Towards an Online Empathy Assisted Counselling Web Application

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Abstract

INTRODUCTION: In today's society mental health is becoming increasingly important. As a result, more and more individuals need guidance and counselling. This care giving becomes even more important in a person's life during times of hardship, for instance during pandemics like COVID-19 where social isolation makes it even more difficult to cope with mental anguish. Whereas there exist various interventions, guidance and counselling activities are not easily accessible for resource stricken communities and where it exists, then its efficacy is hard to measure. With appropriate guidance voluntary counsellors could assist fill the void for such societies and provide counselling to them for various mental anguishes thereby providing relief for such conditions some of which are quite debilitating.

OBJECTIVES: The main objective of this paper is to encourage the uptake of counselling services to resource stricken communities in particular, by leveraging technology resulting in an increased 'counselling culture' that has empathy at its core.

METHODS: Incorporating National Language processing (NLP) into online unstructured chat discourses during a counselling session with an end goal of achieving positive efficacies driven by empathetic approaches. These approaches were adopted after rigorous consultations with a Counselling psychologist and also via views derived from an online questionnaire sent anonymously.

RESULTS: An online web-based application that provides a counsellor the platform to provide 'counselling services' to persons in distress by way of chat discourses. These Chat discourses are then filtered through the IBM Watson platform providing NLP and Artificial Intelligence capabilities to undertake lexical analysis in order to derive the emotional measure of the empathy level adopted in a chat discourse. As a result of the analysis, important statistical components like Precision and Recall are adopted in measuring the performance of the solution in terms of measuring, for instance, empathy inclusivity. Once Precision and Recall values are derived, the F1 score is calculated.

CONCLUSION: This study highlighted the critical need for counselling services especially in resource-stricken areas. In addition, socio-cultural norms sometimes are an impediment to effective counselling service delivery. The approach adopted in this paper resulted in an online web-based application that not only provides chat functionalities which are put through lexical analysis from where an 'Empathy quotient' is derived but also leverages the Natural Language Processing and Artificial Intelligence technologies. In this way, technology can provide an effective outreach methodology that provides in the very least a first-level counselling support structure. With purposive testing undertaken, it is evident that this study needs to be taken further to cover more areas of counselling and to strengthen the adoption of artificial intelligence in order to, for instance, leverage volunteers' efforts vis-à-vis providing counselling services.

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1. Introduction

In our fast-paced life, that we humans find ourselves in, greater connectivity does not necessarily mean greater connection. As a result, of the lack of this connection, more and more people experience social isolation leading to loneliness and other emotional imbalances. At the same time in some societies, there exists a lack of support structures for people in emotional distress to turn to.

This research found that emotional well-being is now important more than ever before and this is widely reflected in various national and/or city health care policies. It is therefore, imperative to provide these social structures to people and especially young adults wo are most at risk due to the cultural and social disruptions brought about by everyday stresses.

Counselling services can be a strong delivery mechanism in the provision of strong support structures especially in situations where first-level counselling services are required. Making sure that people and young adults are simply heard can go a long way in for example, curbing teen suicides. Therefore, first-level counselling services need to give urgent feedback to people in distress and here technology can play a key role, for example, in the form of an online chat system.

Technology can play a key role in providing the much-needed social support structures especially in societies where access to such support structures is non-existent either due to lack of material resources, socio-cultural issues or even due to natural calamities like pandemics, wars, etcetera.

There are, however certain challenges in ensuring that positive outcomes are achieved both quantitatively and qualitatively especially when it comes to dealing with the large number of people needing support services.

Due to a lack of adequate professional counsellors, the notion of volunteer counsellors can fill this void. With proper training, volunteer counsellors can provide peer-to-peer counselling services especially to younger people. However, the services provided by such volunteers should be properly monitored to ensure that people reaching out to them receive empathetic responses. Empathy is without a doubt the bedrock of a successful counsellor intervention for it not only enhances positive outcomes but encourages 'Client' retention.

This paper explains the study undertaken culminating in the design of a system prototype that puts into practice the key elements derived from the study. This is achieved by leveraging technologies that provide Natural Language Processing (NLP) as well as Artificial intelligence and machine learning which are incorporated onto an online web chat service to measure empathy inclusivity by the counsellor and to understand the type of feedback being received from the 'Client' during a certain chat discourse. The 'Client' in this study refers to the person receiving the counselling services.

The paper has five sections with the first and second sections describing the need for counselling as well as expounding on the importance of empathy in counselling and how technology can be applied to empathetic counselling. The authors then present their study findings in the third section that also includes feedback received from a counselling psychologist. The authors then develop a prototype system actualizing the study results.

2. Empathy in Counselling

The feeling of distress and discomfort experienced by individuals drives such persons to seek counselling. Persons receiving counselling and guidance can take advantage of the anonymity offered by seeking help from individuals or institutions not known to them. These entities can provide a disciplined approach to counselling whereas, seeking help from close family and friends can sometimes be difficult.

Counselling can be defined as an activity provided by people involved in the psychological field, be they qualified health care professionals or persons providing voluntary services to persons with intimate concerns or problems [1].

Adolescents and young adults are increasingly seeking help and need counselling. According to Mitchell J. Dowling of University of Canberra, adolescents and young adults face severe challenges as they develop a sense of self and personal identity and need to form intimate relationships with other people that may lead to depression, substance abuse,etcetera. In addition, many of the disorders that start by age 23 have a lasting negative impact for years on end [2].

A key element in the dispensation of counselling is the adoption of empathy. Empathy can be aptly defined as a cognitive process of rationally understanding another's experience and then responding with behaviour that is deemed, to be caring [3]. Arthur J. Clark in his book mentions that the origin of the word empathy emanates from the Greek word 'empatheia' and refers to 'enter or to be with a person's suffering or passion' [11]

There exist four very important concepts of empathy. The first concept refers to the need for the counsellor or helper being receptive to the communication being received by him/her. The second concept deals with the helper's comprehension of the communication in order that he/she may acquire the knowledge of the subject matter through his or her thoughts, experience and the senses. After successful comprehension, the third concept involves transmitting the knowledge acquired by the helper to the Client to the advantage of the client. The fourth component, if relayed to the Client efficiently, can lead him/her to validate that indeed the helper understands his or her situation. [4].

The four concepts above highlight the fact that empathy is all about communicating and the understanding of the client's world on the part of the helper while for the client

it is important that he or she validates the fact that he or she is being understood.

Over the years, theorists have been hard-pressed to define emotions because it comes in several forms through a multitude of responses from the mild to the intense and even from the public to the private. These emotions when they are not within the realm of personal acceptance may drive the individual to the counselling option. When the four empathy components above are considered in human to human counselling then empathy is achieved which can greatly influence positive outcomes.

Technology has a key role to play in the Counselling field especially in a situation as is being faced currently with the COVID-19 pandemic. Social distancing makes it difficult for traditional counselling to take place. A recent study carried out in Hong Kong explored student mental health and intention to use online counselling. Out of the 300 students who participated one third of them had some form of mental distress. The results also showed that 40% of the students showed intention to use online counselling especially when access to counselling facilities were inaccessible as a result of the pandemic [16]. It is evident that even in areas where counselling can be accessed at a brick and mortar facility, a pandemic such as COVID-19 can restrict or at times hinder such accessibility.

3. Technology in Counselling

Social media has brought about tremendous technological socio cultural changes in people's lives and even though it has some negative outcomes especially as it discourages physical interaction, it may make an individual to loosen up and feel more uninhibited, thereby giving him or her the space to better express his or her emotions.

Research carried out on the subject of online support groups mention that in text communication, for example, a person may feel that the opposite person he or she is chatting with has the same experiences being felt by him or her and therefore resonates with his or her own feelings. This is often referred to as Solipsistic introjections where the person chatting feels that his mind has actually merged with the mind of the person on the other end of the chat[5]. These introjections become even more beneficial during pandemics where social isolation may be required.

The notion of anonymity as well as the absence of status and power of the chat 'parties' that online chats provide encourage the uptake of the online platform. Thus, the focus shifts from the brick-and-mortar psychology rooms with all the stigma attached to it to a more informal issue-oriented online setting.

A major challenge faced when undertaking chat conversations containing unstructured data, is measuring the tone and therefore empathy inclusivity in general in the chat exchanges bearing in mind that in such a situation, there is total lack of body language, which is an important part in emotional interpretation. Moreover, the transition time, that is the interchange time between the chat parties may be too small to make meaningful interpretation and in

this way emotional information may not be fully passed on [6].

3.1 Natural Language Processing

Natural Language Processing (NLP) is a branch of computer science that facilitates communication with users and involves processing the use of everyday language. Systems that use NLP analyse word combinations and deduce representations which aid in drawing contextual definitions [7].

Due to the capability of analyzing word combinations, NLP can assist researchers as well as software developers to unravel the intricacies of sociolinguistic research. One of the key research areas focuses on emotions, which are embedded in for example, chat messages and the disentanglement of such threads of chat conversations can lead to a better understanding of such emotions, which in turn can then lead to 'emphatic' service delivery. In the end, it's all about genuine understanding of an issue that leads to positive outcomes in counselling [6].

Three major components shape up NLP and these are Syntax, Semantics and Pragmatics [9]. Comprehension of, for example, the chat discourse by breaking down the words contained within helps to decipher the syntax of it. Syntax becomes important as it refers to the way in which the words are organized in a sentence and what information they transmit thereby affecting the meaning, for instance 'The dog bit the boy' has the same words as 'The boy bit the dog' but conveys a totally different meaning [8].

Generally, Semantics is the component that refers to the 'real' meaning of the textual context. In other words, the same word may depict a certain meaning in one context and a very different one in another. An example of this could be the word "Plant" where it's inclusion in a sentence could denote a manufacturing location or could denote the act of 'sowing'.

The Third component refers to Pragmatics. This component builds on the 'semantics' component where contextual analysis is carried out on the various correlations between different semantics. As the analysis grows so does the scope of the correlations bringing about better understanding and interpretation of, for example, 'thread' conversations [9]. In short, Pragmatics is an important factor as it analyses the overall context of the 'discourse' whether it may be the syntax or the semantics eventually aiding in the interpretation of the same [8].

From the dynamics explained above, it becomes apparent that NLP is important to lexicology and really becomes a key facet in measuring the interpretation of natural language. The same dynamics can then be applied in the measurement of empathy.

Natural Language Processing (NLP) is one area where technology can be applied to assist in the Counselling field. Research is currently ongoing in this complex field and especially in the area of text mining. The authors found a study carried out by M.Deshpande and V. Rao titiled 'Depression detection using emotion artificial intelligence' quite interesting as the study applied NLP on twitter feeds

to measure emotion analysis on depression [13]. Another study titled 'Natural Language Processing and Lexical Approach for Depression Symptoms Screening of Indonesian Twitter User' describes how a scrapping process of twitter feeds leveraged NLP to extract depression-related keywords [14].

4. Statistical Analysis

The researchers reached out to various individuals both from Kenya and the East African region as well as internationally. Whereas the research primarily focused on the local and regional counselling environments, parallels were drawn with the international environment comprising of 42% of the total respondents mainly from Canada, United Kingdom and the USA.

Individuals unknown to both the researchers and amongst themselves responded to an anonymous online questionnaire from where the researchers would understand counselling 'appetite' in the local environment and in addition to also understand the factors that give credence to the adoption of technology in counselling.

Apart from the Questionnaire that was sent to 'Clients' asking them questions on whether they would take up counselling services it was equally important that views were sought directly from a counsellor in order to understand various contemporary aspects on counselling.

4.1 Statistical Analysis – Survey Results

When asked who they would be comfortable to talk to if they would like to discuss an intimate issue majority of the respondents would rather discuss their issues with a close friend than a family member. The results shown in Figure 1 give credence to the fact that a peer to peer counselling would be beneficial especially for young people.
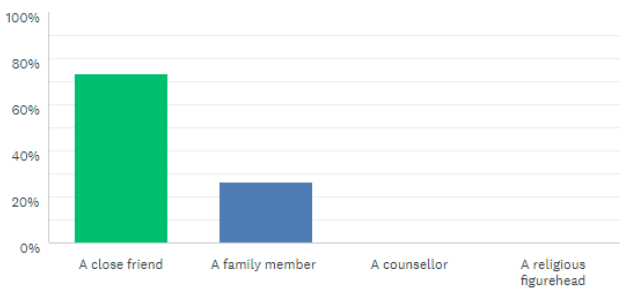

Figure 1. Respondents view on who they would prefer to turn to for advice on an intimate issue

The researchers then wanted to establish the nature of the outcomes the respondents had from the discussions they had with their friends. As can be seen in Figure 2 80% felt better after talking to a friend.
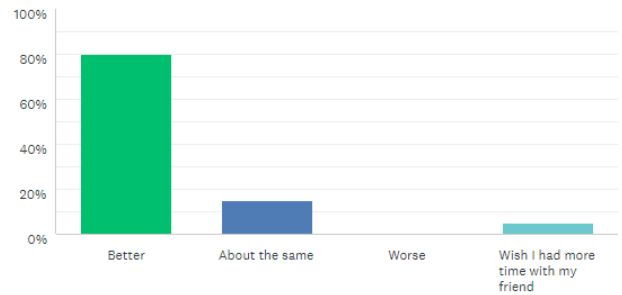
Figure 2. Respondents view on how they felt post-interaction with a friend

The next question introduced the counsellor as an alternative to reaching out to a friend. If a friend does not provide satisfactory outcomes, then would the respondent be willing to seek advice from a counsellor? Figure 3 shows an overwhelming 65% of the respondents willing to reach out to a counsellor.
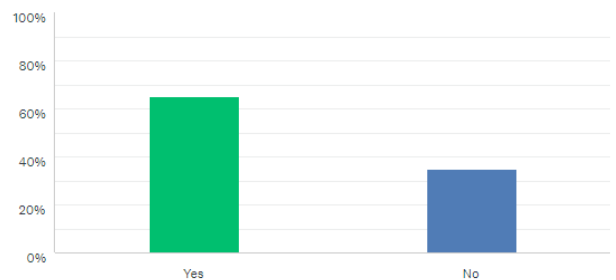

Figure 3. Respondents view of Counselling as an alternative

Upon further analysis, an important observation was that a higher percentage of those who did not mind visiting the counsellor were international respondents. This can be attributed to easy accessibility to counselling facilities.

As a rejoinder to the above question, the researcher further asked the respondents whether they would prefer to visit the counsellor physically or would they prefer to have an 'online' session be it through the phone or an online chat. As can be seen from figure 4, 40% would visit the counsellor physically, 35% would prefer an online chat facility, 25% would prefer the telephone and 15% would prefer all of the options. Through this analysis, it seems that the combined choices of online chat and telephone far outweigh the choice of visiting the counsellor physically.
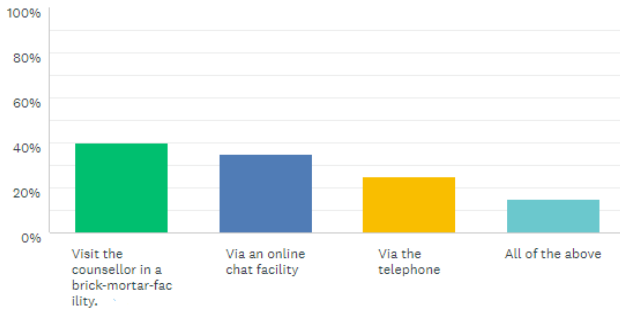
Figure 4. Respondent's preferred counselling delivery mode

An important observation during the analysis was that international respondents were more comfortable with visiting a counsellor physically while the domestic respondents preferred the online facility. It is evident that some cultures take counselling as a normal activity like any other medical condition and would visit a counsellor with ease. In addition, there is ease of access both materially and in terms of infrastructure. However, due to cultural stigma and fewer material resources the domestic respondents have a strong inclination towards online counselling services. The heavy proliferation of mobile technology in Africa may also have an effect on these results.

One of the most important questions was whether the respondent was aware of any online facility providing online counselling. This was important as it provided the prevalence rate of online counselling present in the respondent's vicinity thereby providing a needs assessment for the implementation of the technology. Figure 5 demonstrates that 65% of the respondents had no knowledge of any counselling facility in their city of residence and of these 86% were domestic respondents and therefore highlighting the need to for an online counselling presence in Africa.
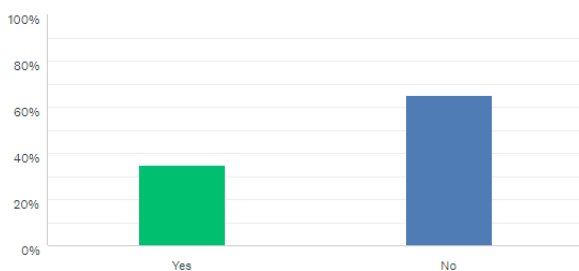

Figure 5. Respondent's knowledge on counselling facilities

As can be noted from Figure 6, when asked what constitutes a positive outcome, 85% of the respondents would like to have a solution to their issue while 25%

would like to acknowledge that they are facing a common issue. It is important to note that none of the respondents actually thought that referring to an elder person or a parent was a positive outcome. It can therefore be deduced that the notion of peer-to-peer counselling holds some credence.

Furthermore, the analysis also points to the fact that there definitely is a strong need for measuring the outcomes of the counselling as majority of the respondents would like to get a solution to their problems. In addition, to encourage Client retention there needs to be some escalation to a more senior or experienced counsellor if the first level point of contact does not provide the desired outcome.
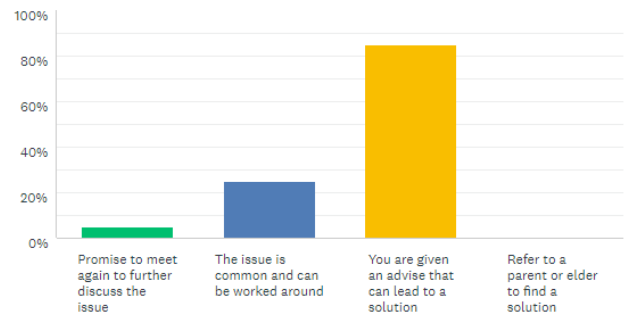


Figure 6. Respondent's views on positive outcomes

The authors wanted to comprehend whether the respondents understood empathy and how they rate it amongst other attributes. This was done without explicitly mentioning the word 'empathy'. A question 'Please rank in priority which of these characteristics promote positive outcomes when seeking advice to an intimate concern' was posed to the respondents. The question tries to ascertain what characteristics are important from a priority point of view. Six (6) characteristics were availed in the question and to make a clear distinction between empathy and sympathy, the notion of sympathy is explicitly introduced. The respondents were instructed to rate the attributes by giving them a score between 1 – 6 with 1 being the highest. Table 1 shows a graphic summary of the priorities as ranked by the respondents.

Table 1. Priorities as ranked by the Respondents

Parameter	Priority						Score
	1	2	3	4	5	6	
Confidentiality	82.35%	5.88%	11.76%	0.00%	0.00%	0.00%	5.71
Accessibility	6.25%	18.75%	31.25%	6.25%	18.75%	18.75%	3.31
Duration of the Conversation	0.00%	10.53%	21.05%	21.05%	26.32%	21.05%	2.74
Anonimity	5.56%	22.22%	5.56%	33.33%	11.11%	22.22%	3.11
Understanding of your situation	5.26%	26.32%	26.32%	10.53%	26.32%	5.26%	3.58
Sympathy being shown by the listener	5.26%	15.79%	10.53%	26.32%	15.79%	26.32%	2.89

To justify the outcomes, the researcher did not explicitly mention the word 'empathy' but rephrased the question to 'Understanding of your situation'. From a general point of view, 82% of the respondents, both domestic and international feel that confidentiality is most important and attach the highest priority with a score of 5.71. The most interesting point was that the second priority with a score of 3.58 went to 'Understanding of your situation'. This means that after confidentiality, empathy was the key constituent the respondents felt would end in a positive outcome. Accessibility to counselling services and Anonymity then followed in priority with a score of 3.31 and 3.11 respectively.

Sympathy being shown by the listener came in fifth position. Note that a clear distinction is made between sympathy and empathy. Whereas empathy came in 2nd, Sympathy comes in a distant number 5. It demonstrates that the respondents just do not want a 'I am sorry' statement but want to be understood. Last in terms of priority came the 'Duration of the conversation' with a score of 2.74.
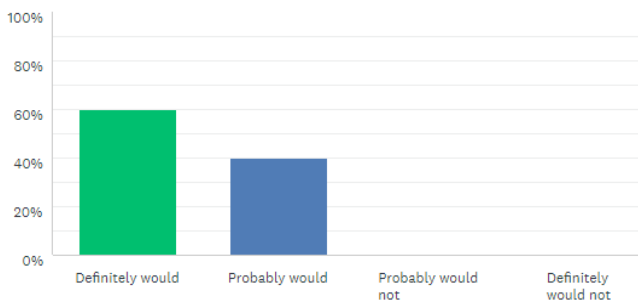
Figure 7. Respondent's preference to visit counsellor if anonymity is guaranteed

Finally, the last question enquires whether respondents would be more comfortable to chat with a counsellor if anonymity is guaranteed. Online chat facilities provide anonymity and this is their key strength. As can be seen from Figure 7, 60% of the respondents would definitely chat with a counsellor if anonymity was guaranteed.

4.2 Statistical Analysis – Interview Results

When asked if people would prefer to reach out to friends and family, the practicing counsellor did mention that there are so many cultural, psychological, and societal factors that come into play. Some people will reach out to a counsellor before speaking with friends or family, because speaking with a counsellor seems safer in terms of privacy, or they see a counsellor as having an expertise they are seeking. Others see counselling as something unfamiliar, something that indicates they have a mental problem that feels unacceptable, and they might reach out to friends and family, or they might not reach out to anyone at all.

On the issue of whether there were any reservations individuals might have, the counsellor alluded to the fact that there are many potential reasons ranging from the individual's personality to familial, cultural, and societal norms, to access issues, that can all cause people to shy away from visiting a professional counsellor.

The practicing counsellor also mentioned that 'Counsellors gravitate toward orientations that they believe are most helpful, and these orientations will determine specific techniques and methods they use to help their clients. In general, however, there are basic steps to counselling, the first of which is about developing a client-counsellor relationship or rapport. This relationship is developed based on confidentiality, advocacy, empathy, and a belief in the client's ability to move in a positive direction according to their own value system'.

When the same Counsellor was asked if it would interest her to have a counselling outcome that could be measured she responded categorically that 'Yes, any increased potential for measuring counselling outcomes can only help to develop the field, which means that more effective help can be made available to clients based on quantifiable evidence'.

On the most important topic of Empathy in counselling, the practicing counsellor without a doubt put Empathy at the forefront of counselling saying 'Empathy is arguably the most important ingredient in counselling. Without empathy, a counsellor cannot begin to understand a client's perspective and perception of the world, they cannot attempt to understand the experiences of the client, which means they cannot provide valuable insight and authentic care, and that results in an inability to support a client's progress. Empathy is at the heart of every successful counselling relationship'.

Finally, on the issue of counselling undertaken by volunteers at crisis and distress centres, the practicing counsellor was categorical that online chat counselling could extend the reach of counselling services which would add value from a socio economic perspective. She went onto add 'that there is recognition that humans need to be able to seek support in order to get through emotional/psychological crisis situations. It makes practical sense that these centres must often be manned by volunteer counsellors, but that should mean that volunteer counsellors are receiving excellent training and support, so that they in turn can provide adequate support to potential users of the services being provided'.

4.3 Case Study – Online

There are now various case studies of various interventions that undertake online counselling. More and more state and city authorities are turning to online counselling which provide much needed 'first-line' relief for various categories of their people who fall under their jurisdiction. Majority of these interventions are geared towards the youth as emotional distress amongst the youth can have a lasting negative impact.

One successful online counselling intervention is the one provided by the Alberta Authority in Canada. Serving the youth in Calgary, which is one of Canada's large metropolis is an online program called Connecteen, that

forms part of the Authority's Distress Centre. Connecteen provides the youth with a platform where they could seek assistance and connect to a 'peer' who would then endeavour to understand the issue in a non-judgemental manner. Moreover, the services are totally anonymous.

A team of youth volunteers who are trained by professionals runs the intervention services. The main objective of the intervention is not to direct the youth on what to do but to encourage them to make safe and sound decisions including getting in touch with a resource at the distress centre or any other adult that they are comfortable with. In addition, the voluntary services that are offered by the youth for their fellow in-need youth offers a space for the volunteers to not only provide service but also garner key listening and understanding skills, which increase their empathy levels.

5. The Developed Solution

From the study carried out and especially the results derived from the statistical analysis, a solution was designed to put into practise the output derived from the study.

5.1 System Workflow – Design and Key functionalities

One of the key areas that was brought to the fore during the requirements analysis and indeed from the responses to the counsellor's questionnaires was that there was a structure or a process that could be followed during a counselling session. Through this process, the chances of getting a positive response are greatly enhanced. This structure can be enhanced by the adoption of Intentional interviewing and counselling.

'Interviewing' is used in gathering information which can then be used for arriving at the best possible solution to the client with a view to bring solace to them resulting in a positive outcome or have them referred to professional help. Counselling on the other hand, builds on the interviewing process where the counsellor listens to the client and 'works' with the client to develop an understanding with him/her on how best to tackle a challenge or an issue. Finally, psychotherapy requires more in-depth interviewing and counselling skills which can be more long-term and can involve treatment with medications [10].

Counsellors play a key role in the process even if they spend a short time with the client. There is now a science behind the process of counselling a client. As counsellors go about their business of making the client heard and respected, they can get the client to reciprocate positively in an environment of trust and flexibility. This way of counselling is what is referred to as intentional counselling. With intentional counselling, the client can be persuaded to contemplate on his issue with more resilience and in the process strengthening self-efficacy.

With a higher level of self-efficacy, the client can now realize self-actualization where they feel good and hopeful about themselves. Empathy plays a key role here for self-actualization demands that the counsellor understands the client in the process. The process exists and operates in a multi-faceted environment where culture and age as well as the social structure plays a key role and both the counsellor and the client have a common goal in this regard.

Therefore, to realize intentionality, resiliency and self-actualization there exists a methodology that then provides the skills to the counsellor. This is where the 'Microskills Hierarchy' can be incorporated by the counsellor in his/her activities. The 'Microskills hierarchy provides the counsellor with the required skills to direct an interaction with a client and in the process can let the counsellor predict the responses from the client thereby bringing some control to the process. This results in a positive outcome to the client.

As mentioned in Figure 8, the microskills pyramid has at its base ethics, multicultural competence and wellness. The next level in the microskills pyramid is 'Attending behavior' after which follow a set of basic listening sequence. 'Attending behavior' and the basic listening components form a strong foundation for the other skills above in the pyramid including the five-stage structure explained further [10].

The notion of empathy is key in the basic listening sequence that involves questioning, observations and summarizing. It is also very important that the counsellor paraphrases certain responses from the client with a view to reflect back the client's feelings. In this way, the client feels that he is indeed being listened to and that there is focus from the counsellor [10]. The proposed system borrows strongly from the basic listening sequence section of the pyramid as paraphrasing a client's response is key to not only to confirm what the client said but also as a channel to get more information.

The stage above the listening sequence comprises of five sub stages that form the 'Interview Structure' as shown in Figure 8 which assists the counsellor to make the information gathering process a more meaningful process which will eventually make the counselling session a more complete process. The five stage model comprises of empathic relationship, story and strengths, goals, re-story and action. The initial stage is the emphatic relationship that the counsellor endeavors to establish with the client for example in the manner in which he/she initiates the conversation.

Story and strengths are where the counsellor in conjunction with the client endeavor to identify the problem clearly and seek out any strengths that the story may have. It is from the identification of the story that goals can be set. The re-story stage is basically where the counsellor tries again in conjunction with the client to get alternatives to the issue at hand. Once the story and the goals are set, then the final stage is where the counsellor and the client decide what action can be taken so as to arrive at a positive outcome.

After the five stage Interview Structure, the 'Empathic confrontation' stage can be incorporated into the solution design. Many clients who seek counselling services are

normally stuck and do not know how to achieve self-efficacy or how to change their situation in order to achieve a positive outcome for the issue they are facing and they look to the counsellor for alternatives for which they can take action on [10].
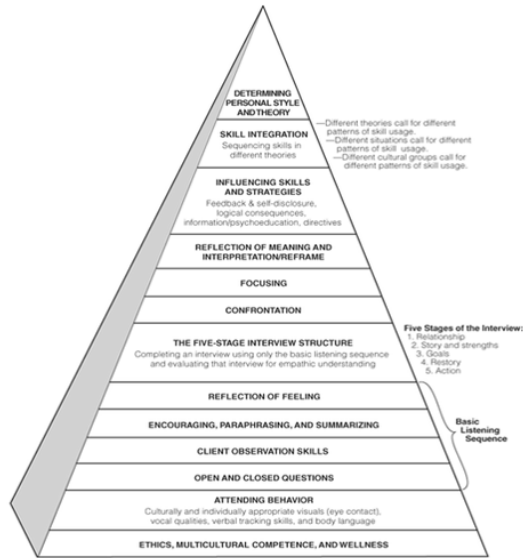
Figure 8. The Microskills Pyramid

In addition, The Empathic confrontation stage is where the client is gently influenced to analyze his or her own story and see any discrepancies with the goal and that this analysis will spur the creation of new alternatives and increase self-efficacy. This stage is not about going against the client or forcing him/her to adhere to an alternate story but rather working with the client. Confrontation also assists in the reflection of feelings and is particularly helpful when the client is undergoing mixed feelings. It is here that paraphrasing, for example of the thoughts becomes important and the counsellor could say "("on one hand, you feel . . . , but on the other, you also feel . . .") [10].

From the emphatic confrontation stage, the 'Focusing' step of the Microskills framework is where the clients' stories are seen from different angles thereby enabling the counsellor to encourage the client to think of new alternatives via restorying, for example. By looking at the various angles, the client can appreciate the many factors influencing the issue being faced. Thus any confusion can be thought about through open or closed questions.

One of the most important aspects of the 'Focusing' stage is that the counselling should bring attention to the counselling session and predicting what the client is going to say next. This can be achieved by pushing the client to let the counsellor have more information. For example, "So you didn't get along with the sales manager. I'd like to know a little more about him." "How supportive has your family been?" can effectively inform the counsellor on how strong the client's family relations are, for example or how strong his/her support structures are. Focusing can basically awaken the internal forces affecting the client and through this process the client can then be encouraged to write his new story and formulate a plan of action [10].

5.2 System Design

One of the key goals of the study was to leverage the study findings into designing and building of a system prototype consisting of a chat system. It is imperative from the study that any online chat service must be able to segregate a session between a Counsellor and his 'Client' – an individual who has been able to connect to the service successfully. These sessions should be session-specific that is, there should be no confusion between one session and another as this could lead to misinformation for the Client, which could be disastrous.

Integration with an external system providing NLP capabilities as well as Artificial Intelligence can be integrated via the Applications Programming Interface (API) methodology. This is the most cost effective method of integrating an already established inference engine into an online chat service. This cost effective methodology would save on development costs and only requires API competencies.

The proposed system should be able to store data into, for example, a database that stores data from within and from an external system. Figure 9 illustrates the conceptual design for an online chat service.
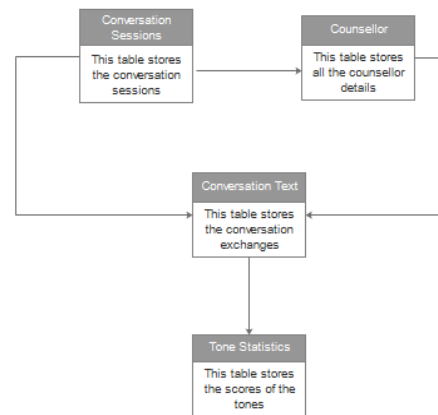
Figure 9. Conceptual Database Design

A scoring mechanism has to be put in place and a formula deduced that will then perform computational analysis on the data it receives from the external system thereby measuring the adoption of empathy.

In addition, the system must address non-behavioral external constraints and which form the intangible

requirements. Such non-functional requirements mainly concentrate on how well the system does as compared to what the system had been designed for. This refers to, for example, how the users will interact with the system in terms of navigating through it or whether a plan has been set up for the system design and how well it delivers as per the initial needs-assessment.

Another key feature of the solution should be the availability, confidentiality and integrity of the system and the data contained therein. Any malicious person or system must not interfere with the system. Security is key as the system deals with sensitive data and therefore security features should, be incorporated and are critical.

As a counsellor proceeds with dispensing counselling services, it should be possible for him/her to be guided on how to structure a response back to the Client. In this way, the Client can be encouraged to think of alternatives which would help him/her set goals and corresponding actions to achieve these goals.

5.3 System Design – Integration of IBM Watson

The authors undertook research of various solutions that can integrate with the proposed solution and can provide Artificial Intelligence(AI) and machine learning(ML). After thorough research it was noted that IBM Watson provided a convenient solution and could be integrated into the system design.IBM Watson which came into prominence in 2011, is well suited for the system with two of its core modules 'IBM Watson Assistant' and the 'IBM Watson Tone Analyser' most suited. All configurations and setups for IBM Watson are done on the IBM Cloud (which was formerly called 'Bluemix').

IBM Watson's prominence came in the year 2011 when the solution was put to test in the 'Jeopardy' show that pitted two former grand champions, Ken Jennings and Brad Rutter. IBM Watson won the 'Man Vs. Machine' challenge. To achieve this, IBM Watson had to decipher complex unstructured data and thereafter undertake processing of such data thereby giving them structure in order to return answers with a high confidence score [12].

IBM Watson also has over the years built on its conversation system and has now incorporated other services with its current service catalog now offering Text to Speech, Discovery Service and the Tone Analyser. Through NLP, certain keywords and whole paragraphs of sentences can be analyzed thereby providing lexical services.

The IBM Watson Assistant's NLP can process the conversational texts received by the clients via chat messages and then provide adequate responses which are then processed into statistical information with the hope of improving client – counsellor interaction.

The responses, which can be configured in the IBM Watson system act as benchmarks, and can act as hints for the counsellor. These benchmarked responses can be based on the Microskills hierarchy and allow for IBM Watson AI

and ML functionalities to process unstructured data. Thus, a kind of a chat bot is created. However, due to the sensitive and fragile nature of counselling, it would be prudent for the responses not to be delivered to the client directly but via a counsellor bearing in mind the complexity of the 'Microskills hierarchy'.

Another interesting feature of the IBM Watson Assistant is the functionality where all responses that are given out by the engine are assigned a confidence level (0-1) providing context-supporting applicability measurements to all responses the system gives out. What this means is that unstructured data ingested to the Watson Assistant are analyzed and compared to the benchmark responses configured therein and if the input received is very far-out from the benchmark, then the confidence level is low and if it is very close to the benchmark, then the confidence level is high.

This confidence scoring mechanism can greatly increase the effectiveness of the solution. In addition, the IBM Watson Assistant serves as a source of artificial intelligence that can be trained and re-trained with the aim of making it more value-adding to the solution. This is even more relevant where low confidence sentences can then be re-trained.

The second module of the IBM Watson catalogue incorporated into the design for the solution is the 'Tone Analyser' which is mainly used to support conversations and is therefore appropriate for this solution. Through this functionality, the client's feelings and emotions can be monitored and the client's chat exchanges can be grouped into tones that denote sadness, excitement and even frustration. On the other hand, the tones from the counsellors could be grouped into polite, impolite and whether they are sympathetic. Table 2 highlights the tones that are output from the Tone analyser service. These measurements come in the form of scores between $0 – 1$ with 1 being the highest denoting that indeed there is strong evidence of a particular tone usage in a particular chat exchange. The empathetic tones as measured by the Tone Analyser's exchange of the counsellor are comprised of the 'Polite' and 'Sympathetic' tones.

Table 2. Tones output by the IBM Watson Tone Analyzer

Tone	Actor to be Monitored
Sad	Client
Excited	Client
Frustrated	Client
Satisfied	Client
Polite	Counsellor
Impolite	Counsellor
Sympathetic	Counsellor

5.4 IBM Watson Assistant – Configuration

Once connected to the IBM Cloud's IBM Watson Assistant portal, dialog workflow systems can be configured in order that the users can interact with the Watson assistant system. Figure 10 illustrates the IBM Watson Assistant tool configuration interface.
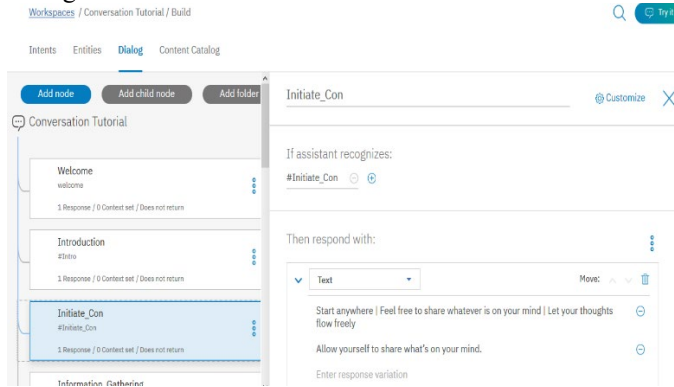
Figure 10. IBM Watson Assistant Dialog configuration Interface

Watson Assistant consists of a workspace which contains intents, entities and dialog flows. While Intents are 'focus points' that the workspace receives from the Client, entities refer to items or information that is emanating from the Client and that represent the Intents defined. Once Intents and Entities have been defined, Dialogs can now be defined. Dialogs are very important in that they are the ones that provide the responses and are dependent on the intent and entities defined earlier. The dialog builder (part of the Watson Assistant) assists the developer to connect the Intents and Entities to the responses.

The Intents are preceded by the sign '#' and each of the Intents have to be configured with some Case example chat exchanges that could be ingested by the Watson Assistant engine which would then form the data to be used by the Artificial Intelligence engine to formulate a response after pegging the exchange into one of the configured Intents. As this study focused on the emotional distress brought out by 'relationship issues' the following Intents were identified:

- #Initiate_Con - This intent refers to exchanges that gets the Client to start giving the problem
- #Intro - This intent refers to exchanges that pertain to the start of the conversation
- #Gather_Info – This intent refers to the Gathering of information and active listening that can occur interchangeably throughout the middle of the conversation.
- #fear - This intent refers to the statements that denote fear in a client

- #Life_issue - This intent details those client sentiments that denote life issues
- #sadness - This intent denotes the Client's sad sentiments
- #frustrated - This intent details the Client's Frustrated sentiments
- #Negative_change - This intent details the Client's negative change
- #Focusing – This intent refers to guidance to the Client towards a potentially helpful line of thinking once information has been gathered
- #right – This intent refers to the Client's willingness to accept the situation
- #Conclusion – This intent refers to a focus point leading to chat session closure in an empathetic manner.

As indicated above, a list of the Intents and related Case examples were drawn up for the purposes of this study, a full list of which can be referred to in Appendix A.

Once the Intents have been configured, the Dialog flows are then configured via the Dialog Builder available on the IBM Watson Assistant platform. Table 15 describes the dialog flows that were considered as part of the design. As highlighted earlier, this study borrows heavily from the Microskills hierarchy explained earlier. In the table, the OR in the responses column separate the various responses available to the counsellor to respond depending on the context of the chat discourse being rendered. As can be seen from the table, responses are pegged to an intent and form a dialog.

Table 15. Dialog Flows configured for the system

Rule (Intent-based)	Responses based on the Intent
If IBM Watson recognizes #Intro	Hi there, what makes you reach out to us? (If follow up text, 'Hi there' to be avoided) **OR** Hi there, what's on your mind? ((If follow up text, 'Hi there' to be avoided) **OR** Hi there, how can we help? (If follow up text, 'Hi there' to be avoided)
If IBM Watson recognizes #Initiate_Con	Start OR Feel free to share whatever is on your mind **OR** Let your thoughts flow freely **OR** Allow yourself to share what's on your mind.
If IBM Watson recognizes #Gather_Info	I hear you. That sounds difficult. You are saying(insert information shared by client), Go on.

If IBM Watson recognizes #Sadness	I am sorry you are going through this. It must be very difficult.
If IBM Watson recognizes #Negative_Change	You are feeling negative. And this is because you say that (insert reason for being negative), Is that right?
If IBM Watson recognizes #Frustrated	You feel frustrated. I sense this. So, you say you are frustrated because (insert reason why he/she is frustrated), is that right?
If IBM Watson recognizes # fear	Thank you for trusting me with this. You are saying (insert fear or scared emotion shared by client) because (insert information gathered from client). Can you tell me more about that?
If IBM Watson recognizes #Life_issues	(Restate problem expressed by the client), go on. You are brave to reach out./ (No need to always say "You are brave to reach out"
If IBM Watson recognizes # Problem	I'm happy to listen any time. I understand that this is difficult. What do you envision would make you happier?
If IBM Watson recognizes #Focusing	I understand that this is difficult. What do you envision would make you happier? **OR** This sounds difficult. Are there changes you can envision that would help you fulfil what you are looking for?
If IBM Watson recognizes #Conclusion and #right	I am glad that you yourself have come up with a solution to the issue. You are brave (How will you go about accomplishing this?) **OR** Even though the problem has not disappeared, you are finding ways to face it with positivity. OR That is so good to hear. I am glad that you feel better. Can I help you with anything else **OR** If you would like I could give you some info on counselling services in your area, Is that ok? OR Bye Have a nice day **OR** Bye, please feel free to reach out to us anytime.
If IBM Watson recognizes anything_ else	Not in Scope. Please follow procedure when responding. **OR** Nudge Client to rephrase the sentence. **OR** Probably, AI needs training on this

Once the intents and relevant case examples had been configured, the researchers in conjunction with a professional counsellor, undertook some tests on the configured IBM Watson Assistant to test the efficiency of the configured intents and dialogs. This efficiency measure was undertaken by analyzing the confidence score as received from the IBM Watson Assistant system. The confidence Score highlights how off the chat discourse (dialog) is from the pre-defined configured intent and the corresponding response. Table 16 in Appendix B shows the tests carried out and the results thereof. It is evident that the closer the unstructured chat discourse was to the case example then the higher the Confidence score was. This also proved that the Artificial Intelligence was operating as configured.

Moreover, it was also noted that the Artificial Intelligence analyzed the ingested chat discourse and thereafter assigned it a relevant Intent. For instance, when a chat discourse like 'I wish my days could be happier'was received by IBM Watson Assistant then the Artificial Intelligence analysed the data and assigned the '#Problem' Intent to it. Having analyzed the data it is apparent that the Client has a problem he would like help with. Correspondingly, the response for the '#Problem' Intent is ' I'm happy to listen any time. I understand that this is difficult. What do you envision would make you happier?' As can also be seen from Appendix B, the score for this chat discourse is 0.742. On another Chat discourse such as 'I have low confidence' this returns a Confidence score of 1 which is the highest attainable score because 'I have low confidence' actually exists as a case example for the 'Negative_Change' Intent.

5.5 IBM Watson Assistant Tone Analyser – Configuration

The second module of IBM Watson that was used for the system was the IBM Tone Analyser. The main objective of the study in terms of the Tone Analyser was primarily to get a sense of the level of empathy employed by the Counsellor as he goes about undertaking the counselling service. In the same light, the same module can assist to measure the efficacy of the counselling service delivery.

Tests were also carried out on the Tone Analyser. Table 17 in Appendix C highlights a chat exchange between a Client and a Counsellor whereas Table 18 displays the category of tones received from the Tone Analyser as well as the scores with 1 being the highest. Therefore, whereas the IBM Watson Assistant module 'throws back' to the counsellor a proposed response, the Tone Analyser analyses the counsellor chat exchanges and processes them into an emotion or a feeling together with its quantifiable measure.

Table 18. Test results showing Counsellor responses and relevant tones (emotions) and scores

User Id	Conversation Text	Tone Name	Score
Counsellor	Even though the problem has not disappeared, you are finding ways to face it with positivity.	Excited	0.70026
Counsellor	I hear you and you do make a lot of sense. What do you envision would make you happier?	Excited	0.787861
Counsellor	You say that you could spend more time with the people who care about you. That is a positive thought. You are brave. Go on.	Excited	0.500111
Counsellor	You say that you would not want her to leave you, go on.	Frustrated	0.665206
Counsellor	Bye, please feel free to reach out to us anytime.	Polite	0.935026
Counsellor	Hi there	Polite	1
Counsellor	I hear you. Are there changes you can envision that would help you fulfil what you are looking for?	Polite	0.734221
Counsellor	Okay you could reach our counselling centre at 0734-99999, Hope this helps?	Polite	0.574247
Counsellor	I hear you. That sounds difficult. You are saying that your girlfriend might break up with you. Go on.	Sad	0.522962
Counsellor	You are feeling negative. And this is because	Sad	0.515189
Counsellor	you say that you fear being alone. Is that correct?		
Counsellor	You say that you could spend more time with the people who care about you. That is a positive thought. You are brave. Go on.	Satisfied	0.783878
Counsellor	I am sorry you are going through this. It must be very difficult.	Sympathetic	0.787688
Counsellor	Feel free to share whatever is in your mind		
Counsellor	Thank you for trusting me with this. You are saying that you are scared of being rejected by her because you do not want her to leave you.		
Counsellor	This sounds difficult. Are there changes you can envision that would help you fulfil what you are looking for?	Sad	0.567876
Counsellor	Feel free to share whatever is in your mind		
Counsellor	Thank you for trusting me with this. You are saying that you are scared of being rejected by her because you do not want her to leave you.		
Counsellor	I understand that this is difficult. What do you envision would make you happier?	Sympathetic	0.734563

Statistical information is then derived via configured reports which provide information that detail, for instance which counsellor is achieving more positive counselling outcomes, which keywords or sentences achieve positivity as well as the progression of positive emotions as the chat conversation progresses. The statistics provided can be a key performance indicator for the counsellors and the various chat exchanges can be enhanced through the process of retraining the engine which in turn can produce positive outcomes.

The reports can also provide which Clients require escalation to a senior counsellor. This is especially

beneficial where volunteers are manning the 'chat' stations.

5.6 IBM Watson – API Design

The API methodology used is POST. The API processes data in a universally configured format and therefore data is exchanged accordingly in this format. For the purposes of this solution, the data is sent via the API in JSON and TEXT format. In addition, a REST (representational state transfer) API is also used. This is where the API uses, for example, a POST activity using existing technologies and protocols, for example HTTP. Most of the API scripts used in this solution have been provided by the IBM Watson platform.

5.7 Tone measurement with the goal of measuring empathy

Using IBM Watson APIs, the solution should be able to interact with IBM Watson and the results returned are received by the solution and displayed on the screen and stored into the database. For instance, when the API sends an exchange to IBM Watson Assistant then the 'chat bot' can send back a response with an appropriate confidence level that is then displayed on the screen.

In addition, when the counsellor ends the chat, then all the exchanges that are stored in the JSON file can be sent to the IBM Watson Tone Analyser service that then returns the tones found with their associated scores. These can then also be stored in the relevant table in the database and used for statistical purposes later.

The statistics can then be displayed using a report generator thereby also reducing developer costs and therefore allowing funds to be channeled to other more important areas like hardware acquisition for the volunteers. During the design of this solution, an open source reporting software called Reportico was deemed fit to be incorporated into the solution design. Reportico assists in the conversion of stored data into information. This information can be displayed in graphical format.

Once the IBM Tone Analyser data has been processed, the emotion together with the scores returned can be stored into the various database tables. These stored emotion measurements for a particular chat exchanges of a particular conversation are run through the F1 score mechanism, which outputs a harmonic mean thereby measuring the level of empathy. This mechanism can be integrated into the solution with the aim of using the F1 score, via the usage of precision and recall models to come up with the resultant empathy measurement as can be seen in Table 19.

Table 19. Components of Precision and Recall

True Positive (TP) (Total number of tones from the counsellor exchanges that are Polite and/or Sympathetic with scores more than 0.7)	False Negative (FN) (Total Number of exchanges made by the counsellor that have returned no tones from IBM Watson
False Positive (FP) (Total number of tones from the counsellor exchanges that are Polite and/or Sympathetic with scores less than 0.7)	True Negative(TN) (Total number of tones from the counsellor exchanges that are not Polite and/or Sympathetic)

In line with Table 19 the Precision and the Recall scenarios can be calculated as per equations 1 and 2:

$$Precision = TP/(TP+FP) \qquad (1)$$

$$Recall = TP/(TP+FN) \qquad (2)$$

Equation 3 below calculates the F1 score

$$F = 2PR/(P+R) \qquad (3)$$

Where 'P' denotes Precision and 'R' stands for Recall. As an example, from the scores derived from the IBM Tone Analyser in Table 18, the emotions and in turn empathy can be measured. As explained earlier, the F1 score is measured by the Precision and recall components. As per Table 19, Precision can be calculated as explained below:

$$Precision = \frac{(Total\ No.\ Polite + Sympathetic\ Tones > 0.7)}{(Total\ No.\ of\ Polite + Sympathetic\ Tones > 0.7) + (Total\ No.\ of\ Polite + Symphatic\ Tones < 0.7}$$

which equals to: $5 / (5+1) = 0.8$

While Recall can be calculated as explained below:

$$Recall = \frac{(Total\ Number\ of\ Polite + Sympathetic\ Tones > 0.7)}{(Total\ No.\ Polite + Sympathetic\ Tones > 0.7) + (Blanks)}$$

which equals to: $5 / (5+4) = 0.5$

Therefore, as per Equation 3, the F1 score can be translated to

$$2 * \frac{0.8 * 0.5}{0.8 + 0.5} = 0.61$$

A similar case study was carried out and presented at the 2012 Asia Pacific Signal and Information Processing Association Annual Summit and Conference, Hollywood, CA that leveraged on the F1 score to measure empathy in Motivational Interview based psychotherapy. The Case study used an N-gram language model that strategically

classified empathic versus non-empathic utterances and then this made up the Precision and recall elements needed for the F1 score [15].

This study complements this and other studies by using 'Intentional Interviewing' skills and adopts the F1 score computational analysis to analyse the emotional tones by the Client and the Counsellor that underpin a chat discourse which constitutes unstructured data. In addition, to aid the counsellor in the dispensation of 'empathetic tones' it would be prudent to adopt machine learning thereby providing responses to the Client as the Chat discourse continues.

6. The Developed Solution

The solution needed to fulfil the requirements that were gathered at the needs assessment stage. The Use Case in Appendix D showcases the designed system. All data flows within and from external integrated applications, for example, IBM Watson Services, had to be underpinned by a simple user experience interface design. For instance, upon clicking 'End Chat' the system would immediately initiate the empathy measurement engine that would deduce the F1 scoring score and save the details on the database.

Reporting was another area that was key for the researchers as it assists to showcase the output of the chat discourses statistically. The data stored in the database had to be translated into meaningful information and displayed graphically on the screen for decisions to be undertaken on whether self-efficacy was being achieved on the part of the 'Client'. Moreover, it was critical to filter out those sentences and hence chat exchanges that required retraining by the inference engine. Another area where reporting was key was in 'filtering' those volunteers who got empathetic counselling right and who could thereafter be used for train the trainer initiatives, amongst other things.

For the purposes of fulfilling the needs-assessment requirements, the system was implemented in the PHP Hypertext Preprocessor programming language, the main reason being a system that would be easily supported by a large number of software developers and the fact that the system required an interface that facilitates chat exchanges to occur between the Client and the counsellor. This kind of architecture requires server side processing that also then seamlessly connects to the database. The other strong reason for PHP to having been selected was due to the fact that the system developed required the handling of multiple sessions between the various stakeholders who might be spread out geographically. As a result, the system needed to have a web interface in order to leverage critical ICT technologies like Hypertext Markup Language (HTML). PHP can effectively be embedded with HTML.

Javascript, a web programming language, made the HTML web pages more interactive. Javascript can easily be embedded into PHP and HTML and works on the Client side and therefore some of the activities, for instance of the

chat engine are processed with greater speed and lowers the load on the server hosting the web system. This is perfect for low budget implementations like this one and is appropriate in resource-deficient implementations.

6.1 User Interfaces Designed

Most of the screens that have been designed reflect the aspect of 'minimalism'. The user starts by putting in his name in the 'Name' field after which, he presses the 'Enter' button to move to the next screen. Figure 11 shows the logging page seen by a client.

Information is made available to the client for instance informing him to wait as a counsellor connects with him/her. In addition, the institution's twitter feed has been incorporated at the top of the page as a 'ticker' and the client and/or counsellor can click on any one of them for more details. The ticker can provide motivational information or any other information that the institution deems fit.

In comparison to the Client's interface, the counsellor has to enter his/her name and include the prefix 'VC-' to inform the system that he is logging in as a counsellor as can be seen in Figure 12
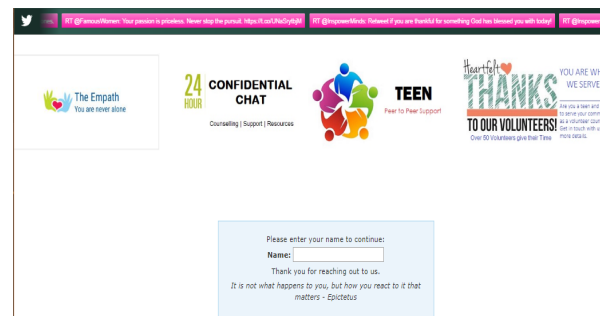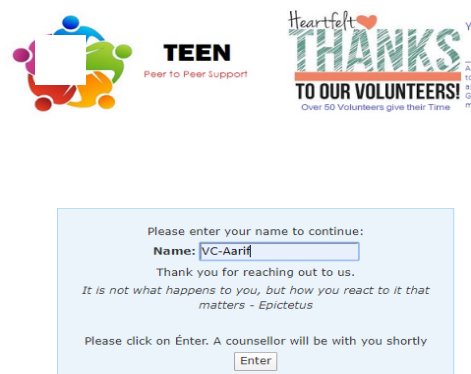

Figure 11. Landing page for Clients

Figure 12. Landing page for Counsellors

After the user clicks on the 'Enter' button, he/she will be forwarded to the screen on Figure 12 or 13 depending on whether the user is a Client or a counsellor as it is here that the Client and the counsellor shall have different interfaces. Figure 13 primarily is for the Client. It is here that the user shall wait for a response from a counsellor.

Apart from displaying the banner as explained above, the screen welcomes the user and displays the name of the user. The page also has a Text place holder where the Client can type in the chat exchanges he/she wishes to send to the counsellor. The user clicks on the 'Send' button to send the text that he or she has typed in. This is in line with normal messaging user interfaces.

Both the Client and Counsellor screens have been designed to display the contents or the exchanges from both the client and the counsellor as soon as it has been typed and this window refreshes every 3 seconds so that the user can see a 'live' stream of the exchanges being typed.

The Counsellor upon clicking the 'Enter' button on the screen displayed in Figure 12 is directed to a counsellor-specific screen as displayed in Figure 14. The counsellor will notice that there are more screen elements displayed than those that appear on the Client interface. The first thing for the counsellor to do is to connect with a Client who has logged in and is waiting for a Counsellor to attend to him/her. The counsellor can do this by clicking on the drop-down button that appears before the 'Click here to join with Client' button. Upon selecting a conversation ID of a Client and clicking the button 'Click here to join with Client' the counsellor is now paired with the Client. Figure 15 shows this process.
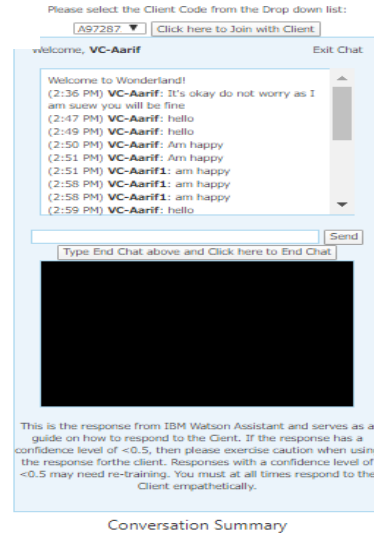

Figure 13. Client can exchange Chat Messages
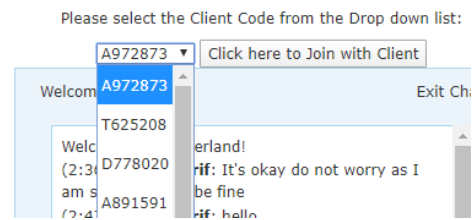

Figure 14. The Counsellor's screen

Figure 15. Counsellor pairing with a Client

As soon as the Counsellor and the Client are paired, the chat exchanges of the Client are displayed as shown in Figure 16
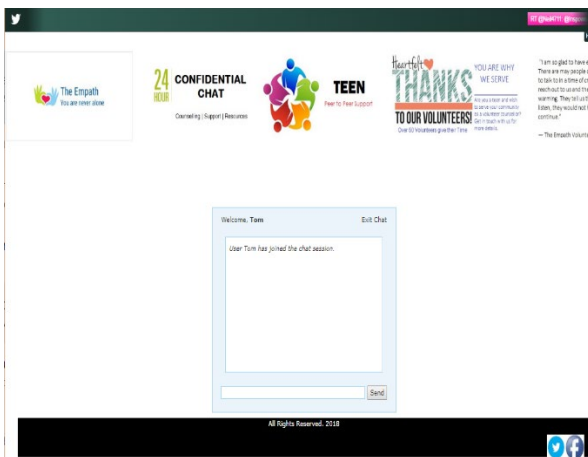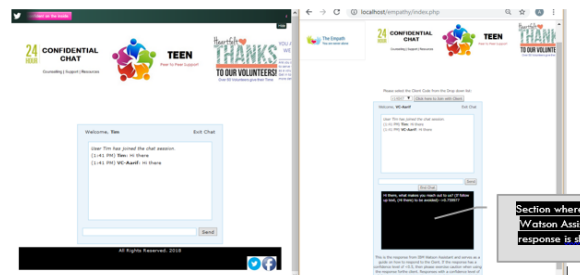

Figure 16. Chat exchanges displayed on the Client and counsellor screens

A key feature of the system is the integration with IBM Watson and just below the text placeholder where the counsellor types in his/her message there exists as shown in

Figure 17 a section with a black background and it is here that the system displays the probable response that the counsellor could give to the Client.
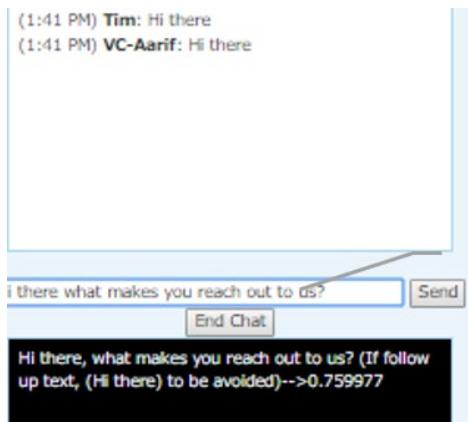
Figure 17. The Counsellor uses the hint to respond to the Client

As earlier mentioned, the hint is received from the IBM Watson Assistant engine. For example, in Figure 17 the Client says 'Hi there' and the IBM Watson Assistant response that could be used and that is displayed is 'Hi there, What makes you reach out to us? (If follow up text, (Hi there), to be avoided) 0.759977' As well as the response hint for the counsellor, there is some information on how the responses should be used, for example, in Figure 17 the words 'if follow up text, (Hi there) to be avoided', simply denotes that if it is a follow up text message, then the 'Hi there' could be avoided.

Every hint that is received from IBM Watson comes with a corresponding confidence level that ranges between 0 and 1 which is a statistical benchmark to a predefined configuration. For example, in Figure 17, the score of 0.759977 translates to a hint that has returned a high score Figure 18 is the Client's screen where the counsellor has opted to use the response from the IBM Watson Assistant as the confidence level is high enough to be used in this context.
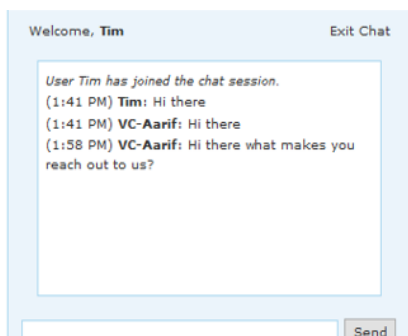
Figure 18. Client screen showing the response from Counsellor

Once the Chat conversation has been completed, then the Client or the counsellor can end the conversation session. The Counsellor has the facility to measure the outcome of the session and this can be done by clicking the 'End Chat' button. This information is processed and then sent back to the system by IBM Watson's Tone Analyzer. Figure 19 shows the screen that appears upon clicking the button. An example of the conversation summary that would appear will be shown including the F1-score and the relevant tones and their scores as per the chat discourse.

Figure 19. Displaying the Tone Analysis as well as the F1 - score

6.2 Statistical Reporting

Statistical analysis and reporting is a key component of the solution and counsellors and especially senior counsellors. Reportico, which is a reporting solution was implemented as an add-on for statistical reporting. Reportico makes use of the PHP technology and extracts the data from the database and represents it graphically and/or in tabular format.

The landing page of Reportico has a section for the administrator to put in a password in order for him/her to access the administration functionality where reports can be configured. This is critical as the reports detail chat exchanges between a counsellor and a Client and as such security has to be guaranteed. Figure 20 displays the screenshot for the admin page.
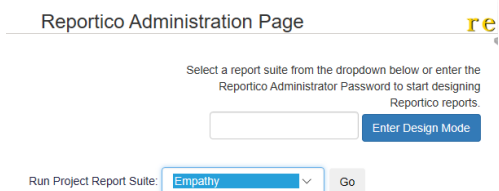
Figure 20. Reportico Landing Page

The reporting facility also provides the administrator to create reports. These reports are populated from the database via specific SQL query commands. The following are the reports that have been configured and provide the relevant statistics.

Average – Tone Analysis (Global)

The 'Average – Tone Analysis (Global)' highlights the average of all the tones irrespective whether the conversation is from the client or the therapist. A kind of a 'Gross National Happiness' index for the counselling entity. Figure 21 illustrates the report.
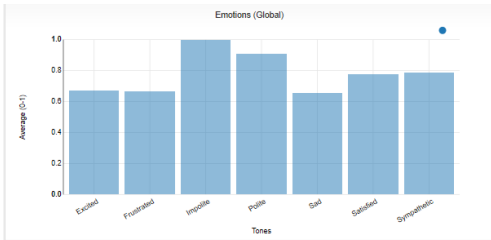

Figure 21. Average – Tone Analysis (Global)

In addition to the report showing the total emotion scores, it can also display the scores per conversation ID which translates to a particular chat discourse. Figure 22 displays the graph, for example, for conversation ID.
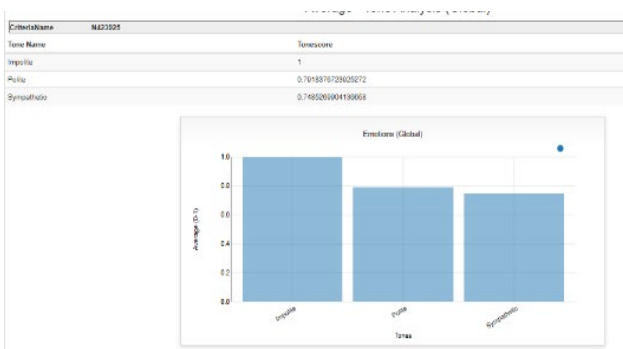

Figure 22. Average –Tone Analysis (Per Conversation_ID)

Volunteer Tones – Global

The 'Voulnteer Tones – Global' report highlights the sum of tones and the relevant scores for such tones as received from IBM Watson Tone Analyzer. This report highlights the tones and the relevant scores as per the conversation undertaken by a particular counsellor. Figure 23 illustates the tones in a tabular format while Figure 24 illustrates the same in graphical format, for example, of volunteer counsellor Aarif (Counsellor). Whereas Figures 23 & 24 display a Volunteer's emotions on chats globally Figure 25 shows the emotions of the counsellor for a particular conversation exchange.

Figure 23. Volunteer Tones for a counsellor (Tabular format)

Figure 24. Volunteer Tones for a counsellor (Graphical format)

**Figure 25.** Volunteer Tones per Conversation ID (Form format)

Tone Analysis – Progression

The 'Tone Analysis – Progression' report highlights the change in the tone score of particular tone(s) in a conservation. These tone scores are provided by the IBM Watson Tone Analyzer API. The information gathered can assist a counsellor to gather information on how best to approach a conversation the next time.

For example, Figure 26 shows a conversation containing the tone 'Sad'. The Y-axis contains the scores that have been attained over a specified period. In this way, the progression of a certain tone can be measured over the conversation's exchanges. This report only highlights the client's exchanges.
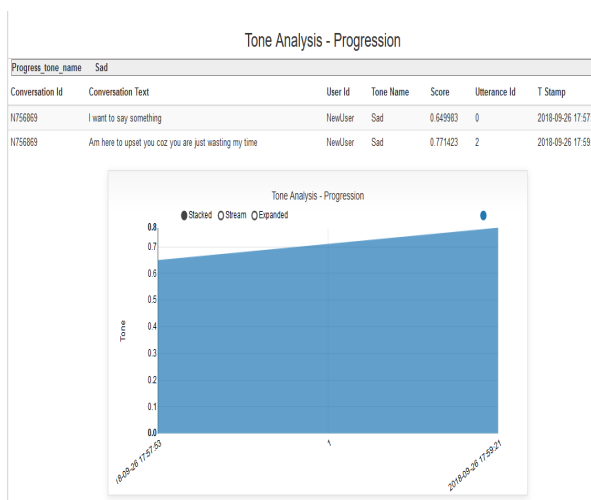
Figure 26. 'Tone Analysis - Progression' report as it is displayed on the screen.

F1-score Calculations

The 'F1-score Calculations' report highlights the score that has been calculated by the system for the various conversations. This report can also be filtered via a specific conversation ID.

For example, Figure 27 shows a graphical representation of conversation containing the F1-score where the Y-axis is the F1-score and the X-axis denotes the conversation ID.

Figure 27. F1-score represented in a tabular and graphical format.

7. Conclusion

The main goal for this solution was to implement an online platform that would give users (known as Clients) who are experiencing issues ranging from mental anguish to get in touch with a counsellor who would then listen to them and

try and make them feel better if not succeed in bringing a positive change. The system goes a step further by incorporating a measurement tool that measures the tones that are contained in the chat engine thereby bringing positive outcomes and ensuring that counsellors deliver counselling services in an empathetic manner.

During the requirement analysis, design, implementation and testing phases, the researcher had access to counselling information from a counselling practitioner who provided the much needed knowledge including in the area of Intentional interviewing.

The designed solution incorporated Natural Language processing (NLP) capabilities as well as artificial intelligence in order to decipher the content it receives and compare with a configured benchmark. This is achieved by integrating the solution with IBM Watson. IBM Watson provides a well-defined natural processing capability with a well-known artificial processing platform.

Initially, the researcher's thought process only focused on measuring the results from IBM Watson Tone analyzer as the service returned the scores of the tones from the tone exchanges. However, it became apparent that the counsellors for whom this system is primarily focused on, could as well be volunteers and therefore should be guided on the approach to take during the counselling discourse in order to achieve a positive outcome for the Client. Therefore, it became necessary for the system to integrate with IBM Watson's Assistant service which is basically a 'chatbot'. However, responses from the IBM Watson 'chatbot' were designed not to be communicated directly to the client but to the counsellor providing them with 'empathetic hints'.

Working with the IBM Watson Assistant posed challenges as the client's exchanges initially were not correctly interpreted by the 'bot' and therefore a lot of retraining had to be undertaken. This retraining lasted for almost four weeks where chat exchanges were 'cycled' through the bot until a reasonable response was given by the bot and to the satisfaction that it was appropriate bearing in mind that the IBM tone analyzer service had to give more empathetic scores.

On the reporting side, emphasis was put from the onset that information be generated graphically and the reportico platform was the most suited and was selected. The SQL queries used to generate the reports took some time and especially the section on filtering the data in order that the users could actually view data on a specific conversation ID, for example.

The system interfaces had to be simple and reflect minimalism with no clutter. During the design and implementation of the interface, it was recognized that the Clients are logging in to seek solace and a positive outcome to their issues and hence the system shall require simple interfaces with light colour tones.

The system delivered the goals and objectives which was to measure the empathy levels of the counsellor as he/she went about delivering the counselling sessions. However, due to research and system time constraints the IBM Watson Assistant did not have enough time to train

and output responses with a higher confidence level. It definitely would be more prudent to retrain all the responses as well as more case examples on the various Intents.

This solution focused on one of the topic areas that can result in mental anguish by Clients and touched on relationship issues. The Intents and Dialogs and resultant responses designed on the two IBM Watson modules (Watson Assistant and Tone Analyzer) were designed with this in mind. With more research and training more complex scenarios could be handled, for example, to mitigate or inform the counsellor of a Client having suicidal thoughts.

It is imperative that increased retraining of the Watson inference engine is required. This could be undertaken by analyzing more and more chat exchanges received from Clients and monitoring the responses from IBM Watson. The Confidence levels are key here. The goal should be to make sure that chat exchanges received from Clients fall within the correct IBM Watson Intent and hence the correct responses given back to the counsellor. At the same time, the responses configured into the IBM Watson engine could be tweaked or modified to give Counsellors more 'real-life' responses.

On a more technical front, the system Interface could be enhanced by allowing multiple rooms to be configured. As more and more Client scenarios could be configured responding to the various issues, then a functionality could be added where a head counsellor could 'transfer' a client to a room dedicated for a particular client affliction or issue being faced by him/her.

In addition, Currently, the system outputs and stores the tone names and scores received upon the counsellor clicking on the 'End Chat' button. However, further developments could factor in a live display of various contents including the F1 score. This could benefit the senior counsellor as he/she could instantly monitor the performance of the counsellors under his watch.

There could be improvements in the area of statistics where more reports could be designed, for example, which Client chat exchanges could be set as case examples thereby providing retraining data cum material for the IBM Watson inference engine.

This solution should be a learning curve in terms of the manner in which to approach human conversation which is an important factor in counselling and in particular Intentional Interviewing.

Finally, a detailed review should be undertaken in the area of Cybersecurity and how to secure the solution from man-in –the middle attacks for instance as well as other malicious activities. Sensitive material may be transmitted during a chat discourse and therefore it is important to secure the solution from malicious actors.

Appendix A. Intents and related Case examples

For every Intent, case examples have to be configured in order for the Artificial Intelligence engine of Watson Assistant to ascertain which Intent a certain chat exchange best falls in. More examples can be added while existing ones can be fine-tuned in order to realistically better pair the exchange to its Intent. During the design phase, a list of the Intents and related Case examples were drawn up and this can be seen in Tables 3-14 below:

Table 3. Intent #Initiate_Con Details and case examples configured

# Initiate_Con (This is to get the stakeholder to start giving the problem)	
Everything seems unclear	I do not what's happening
I am not feeling too good	I don't know
I am not really sure	I don't know how to put my thoughts forward
I am not sure what is wrong	I'm having a problem I need help with
I am not too sure where to start	I need help as I am going through a hard time.
I do not feel too well	I would like to talk

Table 4. Intent #Intro Details and case examples configured

# Intro (This is for the introduction - start of the conversation	
Can someone help me?	I am in trouble
Good afternoon	I need advice
Good evening	I need assistance
Good Morning	I need help
Hello	I need someone to talk to
Hi, Can you help me?	

Table 5. Intent #Gather_Info Details and case examples configured

#Gather_Info(Gathering information and active listening can occur interchangeably throughout the middle of the conversation.)	
afraid of failure	no belief
facing problems	no options
fear of things not working	not going accordingly
feeling down lately	not moving
guess	not myself
guess was	not successful
I am having some issues	Problem
I believe I was not prepared	Scared
I feel defeated by the situation	some issues
I feel overwhelmed by the situation	The situation overwhelms me
I was scared that I would fail the exam	Things not working out
Life	Things do not seem to be working for me
miserable	very worried
My friends rebuked and I felt dejected	

Table 6. Intent #fear Details and case examples configured

#fear(This contains all the statements that denote fear in a client)	
I am afraid of failing	I do not wish to fail.
I am petrified	I fear that things will not go according to plan

I am scared	I feel scared whenever I try.
I am terrified at the thought of things not working out	I will lose someone
I am worried	What if things are not successful?
I am worried of things not working out.	What if things do not go according to plan?

Table 7. Intent #Life_issue Details and case examples configured

#Life_issue(This intent details those client sentiments that denote life issues)	
I have been through very hard times in life	Life is unfair
I see no value in life	Life seems to be moving in the wrong direction
It started last week when my friend and I got into a fight	Life sucks
I wish life would not be difficult.	My life is complicated
I wish my life was simple	My life is not worth living.
Life is a mess	

Table 8. Intent #sadness Details and case examples configured

#sadness(This intent denotes the Client's sad sentiments)	
I cry at the thought of that, at the thought of being alone without her.	I feel melancholy
I feel blue	feel miserable
I feel dejected	I feel sad
I feel depressed	I feel tired
I feel down	I feel unhappy

I feel gloomy	She has been distant lately and I feel scared she will reject me and abandon me.
I feel lonely	She says that she found someone else

I am having many issues	There are so many obstacles
I am troubled	Trouble
I have come across many hitches in my life	

Table 9. Intent #frustrated Details and case examples configured

Table 12. Intent #Focusing Details and case examples configured

#frustrated(This intent details the Client's Frustrated sentiments)	
am frustrated	I have no options
bad situation	It's impossible to find time
I feel stuck	Things do not seem to be working
I have no alternatives	

Table 10. Intent #Negative_change Details and case examples configured

#Negative_change (This intent details the Client's negative change)	
Feel worse	I think I am not confident
Have not been myself	Not myself
I have low confidence	Yes, because I would never have to be alone.
I have no belief	

Table 11. Intent #Problem Details and case examples configured

#Problem(This intent details the Client's Problems)	
Dispute	Issue
hitch	Obstacle
I am bothered	There are so many hitches in my life

#Focusing(Guiding the client toward a potentially helpful line of thinking once information has been gathered)	
I can imagine things could be better	I have to understand that I cannot get everything
but may be that's because	I know I have to try to believe in myself, believe that I am lovable. Even if she's not the one for me.
I can't go on this way	I wish things could be happier
I have to find a way forward	I would like to find someone to love
I have to find a way out of this	Things seem impossible the way they are right now

Table 13. Intent #right Details and case examples configured

#right(The Client shows willingness to accept the situation)	
Concur	I have to happy rather than worry all the time.
have to accept	I need to go back to doing the things that make me happy rather than always worrying that she will reject me and abandon me.
have to be happy rather than sad	nothing else that can be done.
I agree	that is the way it is

I agree with you	Yes that's right
I have no other choice.	The correct thing for me to do is to move on with life

Table 14. Intent #Conclusion Details and case examples configured

Conclusion (All encompassing)	
Agree	I will take some time to feel better
another session	I will take some time to feel good
Bye	I would like more time to chat
do not mind to be referred	I would like to end this chat
end session	I would not mind you to refer me to someone
explore what to do	love to see some change
I can come for another session	want to know more
I feel better	Sayonara
I feel nice after talking to you	Thank you
I know it will take some time to enjoy myself.	want to know more

APPENDIX B. Test Results carried out on the IBM Watson Assistant

Table 16. Text samples ingested and the responses given out with the corresponding

Text/Exchange used	Response received with confidence level
I live a very lonely life	You are brave to reach out to me. I hear you and you do matter. It seems you have been having problems. Would you
	like to tell me more? / Confidence->0.67122888565063
Hi there	Hi there, what makes you reach out to us? (If follow up text, 'Hi there' to be avoided)/Confidence -> 0.844802322877
I am depressed	That is hard. You say that (insert information shared by client) Can you find a way change that? | I hear you and I know how difficult it must be. You say (insert information shared by client) | I want to make sure I understand. You say (insert information shared by client). Could you tell me more.| Could you do anything different to change that? / Confidence -> 0.66565895080566
I have nothing else to do	I am glad that you yourself have come up with a solution to the issue. You are brave | That's so good to hear. I am glad that you feel better. Can I help you with anything else | I shall refer you to a professional counsellor, Is that ok? / Confidence->0.94287815093994
I feel miserable	You feel (insert emotion shared by client) because (insert information gathered from client). Can you expand on that? / Confidence->0.60510139465332
I feel very miserable	That is hard. You say that (insert information shared by client) Can you find a way to change that? | I hear you and I know how difficult it must be. You say (insert information shared by client) | I want to make sure I understand. You say (insert information shared by client) Could you tell me more. | Could you do anything different

	to change that? / Confidence -> 0.60216484069824
I feel lonely	You feel (insert emotion shared by client) because (insert information gathered from client). Can you expand on that? / Confidence->0.41943361759186
I have to find a way out of this	What could you change in your life to make things better? | Are there changes you can envision that would help you fulfil what you are looking for? / Confidence->1
I have low confidence	You feel negative. And this is because you say that (insert reason for being negative), Am I correct? / Confidence->1
I feel lonely	Likely Response->You feel (insert emotion shared by client) because (insert information gathered from client). Can you expand on that? / Confidence->1
I am bothered	I'm happy to listen any time. I understand that this is difficult. What do you envision would make you happier? / Confidence->1
To be honest, I am not sure where to start	Start anywhere | Feel free to share whatever is on your mind | Let your thoughts flow freely / Confidence->0.70672574043274
I am currently going through many hitches	I'm happy to listen any time. I understand that this is difficult. What do you envision would make you happier? / Confidence->0.97049446105957
My life is not going the way it should	You are brave to reach out to me. I hear you and you do matter. It seems you have been having problems. Would you like to tell me more? / Confidence->0.6634006023407

I am apprehensive of how things will pan out	Thank you for trusting me with this. You are saying (insert fear/scared emotion shared by client) because (insert information gathered from client). Can you tell me more about that? / Confidence->0.88774313926697
I did not see other alternatives	You feel frustrated. I sense this. So, you say you are frustrated because (insert reason why he/she is frustrated), is that right? / Confidence->0.44358658790588
I think I need another session	I am glad that you yourself have come up with a solution to the issue. You are brave | That's so good to hear. I am glad that you feel better. Can I help you with anything else | I shall refer you to a professional counsellor, Is that ok? | Bye Have a nice day | Bye, please feel free to reach out to us anytime. / Confidence->0.5661041021347
I wish my days could be happier	What could you change in your life to make things better? | Are there changes you can envision that would help you fulfil what you are looking for? / Confidence->0.74219646453857

Appendix C. Chat exchanges between a Client and a Counsellor during a test

The chat system was subjected to purposive testing and hence the test below refers to an exchange between a Client and a Counsellor:

Table 17 Example showing client and counsellor exchange

Client	I am having a problem I need help with.
Counsellor	Feel free to share whatever is in your mind
Client	I think my girlfriend might break up with me.
Counsellor	I hear you. That sounds difficult. You are saying that your girlfriend might break up with you. Go on.

Client	She has been distant lately and I feel scared she will reject me and abandon me.
Counsellor	I am sorry you are going through this. It must be very difficult.
Client	Yes, I feel scared to be rejected by her, I do not want her to leave me.
Counsellor	Thank you for trusting me with this. You are saying that you are scared of being rejected by her because you do not want her to leave you.
Client	I cry at the thought of that, at the thought of being alone without her.
Counsellor	I am sorry you are going through this. It must be very difficult.
Client	Yes, it is very difficult.
Counsellor	This sounds difficult. Are there changes you can envision that would help you fulfil what you are looking for?
Client	I wish she would never leave me.
Counsellor	You say that you would not want her to leave you, go on.
Client	Yes, because then I would never have to be alone.
Counsellor	You are feeling negative. And this is because you say that you fear being alone. Is that correct?
Client	Yes it feels really bad to imagine being alone, without her.
Counsellor	This sounds difficult. Are there changes you can envision that would help you fulfil what you are looking for?
Client	I guess I have always been afraid that she does not really love me, but maybe that is because I feel so unsure about myself.
Counsellor	I understand that this is difficult. What do you envision would make you happier?
Client	I know I have to try to believe in myself, believe that I am lovable.
Counsellor	I hear you. Are there changes you can envision that would help you fulfil what you are looking for?
Client	I think I have to accept that if she does not really love me, I cannot hold that against myself. I need to think more positively.
Counsellor	I hear you and you do make a lot of sense. What do you envision would make you happier?
Client	I think I could spend more time with people in my life who really appreciate me. And I could learn to appreciate myself.
Counsellor	You say that you could spend more time with the people who care about you. That is a positive thought. You are brave. Go on.
Client	I need to go back to doing the things that make me happy rather than always worrying that she will reject me and abandon me

Counsellor	Even though the problem has not disappeared, you are finding ways to face it with positivity.
Client	I know it will take some time to get over the pain of her rejection, but I will take my time and enjoy my hobbies and friends and family.
Counsellor	If you would like I could give you some info on counselling services in your area, Is that ok?
Client	Yes, please. Thank you.
Counsellor	Okay you could reach our counselling centre at 0734-99999, Hope this helps?
Client	Yes, thanks it does, Bye.
Counsellor	Bye, please feel free to reach out to us anytime.

APPENDIX D. System Use Case
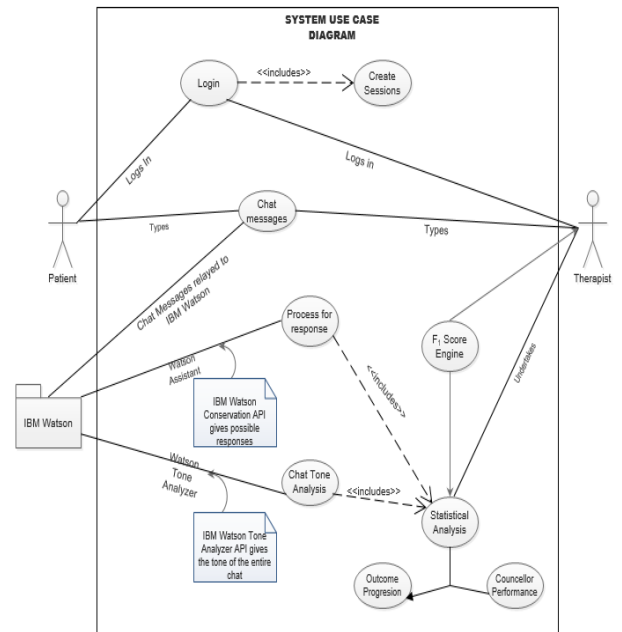
Discussion on the Use Case Diagram

The following is the general view of the Chat process and the measurement of empathy as depicted on the Use Case diagram.

General Full Scenario: Undertaking a chat conversation and measurement of empathy therein.

Precondition: A user gets in touch with the chat system.

Flow of events:
1. The User/counsellor logs into the system.
   Alternative paths:
   .   If, at step 1, the counsellor logs into the system then,

a. Connect the counsellor to the user.
b. Store these messages on a Data store.

2. The user and/or therapist/counsellor shall exchange chat messages.

3. The input from the user is sent to the 'IBM's Watson Assistant' engine in order for it to suggest an appropriate response.

4. The counsellor receives the IBM response and makes a decision on whether the response is valid or how can, the response be altered to encourage a positive outcome.

5. Upon completion of the chat exchanges, the counsellor can end the chat engine.

6. Upon ending the chat exchange session, the chat transcripts are sent to the IBM Watson Tone analyser service in order for the relevant tones to be analysed from the chat sessions and the relevant scores to be derived.

7. Using the derived tones and their scores, the senior counsellor can then view the reports detailing the various statistics including the calculation of the F1-score measurement on empathy inclusivity during the chat exchanges.

Post condition: The user and the counsellor exchange chat messages with a view to derive positive outcomes for the user who has sought relief from the counsellor and thereafter to measure the empathy levels in the exchanges and in particular counsellor exchanges.

References

[1] Sheppard, G., Notebook on Ethics, Legal Issues, and Standards for Counsellors: What is Counselling? Counselling: A Comprehensive Profession.; (1986), pp. 6–7

[2] Dowling, M., The Processes and Effectiveness of Online Counselling and Therapy for Young People; (2015)

[3] Riess, H., Kraft-Todd. G; E.M.P.a.T.H.Y; (2014); Academic Medicine,89(8), pp.1108–1112.doi: 10.1097/ACM.0000000000000287.

[4] J. Reynolds, W. J. and Scott, B: Empathy: A crucial component of the helping relationship; Journal of Psychiatric and Mental Health Nursing, 6(5) (1999); pp. 363–370. doi: 10.1046/j.1365-2850.1999.00228.x.

[5] Barak, A., Boniel-Nissim, M. and Suler, J.:Fostering empowerment in online support groups, Computers in Human Behavior; (2008); 24(5), pp.1867–1883.(2008) doi: 10.1016/j.chb.2008.02.004

[6] Mayfield, E. et al.: Discovering habits of effective online support group chatrooms', Proceedings of the 17th ACM international conference on Supporting group work - GROUP '12 (2012), p. 263. (2012) doi: 10.1145/2389176.2389216.

[7] Eggebraaten, T., Stevens, R. and Will, E.: Natural language processing ('NLP-overview'); (2014); US Patent 8,639,495, pp. 1–19.

[8] Mooney, R. J.: Natural Language Processing Humor and Ambiguity; (1994); pp. 1–20

[9] Cambria, E. and White, B.: Jumping NLP curves; A review of natural language processing research; (2014); IEEE Computational Intelligence Magazine, 9(2), pp. 48–57. doi: 10.1109/MCI.2014.2307227

[10] Ivey, A. E. and Zalaquett, C. P., *Intentional Interviewing and Counseling* (2013)

[11] Clark, A.J,. Empathy in Counselling and Psychotheraphy; (2014); pp. 5; ISBN 0-8058-5366-9

[12] Lally, A., & Fodor, P.. Natural Language Processing With With Prolog in the IBM Watson System (2011) https://www.cs.miami.edu/home/odelia/teaching/csc419_spring19/syllabus/IBM_Watson_Prolog.pdf

[13] Deshpande M, Rao V; Depression detection using emotion artificial intelligence; International Conference on Intelligent Sustainable Systems (ICISS, Paladam); (2017); pp. 858-862, doi: 10.1109/ISS1.2017.8389299.

[14] I. Oyong, E. Utami and E. T. Luthfi, "Natural Language Processing and Lexical Approach for Depression Symptoms Screening of Indonesian Twitter User," *2018 10th International Conference on Information Technology and Electrical Engineering (ICITEE)*, Kuta, 2018, pp. 359-364, doi: 10.1109/ICITEED.2018.8534929.

[15] B. Xiao, D. Can, P. G. Georgiou, D. Atkins and S. S. Narayanan, "Analyzing the language of therapist empathy in Motivational Interview based psychotherapy," *Proceedings of The 2012 Asia Pacific Signal and Information Processing Association Annual Summit and Conference*, Hollywood, CA, 2012, pp. 1-4.

[16] Li TMH, Leung CSY. Exploring student mental health and intention to use online counseling in Hong Kong during the COVID-19 pandemic [2020 Jul 20]. *Psychiatry Clin Neurosci*. 2020;10.1111/pcn.13117. doi:10.1111/pcn.13117