1404 Biscuit Drive
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May 15, 2020

Kathryn Roosa
COA Publishing
11405 Cezanne Court
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Dear Ms. Roosa:

As per our agreement, I am submitting the enclosed report titled *Application of Chatbots in Mental Healthcare for College Students* that I proposed on April 10, 2020.

As we discussed, my report is intended to propose to universities and colleges administrators, academic departments and student services the implementation of chatbots in assisting mental health care system. The report discusses the imbalance between the demand for mental health care in college students and the availability of the service. It then describes the benefits of mental health chatbots and compares the technology of two commons chatbots. The report concludes with the promotion of a potential model for a mental health chatbot in higher institutions and its cost of implementation.

The report is in the required format with number page format citations and includes a reference page, providing appropriate credit to all other works cited.

I hope the report will be useful to tertiary institutions that not only concern about their students' academic performance but also care about their well-being both physically and mentally.

Sincerely,

Thi Huynh

Encl: Technical background report on application of chatbots in mental healthcare for college students.

Report
on

APPLICATION OF CHATBOTS IN MENTAL HEALTHCARE FOR COLLEGE STUDENTS

Submitted to

Ms. Kathryn Roosa

COA Publishing

Austin, TX

May 15, 2020

by

Thi Huynh

This report contains information about chatbots and their benefits, future application and cost of implementation in mental healthcare for college students.

CONTENTS

APPLICATION OF CHATBOTS IN MENTAL HEALTHCARE FOR COLLEGE STUDENTS

I. INTRODUCTION

Natural Language Processing (NLP) is a subdivision of artificial intelligence technology which is used as a means of interaction between humans and computers via natural languages. The applications of NLP can be seen in chatbots and virtual voice assistants. A chatbot is a computer program or mobile application that simulate human conversations using text or text-to-speech without the operation of a real human. Chatbots not only provide help in business and in daily life but also play a vital role in mental healthcare

The main purpose of this report is to propose to universities and colleges administrators, academic departments and student services the application of chatbots in taking care of students' mental health. Mental healthcare has become an urgent need in the 21st century while there is still a serious lack of mental health workers, notably in colleges and universities. With the increasing demand of mental healthcare, especially during the time of pandemic and uncertainty, chatbots can serve as effective assistants to tertiary institutions, providing preliminary screenings and regular check-ins at a low cost.

The report will be divided into five main sections, starting with a discussion of the need for mental healthcare in tertiary institutions compared to the shortage of staff and services. The second part focuses on the benefits of chatbots in both assisting mental health workers and helping student patients, while collecting valuable data to further enhance the system. The third section compares and contrasts some common mental health chatbots in use, which leads to the next part of analyzing the model employed in developing chatbots for tertiary institutions. The report concludes with assessing the cost of this application.

II. NEED FOR MENTAL HEALTHCARE FOR COLLEGE STUDENTS

College students in the 21st century are facing greater social and financial pressure than other generations. The emergence of new technology and social media while with the promise of bridging the gap between people, actually introduces a sense of loneliness isolation. All over the country, a larger number of college students report to experience depression and other mental health issues. An increase of more than double over less than a decade in the number of students with severe depression, suicidal ideation and self-injuries has been reported by Reuters Health in 2019 [5].

While institutions have been trying to raise their mental healthcare capacity to meet this alarming demand, on campus resources are still considered inadequate. Figure 1 below demonstrate the imbalance between the severity of mental issues among college students and the availability of mental healthcare in 2019. The statistics in the first table show that the percentages of students suffering from anxiety and depression within the last year are 66.4% and 46.2% respectively. Meanwhile, the figures of students who get treated for the same issues stand less than a half of those experiencing the symptoms.

Students reported experiencing the following any time within the last 12 months:

Percent (%)	Male	Female	Total
Felt overwhelming anxiety	50.9	72.3	66.4
Felt so depressed that it was difficult to function	37.4	48.7	46.2

Within the last 12 months, diagnosed or treated by a professional for the following:

Percent (%)	Male	Female	Total
Anxiety	12.6	27.9	24.0
Depression	11.6	22.4	20.0

Figure 1 – Findings in Mental Health [1:15-16]

On the other hand, there is always a stigma around mental health issues and depression in particular, leading to college students shying away from seeking help from counselors and campus therapists. Many schools may expel students with suicidal ideation or experiences, or the students may be forced to go on medical leave instead of getting treatment [5]. The sensitive situation suggests the need for a more sustainable and comprehensive approach.

With the on-going pandemic in 2020, colleges and universities across the U.S. have moved online for the Spring and Summer semesters, and many are not planning to open their facilities for the Fall. Distance learning models have posed a new challenge to students and their mental health as students are more prone to stress and depression [4:127]. Students usually face more disruption and lost of concentration in online classes compared to face-to-face lessons, while the availability of other student services is also reduced. The combination of anxiety, uncertainty and loneliness from the pandemic also contributes to the exacerbation of mental issues in college students.

III. BENEFITS OF CHATBOTS TO THE MENTAL HEALTHCARE SYSTEM

Employing chatbots in the process of mental health treatment can benefit both the patients and the mental health workers. Chatbots can provide regular check-ins to students, especially those preferring the anonymity of a computer app. For mental health workers, chatbots can serve as an effective diagnostic tool and help compiling data to assess different counselling techniques.

Benefits to Patients

Chatbots offer regular check-ins to college students. Many students enduring stress and depression do not feel the urge to seek help from a professional or a campus counsellor due to shyness or shortage of time. However, around the end of a semester with finals and deadlines running up, college students face increasing stress levels. While they cannot set up a counselling session any time they need, most students having access to the internet can talk to a chatbot immediate when the need arises. Chatbots can also be set up to check up on the students on a regular basis – every other day or every week.

The figure 2 below describes a typical interaction between a person with psychological issue and a therapist chatbot. The patient initiates the conversation by reporting their negative emotions. The chatbot then parses the sentence using Natural Language Processing technology and accesses its web of semantic information with the use of Artificial Intelligence to generate a response. In this way, the chatbot can prompt the patient to share further information about their problems.

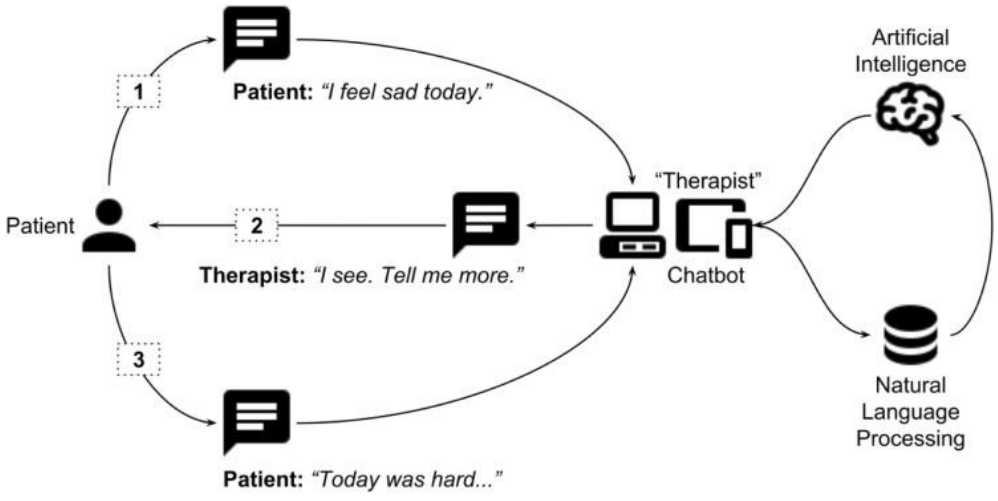

Figure 2 - A sample interaction between a patient and a chatbot therapist [9:458]

Benefits to Mental Health Workers

Chatbots may not be able to replace campus counsellors and therapists, but they act as an effective tool before and after every counselling session.

Preliminary screening. NLP technology performs preliminary screening in passive and active ways. Passive data collecting uses text analysis with data from social media pages of students, most of the time to screen for suicidal language [8]. Chatbots offers preliminary screening in the active approach. In colleges and universities, students are required to fill out a form with information about their mental issues before meeting a counsellor. While the form helps counsellors know some symptoms that students experience, it does not provide a thorough overview. A chatbot can serve as a diagnostic tool using the data from conversations with students, identifying signs of mental issues [3].

Psychotherapy technique assessment. Chatbots do not only help the mental care process before the counselling sessions but also assist with collecting and analyzing data later on using randomized control trial. “Randomized controlled trials often involve a head-to-head comparison of a psychotherapy technique against a control (like another psychotherapy technique, or a population who isn’t receiving therapy)” [3]. With valuable input data from prior screening, mental health worker can assess the effectiveness of the techniques in used and adjust their process for the benefits of students.

IV. CHATBOTS IN USE

The two most common chatbots in use are ELIZA and Woebot. They operate in different ways, yet prove to be effective in helping patients with mental health problems

ELIZA

ELIZA is the earliest chatbot in the mental care field, developed by MIT Artificial Intelligence Laboratory during the 1960s [2:9]. ELIZA uses rule-based system of language with carefully constructed rules of syntax and semantic to guild the conversation. Therefore, it is quite limited and restricted in its responses.

Regarding psychological technique, ELIZA employs Rogerian Psychotherapy [3]. With this approach, ELIZA repeats the patients' answers, avoids directly challenging their flow of conversation, and tries to elicit solutions from within the patients. As a result, ELIZA prefers asking non-directive question and taking in open-ended answer. However, with rule-based technology behind, receiving open-ended answers can pose a challenge in comprehension to ELIZA.

Woebot

Woebot is developed by Stanford University's School of Medicine Psychiatry and AI departments [2:10]. Different from ELIZA, Woebot utilizes machine learning with no hand-coded rules; it collects data from some of internet's largest corpora. This method provides certain flexibility in languages and responses, yet it may allow the chatbot to "learn" harmful, dangerous language if not carefully managed.

Considering psychological technique, Woebot adopts Cognitive Behavioral Therapy [6], and hence attempts to identify patients' thoughts through their moods, then points out the "distortion" in their thoughts. Therefore, Woebot provides daily check-ins to patients, preferring quick emoji replies to open-ended answers [7]. The bot also offers quizzes and videos for self-discovery purpose. Focusing more on analyzing emojis rather than longer answers, it seems like Woebot has not adequately employed the advantages of wide range of linguistics samples.

Woebot is integrated into Facebook Messenger, or it can be accessed by an independent mobile application [7], which makes it more commonly known than any other chatbots. The integration in return brings in more data from user responses to further develop Woebot's language corpus. An experiment using randomized controlled trial has shown that Woebot helps reduced depressive symptoms more than self-help books [3].

V. MODEL OF CHATBOTS IN MENTAL HEALTHCARE FOR COLLEGE STUDENTS

Considering the demand of mental health care, the benefits of chatbots, and the leading examples of chatbots in use, I would suggest the implement of chatbots in tertiary institutions using the platform of Dialogflow, technology of machine learning and a combination of Rogerian Psychotherapy and Cognitive Behavioral Therapy techniques.

Platform

Every chatbot is built on a platform called application programming interface (API). While building its own API brings many benefits, it is also costly and time-consuming. One of the most popular API in the market currently is Dialogflow, developed by Google. Dialogflow employs machine learning to train its chatbots, starting from a few inputs by the conversation designers. The designers can also input data and corpora using Google Docs or Spreadsheet.

Technology

Mental health chatbots have a special goal to fulfill. While other chatbots only need to act as assistants, mental health chatbots must be perceived as a friend to gain trust from its users, thereby have to be as human-like as possible. This goal can only be achieved using machine learning to avoid the restrictedness of sentences constructed by a limited set of rules. As discussed in the previous section, machine learning using data from users and the internet provides greater flexibility to chatbots' conversations than a rule-based system. The larger the corpus, the smoother the conversation.

Psychological Techniques

With the application of machine learning, chatbots can easily adopt a wide range of psychological approaches. For college students, the combination of both Rogerian Psychotherapy and Cognitive Behavioral Therapy can provide immense treatment. At the beginning of the process, when there is a need for long conversation to assess students' problem, Rogerian Psychotherapy offers comfort through open ended questions and a natural conversational flow. After on-campus counselling sessions, Cognitive Behavioral Therapy assists with daily check ins, examining students' changes in moods and thoughts with short quizzes and short questions.

VI. COST

The cost of implementing a chatbot in colleges and universities include the building cost and the cost for API service.

Building Cost

Building an average business chatbot on a ready-made platform would take around 150 hours of labor. The average hourly salary of programmer is $40 an hour. Therefore, the cost for programming a chatbot will be $6000. Along with programmers, we must need the crucial role of school's therapists and counsellors. With the average salary of $40 an hour for 100 hours of labor, the cost for psychological counsellors will be $4000. In total, higher institutions should expect to spend $10 000 to build a chatbot.

API Cost

Dialogflow charges $0.002 per text iterations in its Essentials Enterprise Edition. An average conversation will incur 50 iterations, which costs $0.1. Assume every month, students use the chatbot 10,000 times for both preliminary diagnostic and regular check-ins, it will cost the school $1000.

VII. CONCLUSION

With the percentage of mental issues rising in college students, chatbots can offer immense assistance to institutions' mental health care system. This report discusses the demand of mental health care from students and the shortage of service from institutions. The benefits of chatbots to both mental health workers and students are thoroughly described. The comparison of technology and psychological techniques behind two common chatbots has shed light on the potential model for chatbot in colleges and universities. The cost of implementation is discussed at the end of the report.

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