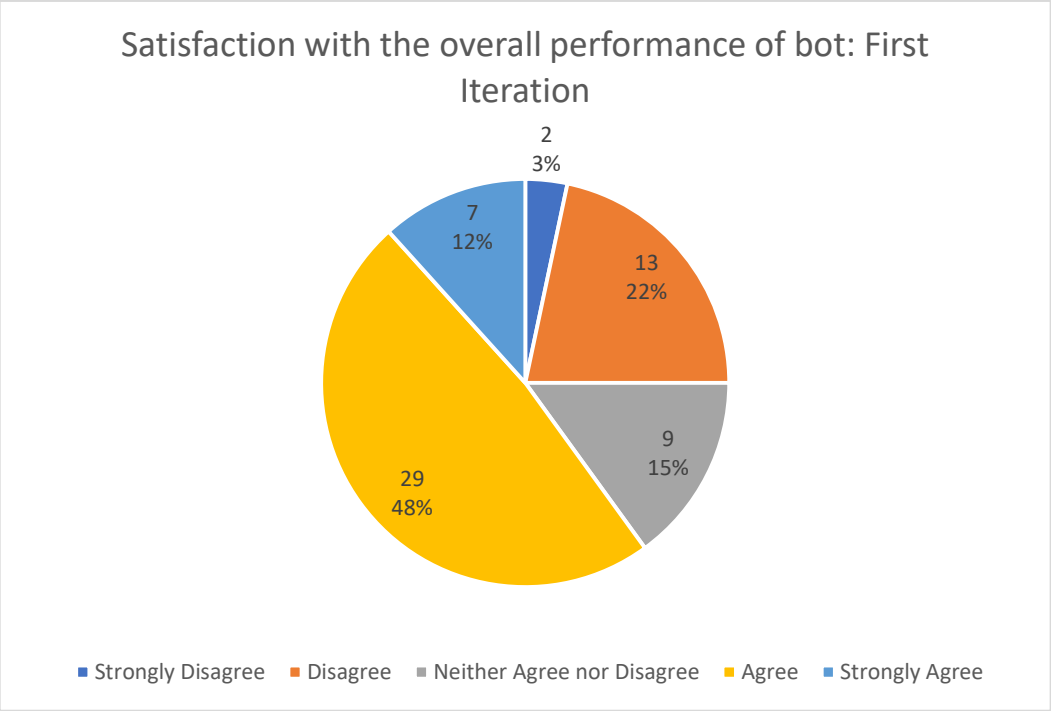

| | I liked interacting with the assistant | The assistant gave me the initial support to understand the functions of Uab | I would like to continue to use the assistant after MAO | My questions were correctly answered by the assistant | The assistant was helpful in finding answers to my questions | I think the assistant is easy to use | I would recommend this assistant to my student colleagues in UAb | I think the assistant is more useful in answering my queries than looking for answers in FAQ list | I am satisfied with the overall performance of the assistant |
|---|---|---|---|---|---|---|---|---|---|
| Strongly Disagree | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 1 | 2 |
| Disagree | 2 | 1 | 2 | 10 | 3 | 2 | 3 | 2 | 5 |
| Neutral | 8 | 5 | 15 | 11 | 6 | 1 | 9 | 9 | 8 |
| Agree | 28 | 27 | 17 | 12 | 23 | 19 | 22 | 20 | 23 |
| Strongly Agree | 5 | 10 | 7 | 8 | 11 | 21 | 9 | 11 | 5 |

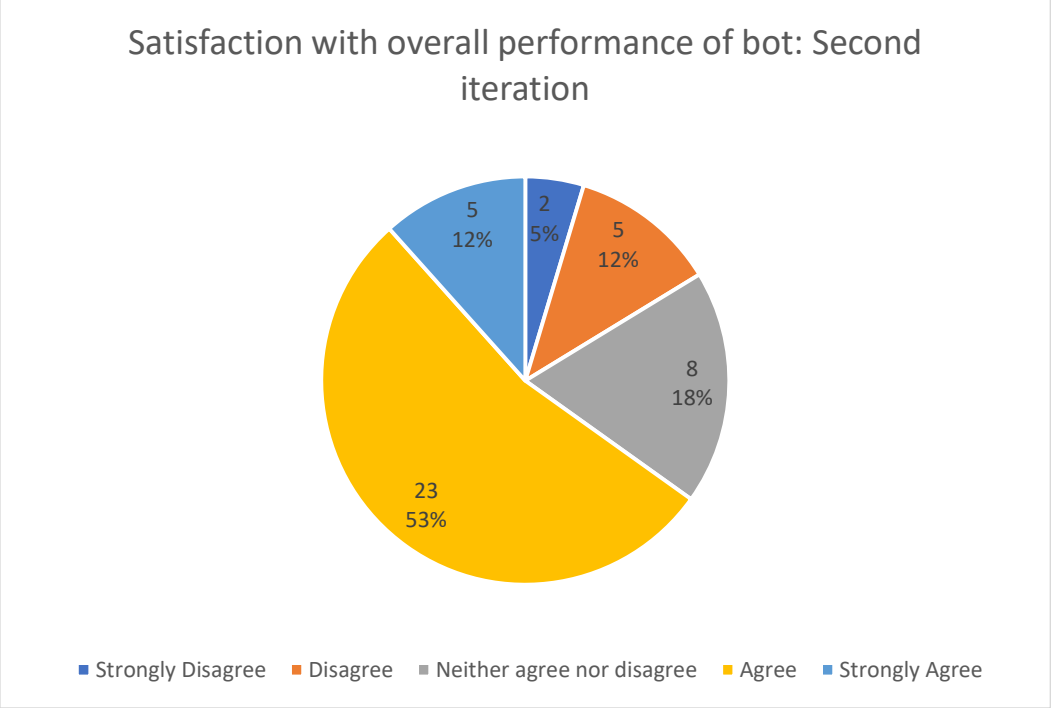
4. Values derived from user response after second iteration.

| Questions | Median | Standard Deviation | Total Agree | Total Agree % | Total | CV (Coefficient of Variation) |
|---|---|---|---|---|---|---|
| I liked interacting with the assistant | 5 | 10.07174 | 33 | 77% | 43 | 1.171133 |
| The assistant gave me the initial support to understand the functions of Universidade Aberta(UAb) | 5 | 9.850888 | 37 | 86% | 43 | 1.145452 |
| I would like to continue to use the assistant after MAO | 7 | 6.343501 | 24 | 56% | 43 | 0.737616 |
| My questions were correctly answered by the assistant | 10 | 3.555278 | 20 | 47% | 43 | 0.413404 |
| The assistant was helpful in finding answers to the questions of new students | 6 | 8.064738 | 34 | 79% | 43 | 0.93776 |
| I think the assistant is easy to use | 2 | 9.350936 | 40 | 93% | 43 | 1.087318 |
| I need to learn a lot to things, to understand how to use this chatbot | 3 | 10.2684 | 2 | 5% | 43 | 1.194 |
| I would recommend this assistant to my student colleagues in UAb | 9 | 7.552483 | 31 | 72% | 43 | 0.878196 |
| I think the assistant is more useful in answering my queries rather than looking for answers in FAQ list | 9 | 6.88767 | 31 | 72% | 43 | 0.800892 |
| I am satisfied with overall performance of the assistant | 5 | 7.445804 | 28 | 65% | 43 | 0.865791 |


Likeness in interacting with the chatbot - First Iteration
1
2%
6
10%
12
20%
34
56%
7
12%
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree


Likeness in Interacting with Uabot - Second Iteration
0
0%
2
5%
8
18%
28
65%
5
12%
Strongly Disagree
Disagree
Neither agree nor disagree
Agree
Strongly Agree


Satisfaction with the overall performance of bot: First Iteration
2
3%
13
22%
9
15%
29
48%
7
12%
Strongly Disagree
Disagree
Neither Agree nor Disagree
Agree
Strongly Agree


Satisfaction with overall performance of bot: Second iteration
2
5%
5
12%
8
18%
23
53%
5
12%
Strongly Disagree
Disagree
Neither agree nor disagree
Agree
Strongly Agree

**APPENDIX III: FAQ List**

FAQ List from Pedagogical Council

**PERGUNTAS FREQUENTES (FAQs)**

**CURSOS 1.º CICLO**

Grupo 1 – **AVALIAÇÃO CONTÍNUA, e-FÓLIOS, EXAME FINAL**

1 - Que classificação final devo obter nos e-folios para poder ir a p-folio?

15 - Numa UC fiz os e-folios tendo obtido nota superior a 3.5 valores, mas, não tenho condições para ir a p-fólio Deste modo, que exame posso fazer? Tenho de me inscrever nesse exame? Os e-folios que fiz continuam a contar?

17 - Caso não obtenha nota mínima nos e-fólios, a inscrição no exame de recurso é automática?

18 - O que acontece no caso de obter nota mínima nos e-fólios mas não no p-fólio? Posso realizar o p-fólio de recurso e ainda aproveitar as notas dos e-fólios?

23 - Adição de um diagrama para ilustrar a forma de avaliação como este:

24 - https://wiki.dcet.uab.pt/files/index.php/Categoria:Engenharia_Inform%C3%A1tica#Avalia.C3.A7.C3.A3o

29 - Gostaria de saber se com 5.5 no p-fólio podemos passar à UC?

31 - Gostaria de saber: não tendo nota mínima (3.5) na soma dos e-fólios, se fico automaticamente inscrito no exame de recurso?

32 - Gostaria de saber: não tendo nota mínima (3.5) na soma dos e-fólios, pago alguma coisa para fazer o exame de recurso?

A variante didática do Modelo Pedagógico da UAb para o 1.º ciclo consubstancia-se à volta de três elementos fundamentais: o Plano da Unidade Curricular (PUC), o Plano de Atividades Formativas (PAF) e o Cartão de Aprendizagem (CAP). São esses elementos que permitem ao professor organizar e estruturar o percurso de aprendizagem na respetiva unidade curricular e, ao estudante, conhecer o seu papel e as suas responsabilidades.

O Cartão de Aprendizagem (CAP) é um dispositivo pessoal que permite ao estudante visualizar, em qualquer momento, a classificação obtida em qualquer prova de avaliação contínua. O estudante que optar por esta modalidade de avaliação credita no seu Cartão de Aprendizagem (CAP) as classificações que obteve nos trabalhos online (e-Fólios) realizados

na unidade curricular ao longo do semestre, bem como a classificação obtida na prova presencial (p-Fólio).

**A modalidade de avaliação** (Avaliação Contínua e/ou Avaliação Final) **é escolhido pelo estudante na plataforma de elearning** (Moodle)**, por Unidade Curricular,** em dispositivo próprio e **no prazo estabelecido, findo o qual não poderá ser alterado. Caso não efetue esta seleção fica automaticamente inscrito na modalidade de avaliação contínua.**

**A Avaliação Contínua** - assume um caráter sumativo, com propósitos classificativos, e desenvolve-se com base num conjunto de atividades propostas ao estudante ao longo do processo de ensino-aprendizagem. A avaliação contínua é o regime de avaliação preferencial no 1º ciclo de estudos na UAb. No Modelo Pedagógico da instituição, esta avaliação é constituída pela realização de 2/3 e-Fólios na unidade curricular (ao longo do semestre letivo), e de um momento final de Avaliação Presencial - p-Fólio (a ter lugar no final do semestre), com peso de, respetivamente, 40% e 60% na classificação final.

O e-Fólio é um instrumento inerente à avaliação contínua nos cursos do 1º ciclo de estudos. Constitui um pequeno documento digital elaborado pelo estudante sobre uma seção dos temas trabalhados, seguindo as indicações específicas fornecidas pelo professor para a sua realização. Este documento é enviado ao professor eletronicamente dentro da Plataforma de e-learning e dará lugar a uma classificação creditada no Cartão de Aprendizagem do estudante (CAP).

Só é considerado aprovado na Unidade Curricular (UC), o estudante que obtenha nas notas parciais, as seguintes classificações:

- Somatório dos e-fólios, nota igual ou superior a 3,5 valores;
- Prova presencial de P-fólio, nota igual ou superior a 5,5 valores.

No final, o somatório das avaliações parciais (E-fólios + P-fólio) deverá ser obrigatoriamente igual ou superior a 10 valores.

Os e-Fólios têm um peso de 40% na classificação final. Ao longo do percurso de aprendizagem em cada unidade curricular, e de acordo com o definido pelo professor, o estudante poderá realizar até três e-Fólios.

As classificações obtidas nos e-Fólios e no p-Fólio são, ao longo do semestre, creditadas pelo professor no Cartão de Aprendizagem (CAP) da unidade curricular. Os estudantes podem, no entanto, em devido tempo, optar um único momento presencial de avaliação.

Em caso de reprovação na UC se pretender manter a classificação dos e-fólios, obtida no ano anterior, deverá solicitar a creditação desta classificação, no espaço da UC e no período estabelecido para o efeito.

**A Avaliação final** - com propósitos classificativos tem por base uma prova a realizar pelo estudante obrigatoriamente depois do término das atividades de ensino-aprendizagem.

No 1.º ciclo de estudos, o estudante pode optar por um único momento presencial de avaliação, realizando uma prova de Avaliação Final – Exame, que tem um peso de 100% na classificação final. Esta possibilidade não se aplica a todas as UC, nomeadamente as línguas estrangeiras, pelo que o estudante deverá verificar qual(is) o(s) regime(s) previsto(s).

O Exame é constituído por uma prova individual de avaliação de competências e conhecimentos, definido no calendário aprovado pelo órgão estatutário competente da Universidade Aberta.

Nos termos dos regulamentos da Universidade Aberta, por ano letivo, estão previstas três épocas de exame: época Normal, época de Recurso e época Especial. Os locais onde se efetuam as provas presenciais estão listados no portal da UAb.

Grupo 2 – **AVALIAÇÃO FINAL PRESENCIAL, RECURSOS**, etc

2 - Se faltar ao p-folio da época normal posso ir ao p-folio de recurso?

3 - Se reprovar no p-folio da época normal posso ir ao p-folio de recurso?

4 - Se reprovar no p-folio da época normal posso ir a exame?

5 - Se faltar ao exame da época normal posso ir ao exame da época de recurso?

6 - Se reprovar no exame da época normal posso ir ao exame de recurso?

7 - Se reprovar na prova de avaliação final (exame ou p-folio) posso solicitar uma reapreciação de provas?

11 - Estou inscrito numa UC no regime de exame final. Se não fizer o exame de época normal posso fazer o exame de época de recurso?

12 - Estou inscrito a uma UC no regime de avaliação continua. Pelo facto de não ter feito nenhum e-fólio posso na mesma realizar o exame de época normal? E, posteriormente realizar o exame de época de recurso se assim for necessário?

16 - O que é necessário para fazer melhoria de nota a uma UC? No caso de não melhorar a nota, qual será a nota final na pauta?

19 - É possível fazer melhoria de nota obtida em exame de recurso?

22 - Como poderei saber a calendarização das provas presenciais?

30 - Gostaria de saber se num exame normal não conseguir aprovação, se fico automaticamente inscrito no exame de recurso?

36 - Quando vou receber a nota do meu p-fólio/exame? (visto não termos esta data em PUC, como temos para os e-fólios acho importante dar a noção que depende da questão dos CLAs, etc..)

A Avaliação final - com propósitos classificativos tem por base uma prova a realizar pelo estudante obrigatoriamente depois do término das atividades de ensino-aprendizagem.
No 1.º ciclo de estudos, o estudante pode optar por um único momento presencial de avaliação, realizando uma prova de Avaliação Final – Exame, que tem um peso de 100% na classificação final. Esta possibilidade não se aplica a todas as UC, nomeadamente as línguas estrangeiras, pelo que o estudante deverá verificar qual(is) o(s) regime(s) previsto(s).

O Exame é constituído por uma prova individual de avaliação de competências e conhecimentos, definido no calendário aprovado pelo órgão estatutário competente da Universidade Aberta.

Nos termos dos regulamentos da Universidade Aberta, por ano letivo, estão previstas três épocas de exame: época Normal, época de Recurso e época Especial. Os locais onde se efetuam as provas presenciais estão listados no portal da UAb em https://portal.uab.pt/informacoes-academicas/

Para saber a calendarização da provas presenciais, pode consultar o Calendário Letivo no Portal da UAb em https://portal.uab.pt/calendario-letivo/

No caso das unidades curriculares (UC) com provas presenciais, o estudante tem acesso a uma época no final do semestre (Época Normal). Se não puder comparecer, ou não obtiver aprovação, dispõe de outra época (Época de Recurso). Não é necessária a solicitação de inscrição nas provas, a inscrição em qualquer das épocas de avaliação é processada automaticamente. Aconselha-se a consulta do Regulamento de Avaliação, Classificação, Qualificação e Certificação no portal da UAb em https://portal.uab.pt/regulamentos/

**Se o estudante não realizar os e-fólios de uma unidade curricular (UC), ou se reprovar nos e-fólios da UC (não tiver 3,5 valores mínimos no somatório dos e-fólios da UC), não pode efetuar a prova escrita presencial de P-fólio**. Porém, ainda pode realizar uma prova escrita na época de recurso, sob a forma de um exame, ficando automaticamente inscrito(a). Esta possibilidade não se aplica a todas as UCs, pelo que o estudante deverá verificar qual o regime previsto para cada UC.

**Pauta de Resultados -** A menção de "ReprovadoNA" no local da classificação, indica que o estudante reprovou no(s) E-fólio(s), isto é, não obteve o mínimo de 3,5 valores (não elaborou qualquer e-fólio nessa unidade curricular (UC), ou no somatório dos E-fólios não obteve a classificação mínima estabelecida), pelo que ficou excluído de continuar no regime de avaliação contínua. Porém, ainda pode realizar uma prova escrita, sob a forma de um exame, na época de recurso, na qual não precisa de se inscrever, pois fica automaticamente inscrito.

A menção de "Reprovado", sem nota quantitativa, no local da classificação, indica que o estudante aprovou no(s) E-fólio(s), isto é, que obteve no somatório dos E-fólios o mínimo de 3,5 valores. Contudo, ou, não compareceu à prova escrita presencial, P-fólio, ou, não obteve o mínimo de 5,5 valores, ou ainda, não atingiu no somatório das avaliações parcelares o mínimo de 10 valores. Nesta situação, pode ainda realizar uma prova escrita, sob a forma de um P-fólio, na época de recurso, na qual não precisa de se inscrever, pois fica automaticamente inscrito.

A menção "Publicitação Diferida", no lugar da classificação, significa que o estudante tem de regularizar a sua conta corrente com a UAb. A conta corrente pode ser verificada no Portal Académico -> Tesouraria.

**Consulta dos Resultados das Provas Presenciais -** Findo o processo de avaliação os resultados ficam disponíveis no Portal Académico -> Consulta de Notas. Tendo a UAb estudantes em todo o mundo, os resultados das provas são publicitados de forma faseada.

Caso verifique algum problema com a nota de uma unidade curricular pode solicitar esclarecimento à Direção dos Serviços Académicos – Serviço de Logística de Exames, preenchendo o formulário Pedido de Resultados de Provas em https://portal.uab.pt/avaliacao/

Para **Melhoria de Classificação**, **Prova Presencial em Época Especial**, **Fotocópia da Prova Presencial**, **Recurso, Declaração de Presença e Condições especiais para realização de Provas Presenciais** consulte as informações disponíveis no portal da UAb em https://portal.uab.pt/avaliacao/

Aconselha-se a consulta do **Regulamento de Avaliação, Classificação, Qualificação e Certificação** em https://portal.uab.pt/regulamentos/

9 - O que é plagiar e como pode um estudante ser penalizado se o fizer?

Consulte o Regulamento Disciplinar dos Estudantes da UAb no portal da UAb em https://portal.uab.pt/regulamentos/

10 - Como devo citar as fontes quando elaboro um trabalho de cariz académico?

Consulte as "Normas gráficas da UAb" na página dos guias e tutoriais no portal da UAb em https://portal.uab.pt/dsd/guias-e-tutoriais-2/

13 - Como posso saber o local onde devo realizar a minha prova presencial?

33 - Gostaria de saber: Em que local estou inscrito para fazer o p-fólio/exame?

Consulte a informação disponível no Portal da UAb em "Locais das Provas Presenciais" em https://portal.uab.pt/avaliacao/ e em https://portal.uab.pt/informacoes-academicas/

14 - Vou iniciar as minhas atividades letivas no 2º semestre. Irei ter módulo de ambientação on-line?

8 - Como devo comunicar on-line?

No Modelo Pedagógico da UAb, para que o estudante possa conhecer bem o Ambiente Virtual onde decorrerá a sua aprendizagem, familiarizar-se com as ferramentas de comunicação e com os modos específicos de comunicar em ambiente online, a Universidade Aberta disponibiliza um pequeno curso, totalmente gratuito, denominado "Módulo de Ambientação Online".

É um módulo de preparação obrigatório para todos os estudantes que se inscrevem pela 1ª vez na Universidade Aberta e que ingressam num curso em regime de e-Learning. Desenvolve-se durante duas semanas, antecedendo o início formal do ano letivo.

Espera-se que, no final do módulo, o estudante tenha desenvolvido uma série de competências de navegação e de comunicação em ambientes virtuais, ficando também a conhecer o Modelo Pedagógico da UAb, antevendo assim, como será estudar na Universidade Aberta.

Na comunicação online o estudante conta com recursos específicos para a interação: a **turma virtual -** o estudante integrará uma turma virtual onde têm acesso os professores do curso e os restantes estudantes. As atividades de aprendizagem decorrem no espaço virtual de cada unidade curricular ao longo de cada semestre sendo realizadas online com recurso a dispositivos de comunicação. Com base nestes dispositivos são organizados **fóruns**. Neles deverá ter lugar a interação a propósito da temática em estudo quer entre estudantes, quer entre estudantes e professor: aspetos que suscitem dúvidas, reflexões que se entendam partilhar, troca de opiniões sobre este ou aquele tópico, confronto de respostas dadas às atividades propostas, etc. A comunicação é essencialmente assíncrona e, por isso, baseada na escrita.

Estão disponíveis ao longo de todo o curso diversos espaços de apoio ao estudante, nomeadamente:
– O SITCON (plataforma de contacto com os diversos serviços de apoio – serviços financeiros, serviços académicos, etc.);
– O espaço da coordenação da licenciatura (espaço privilegiado para contactar com a coordenação e obter apoio em questões pedagógicas);
– O espaço online do secretariado da licenciatura (espaço privilegiado para contactar com o secretariado da Licenciatura e obter apoio em questões de natureza administrativa).

20 - Quando começam as aulas como será o ambiente? Teremos uma sala virtual com todos os alunos em skype, facebook, etc.?

21 - Existem aulas com horários que devo frequentar?

No âmbito do Modelo Pedagógico da UAb, as atividades de ensino e de aprendizagem realizam-se com recurso a software que permite criar um ambiente que simula uma classe, mas de natureza virtual.

O software utilizado é uma plataforma de e-Learning (plataforma Moodle), na qual, para cada unidade curricular é criada uma classe virtual. Nessa classe, que funciona como uma "sala de aula" virtual, o estudante tem acesso a todas as indicações necessárias para realizar com sucesso as unidades curriculares onde se inscreve.

Nesse ambiente, através de diversos dispositivos, o estudante acede aos elementos de aprendizagem (recursos audiovisuais, multimédia textos scripto, atividades de diferente índole, instrumentos de avaliação, etc.) e contacta com o professor e com os colegas. O número de unidades curriculares em que o estudante se inscreve, determina o número de «salas de aula» a que tem acesso. Este acesso faz-se através do portal da Universidade Aberta.

O ambiente virtual de aprendizagem contempla ainda a possibilidade de interações de natureza social, com caráter espontâneo e informal. Estabelecem-se assim relações sociais e de suporte, promovendo o sentimento de pertença a uma comunidade virtual de aprendizagem.

Para saber o inicio da aulas e das atividades letivas, deve consultar o Calendário Letivo no Portal da UAb em https://portal.uab.pt/calendario-letivo/

Na frequência de uma licenciatura na Universidade Aberta não existem aulas com horários. No entanto, aprender a distância, numa classe virtual, implica que o estudante não se encontrará no mesmo local que os seus professores e colegas, nem à mesma hora, ou seja, trata-se de uma aprendizagem flexível, porque é independente do tempo e espaço. Naturalmente que este sistema implica tempo dedicado ao estudo e à aprendizagem. Assim, cada unidade curricular tem definido o número de horas de estudo e trabalho efetivo que se esperam do estudante. Tendo em consideração que cada unidade curricular corresponde a 6 ECTS, o tempo total de estudo previsto para cada unidade curricular é 156 horas, o que inclui, por exemplo, a leitura de documentos diversos, a resolução das atividades online e offline, a leitura de mensagens, a elaboração de documentos pessoais, a participação nas discussões assíncronas, e o trabalho requerido para a avaliação. No planeamento do seu percurso, o estudante deverá ter sempre em consideração a disponibilidade efetiva de tempo necessário para realizar as unidades curriculares em que pretende matricular-se.

25 - O que são os três tipos de regime de estudo que aparecem durante a inscrição às cadeiras?

**Regime de e-Learning**; **Regime a Tempo Integral; Regime a Tempo Parcial;**

O Regime de e-Learning adotado na Universidade Aberta tem por base um Modelo Pedagógico próprio e os cursos desenvolvem-se em modalidade online.
Ao nível do 1.º ciclo de estudos este modelo funciona com base em Classes Virtuais, sendo todas as atividades desenvolvidas online. Os cursos organizam-se em torno de um conjunto de elementos específicos do Modelo Pedagógico da Universidade Aberta (UAb). No 1º Ciclo os Elementos Pedagógicos fundamentais a considerar pelo estudante são: o Plano da Unidade Curricular (PUC) e o Cartão de Aprendizagem (CA). Todos os novos cursos da Universidade Aberta criados ao abrigo do Processo de Bolonha são abrangidos pelo regime de e-Learning. Os cursos adequados transitaram progressivamente para este regime a partir do ano letivo de 2008-09.

Entende-se por regime de estudos a tempo integral aquele em que o estudante, em cada ano letivo, efetua inscrições no total das unidades curriculares. A mudança do regime de tempo integral para o regime de tempo parcial, ou vice-versa, apenas pode ocorrer no ato de inscrição no ano letivo

Regime de estudos a tempo parcial aquele em que o estudante, em cada ano letivo, efetua inscrições em parte do total das unidades curriculares a que se poderia inscrever no regime de estudos a tempo integral.

Na UAb, num curso de 1.º ciclo de estudos, considera-se estudante em regime de tempo parcial aquele que se inscreve num número de unidades curriculares a que correspondam o máximo de 30 créditos ECTS, em cada ano letivo. No caso do 2.º ciclo e do 3.º ciclo de estudos, a inscrição corresponde a um mínimo de 20% e um máximo de 50% dos créditos, em cada ano letivo.
Pode inscrever-se em regime de tempo parcial qualquer estudante que expressamente o indique no ato de matrícula/inscrição.

Grupo 3 - **INSCRIÇÃO/MATRÍCULAS** (informação portal UAb)

26 - Concluí a matrícula e aparece pré-inscrição, é normal? E quando é que a matricula deixa de ser pré-inscrição?

27 - Concluí o processo de matrícula, mas fiquei com uma dúvida! Como sei as referências para pagar no multibanco?

34 - A quantas unidades curriculares me devo inscrever? (isso já é aconselhado na LEI)

35 - Onde posso obter o certificado de matrícula?

A matrícula é o ato pelo qual os candidatos formalizam a sua condição de estudante de determinado curso da Universidade Aberta, sendo realizada e paga, numa das seguintes duas situações:

- quando os candidatos se matriculam pela primeira vez;

- quando os candidatos requerem o reingresso ou a mudança de par instituição/curso.

Consulte o calendário de matrículas e inscrições no portal da UAb em https://portal.uab.pt/matricula-e-inscricoes/

O estudante deve fazer uma inscrição por cada Unidade Curricular (UC), consoante o número de UC que pretenda realizar no semestre. O estudante deve inscrever-se também nas UC às quais ainda aguarda resultados do ano ou semestres anteriores.

No 1.º ano de um curso de 1.º Ciclo, o estudante pode inscrever-se até um máximo de 60 ECTS, o que corresponde a 10 UC por ano. Nos anos seguintes, caso não tenha obtido aprovação em UC nos anos anteriores, pode efetuar inscrição até 84 ECTS, o que equivale a 14 UC.

No 1.º Ciclo, considera-se Estudante a Tempo Parcial aquele que, em cada ano letivo, efetua inscrições em parte do total das UC a que se poderia inscrever no regime de estudos a tempo integral.

Nos 2.º e 3.º Ciclos, considera-se Estudante a Tempo Parcial aquele que, no ato da matrícula e inscrição no ano letivo, e apenas nesse momento, se inscreve num mínimo de 20% e num máximo de 50% de Unidades Curriculares.

Prazos e Pagamentos

As matrículas/inscrições realizam-se online, na Área Privada do Estudante/Portal Académico, respeitando os prazos anualmente estabelecidos no Calendário Letivo em vigor.

A matrícula e/ou inscrição só é aceite se o estudante tiver a sua situação regularizada quanto ao pagamento de propinas e/ou taxas.

Para valores atualizados consulte Pagamentos e o preçário em vigor.

Anulação de Matrícula

A anulação de matrícula origina a anulação de todas as unidades curriculares em que o estudante está inscrito.

Caso o estudante pretenda retomar os estudos tem de efetuar nova candidatura de acordo com o regime e nos prazos definidos para o efeito.

A anulação de matrícula pode ser solicitada em qualquer momento do ano letivo e implica a regularização das propinas já vencidas e o preenchimento do formulário que se encontra em https://portal.uab.pt/matricula-e-inscricoes/ . Na UAb, não existe a possibilidade de suspensão da matrícula/inscrição por requerimento do estudante. Caso pretenda interromper os estudos deve solicitar a anulação da matrícula.

Para obter o certificado de matrícula consulte a informação disponível no portal da UAb em https://portal.uab.pt/declaracoes-certidoes-e-diplomas/

Se o assunto se refere a referências de multibanco, consulte a informação disponível na Tesouraria do Portal Académico.

28 - Como posso a obter a declaração de todos valores pagos para efeitos de IRS?

Consulte a informação disponível na Tesouraria do Portal Académico.