

## Cognitive Behavioural Therapy to Compute Psychological Illness of Students by Using an Expert System

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### Abstract

**Objective:** This research is being conducted to develop a technological solution for mentally distorted students. Though the mental health of university students is known globally as a momentous public health matter. Academic and social stresses are playing quite a negative role in university student's life, especially in forms of mental illness like stress, depression, and anxiety. These mental health issues are becoming a major constraint towards their studies and career.

**Method:** Psychologist used different scales to measure a level of mental disorder. However, to measure such a disease level, we are working on a knowledge-based expert system that will be used to compute its level among the students who are affiliated with technological studies. Mostly psychologist does psychotherapy and use other instruments to cure such a patient for which they must have to visit the psychologist. However, if the psychologist is not available especially in remote areas then the expert system can be used as reciprocal. In order to make our expert system more validate and authentic the knowledge of psychological expert will be used under the process of development.

**Results:** Data from 500 technological University Students are collected from one of the universities in Sialkot, Pakistan. Almost more than 200 students remained clear minded and fall under the normal state of depression and 122 students in case of Anxiety remained normal. 206 students out of 500 were responders to the abnormal stage of anxiety on a 5-point scale from an average of 4.5 points. On the basis of this, an expert system is being designed to facilitate the students.

**Conclusion:** As per results, 30% - 35% students were in the range of abnormality. Therefore, we are further going to develop an evaluation mechanism by using technological ways so that an expert system can replace a psychologist.

**Keywords:** Anxiety; Depression; Expert system; Mental health; Artificial intelligence

### Introduction

Mental health is very important in all phases of lifecycle and it comprises of the emotional, mental and social welfare of each individual. The performance of an individual depends upon its mental health, if the mental health is good then the performance will be high in general work life or as a student or in business. Certain stresses, social pressures or family disturbances may have impact on performance. It has been observed that student's performance also suffers due to these stresses, therefore, there is a need to evaluate such stresses during study period and it is required to design such systems which can evaluate and provide relief to the students so that they can perform well. This study has been conducted for the technological students of a university in Sialkot, Punjab, Pakistan. Students facing peer ill-treatment such as mistreatment habitually show symbols of suffering and these practices can interoperate students' comfort and make them further defenseless to mental health hitches [1].

Each person's mental health may regulate in what way that person can knobs stress, relays to others, and select the option as per scenarios. It depicts how one reflects, feels, and acts [2].

Marvelous growth has thru in emerging Empirically Supported Interventions (ESIs) to indorse optimistic psychological health results for youngsters. Though acceptance, eminence employment, and accountability of these ESIs in actual arena situations continues to hold-up behindhand [3,4].

Artificial Intelligence, preliminary in the expansion of e-science [5,6], is the topmost technology newly recognized as valuable inside healthcare and is predictable to "support healthcare physicians by means of medical data that is clinically pertinent instantaneous distinction information." [5].

By 2025, AI is likely to be affected in 60% of international hospitals and 90% of US insurance corporations. Stimuli for AI comprise enhanced patient results, condensed treatment charges, and patient core plans of treatment. AI supports treatment policies of Directly Observed Therapy (DOT) can leads towards a progress of patient

results grounded on automatic patient supervision and engagement resolutions to recuperate healing program devotion [6,7].

Cognitive Computing is an overall awareness offering Artificial intelligence as figuring abilities which can be functional to enhance/increase human cognition, maintain balances and imitates human knowledge in cognitive-task presentation. Cognitive computing contains AI knowledge and techniques that includes understanding of natural language, machine learning, speech and image recognition, familiar human interface [8,9].

Psychological suffering and mental illness is causing the disability of student's world widely; an account for one-third decades lost for the reason of disability [10,11]. The concern about whether the students in colleges and universities are mentally ill or not and prevalence ratio of mental illness among them; is increasing day by day on international level [12,13]. Information extracted from precise epidemiological data is necessary for: (1) understanding the affliction and degree of mental illness among third-of-order pupils; (2) Guiding many interpolations to minimize the risk of psychological well-being and help in improvement too; (3) to observe lean curve with time [14]. Several studies have been done to identify and measure at-risk populations regarding mental health problems and explored many subgroups of tertian students that comprises of international, graduate, undergraduate students [15,16] students especially from information technology [17] and members from counselling centers of many universities [18,19].

It is important to set benchmarking in contrast to healthy population so that it would make identifiable the mental health of university students is on risk or not? Previously estimates were made containing some limitations and difficulties in benchmarking process due to non-comparable methodology used; because it would not provide a comparison with general population's epidemiological research results. Previous methodologies that were used include questions from students: (1) Whether they have depression or not? (2) Some checklists of symptoms and screening devices to calculate psychological distress that lacks powerful comparable data with general population [15,20,21].

Participants in previous research were of different age groups, nationality differences, and employment status, marital status, living situations, financial stress and hours of employment [22].

To estimate psychological illness of a well-being surveys were conducted and participants were asked about: (1) the number of days you were incapable to do work, manage daily activities or study in last four weeks; (2) the number of days you were able to do any task, manage their daily activities or study but with cut down because of distress or of these feelings? [22]. Responses were assessed and tagged as Days out of Role (DOR) and Days Cut Back (DCB). Univariate ANOVA applied to analyze the difference between various age-groups in terms of distress.

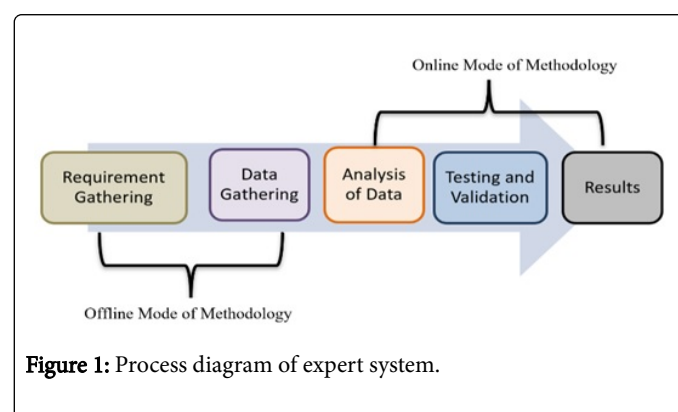
## Research Methodology

Mental wellness of educate is a domain of clear dignity. This research writes up aim to a web-based multi-stone's homo being body through cognitive restructuring program to help true identification. This can be great deal with maladaptive, harmful feelings, and emotion, thereby efficiently endeavoring to promote flexibility and recover mental health between college students. The organization should be collaborative and consistent response must be taken from

the depicted object. Therapist into the organization required for a person subject field if further evaluation is essential. The system suggests a generic platform for implementation of web-based cooperative Cognitive Behavioural Grooming (CBG) a need for particular university [23].

Researchers conducted a National epidemiological survey in Canadian Universities for assessing elevated psychological distress among undergraduate or teen aged students. Probable a sample of 7800 participants from 16 universities were intervened in survey and a screening tool for mental health 12-item General Health Questionnaire (GHQ-12) was used. About 30-35% participants reported elevated psychological disorder varied with respect to region, sex, academic year, orientation, recreational. It was analyzed that ratio of undergraduate students were representing high elevated distress than general population of Canada. Question stem read as follows: "How is your mental health since last some weeks on overall and tell about complaints that you recently put". Possible responses were: (1) usual (2) underneath than usual; (3) very fewer than usual; (4) healthier than usual [24].

By keeping the others work under consideration, we have designed Expert System named as E-Psychologist based on artificial intelligence techniques to compute level of mental illness among students of university who are related to technological fields.



**Figure 1:** Process diagram of expert system.

There are mainly four steps to reach the final results. These four stages are followed one after another in order as shown in Figure 1. Process Diagram of Expert System. The methodology adopted in this research comprises an Action Research (AR) case study based on mentally unhealthy technological students in university.

Further explanation of way to develop this expert is as follows:

## Participants

The contributors consisted of 500 students from Faculty of Computing and IT from one university in Sialkot, Punjab, Pakistan. The age of the contributors was ranged from 19 to 24 having an average age of 21-years.

## Procedures

The methodology adopted in this research comprises an Action Research (AR) case study based on mentally unhealthy technological students in the university. We first contacted the Director of Computing and IT and asked approval to survey numerous classes on campus. After receiving permission, we arbitrarily selected the classes to get the data, survey forms were distributed among students and

collected. The surveys were led in the classrooms and the instructor was currently present throughout all scenario. All participant students were acknowledged with same directions of instructions and were stated that their involvement in this section of data gathering was voluntary and furthermore, their identity would be kept unidentified. Each contributor done with a self-report survey.

### Measurements

Requirements were being gathered through medically approved survey questionnaires (The hospital anxiety and depression scale (Zigmond AS, Snaith RP) by which we have tried to compute the level of depression and anxiety among them. The first portion of the questionnaire consisted of Anxiety questions (what they feel in daily life). The next series of depression questions (what they feel while working with technology). Items were assessed using 5-point Likert scales. Detailed Questionnaire is attached in appendix.

### Psychological expert system

On the basis of data gathered by survey, an android application expert system (E-Psychologist) is designed. E-Psychologist will generate the patient's profile and leads the patient towards different

levels (level 1 for Anxiety and level 2 for Depression). Afterwards, it intelligently predicts disease of the patient via questionnaires specified by each level. Results are obtained by using rule based expert system.

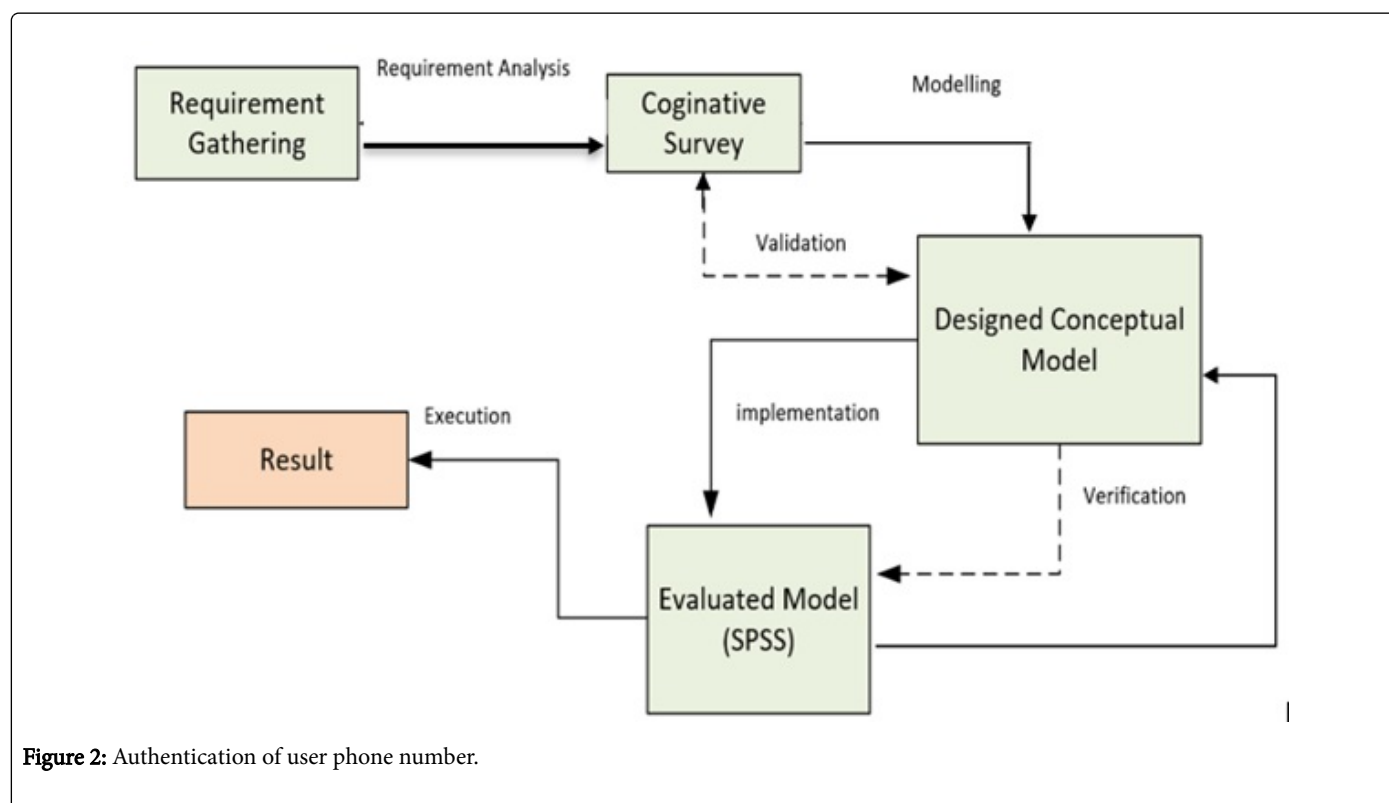
### SPSS validation

Furthermore, the result of application is validated by using Descriptive techniques of SPSS. This has ensured that results obtained by application are correct.

### Implementation and System Design

#### Coding and implementation

E-Psychologist is designed by using java programming language. Rule based technique is adopted for coding this expert system. The Android Studio 3.1.1 is used for implementation. Data related to different users has been stored by using a real time database named as Firebase Database. Only a registered user can access application so its mandatory for a user to be authenticate via mobile number. For this purpose, Firebase AUTH is used as shown in Figure 2. Authentication of User Phone Number.



**Figure 2:** Authentication of user phone number.

### Designed model of an expert system

As shown in code below Design Model of Expert System depicts the complete scenario that how does this psychology based expert system works to compute level of mental illness among students of university who are related to technological fields. Analyses of gathered data is validated by conceptual model that is basically developed on the base of rule based expert system, once it is validated then it is implemented and verified by standard SPSS evaluated model by using various techniques of stats. At the end result of both conceptual and evaluated

model are compared to validate the psychology expert system application that the results obtained by E-Psychologist are accurate.

```

    Private void sign In With Phone Auth Credential (Phone Auth
    Credential credential) {mAuth. sign In With Credential (credential)
    .add On Complete Listener (this, (task) -> {
    If (task is successful ()) {
    Intent intent = New intent (signup. this, Generate Profile.class);
  
```

Start Activity (intent);  
Finish ();

### Designing of android application

E-Psychologist is based on mainly four panels. Front end of this application is quite simple and easy to understand for users, even a new user can easily go through with it without any difficulty. Because it is designed by keeping the user's level of understanding in mind.

E-Psychologist includes following panels:

- Login System
- Automated Profile Generation
- Runtime Repository Questionnaires
- Result Generation
- Working of E-Psychologist

Working of E-Psychologist is mainly consisting of three steps as following:

**Step 1:** As now a day's authentication is major issue, especially when we are talking about medical application and people data. First of all, user needs to login on application and if it is new user it required to register him by using his data i.e., name, age, and gender as shown in Figure 3. Generate a user profile.

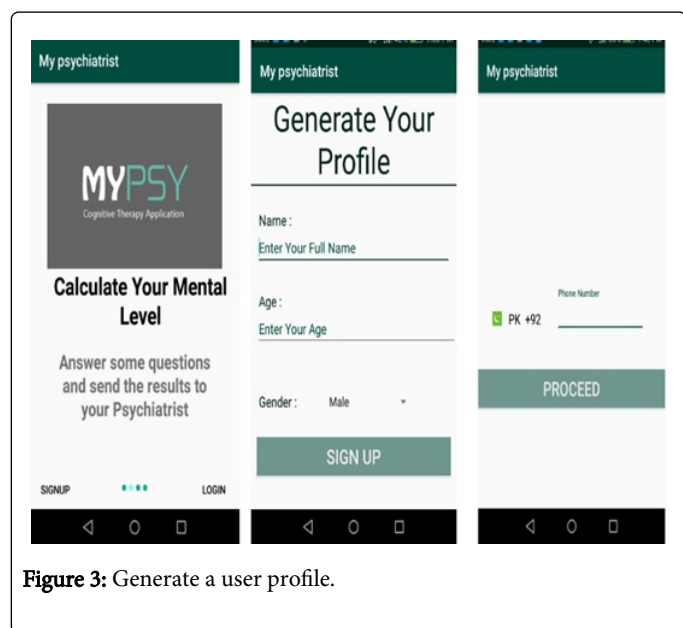


Figure 3: Generate a user profile.

**Step 2:** Registration will be completed by using a phone number. Once the phone number is validated, code message will be prompt over mobile screen to complete a registration over application.

**Step 3:** After successful registration, there are two levels, first for anxiety and second level for depression as shown in Figure 4.

In levels to compute mental disease illness, the user will be able to compute his level of illness by entering in level (in each level expert system will prompt a questionnaire and then generate level of illness and percentage of mental sickness of that individual).

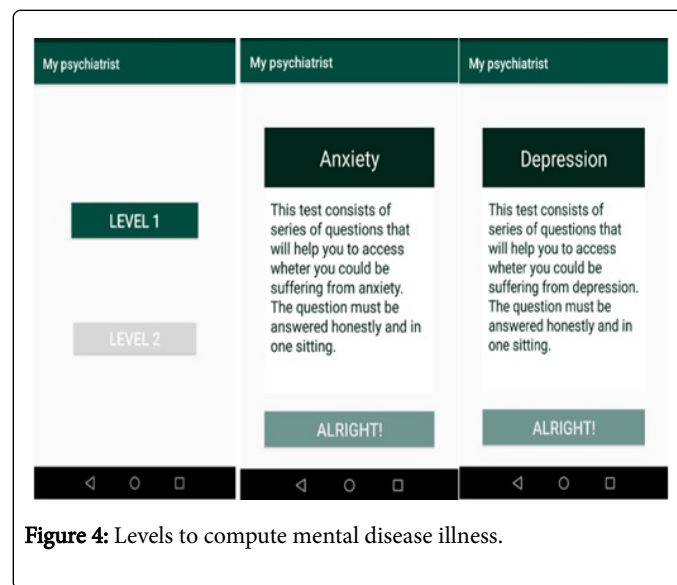


Figure 4: Levels to compute mental disease illness.

### Results and Discussion

Results are compared as they are generated by two ways:

#### Result generated by expert system

E-Psychologist result is being validated by make it available to different students of technology and result is compiled for both anxiety and depression as shown in Table 1. Expert System Computed Result. The table shows only data of four number of patients, it can be clearly seen that two of them are on borderline anxiety only one user is abnormal. But meanwhile, on the other side of depression, none of four is suffered of it.

Patient ID	Anxiety	% of Anxiety	Depression	% of Depression
P1	Borderline Abnormal	47.62%	Borderline Abnormal	47.62%
P2	Normal	28.57%	Normal	14.29%
P3	Abnormal (Case)	71.43%	Abnormal (case)	33.33%
P4	Borderline Abnormal	42.86%	Abnormal (case)	57.14%

Table 1: Expert system computed results.

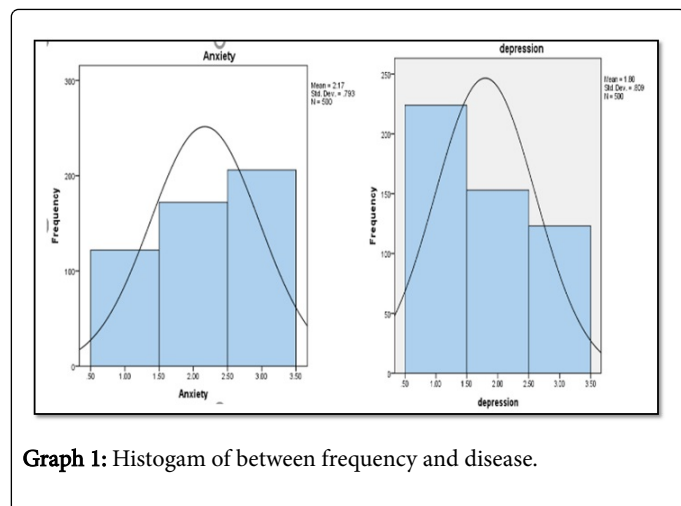
### Result generated by SPSS

Data from 500 technological University Students are collected from one of the universities in Sialkot, Punjab, Pakistan. Table 2 explains descriptive analysis of the data explains that most of our participants that are selected by the sample are at the normal stage of anxiety. Standard Deviation explains that on average, the values in the dataset differ from the mean by + 0.79312 in case of anxiety and in case of depression it differs from the mean by + 0.82985. The overall variation in anxiety is 0.629 and in depression is 0.689.

Statistics	Anxiety	Depression
Mode	3.0	1.0
Standard Deviation	0.79312	0.82985
Variance	0.629	0.689

**Table 2:** Descriptive table of disease.

The frequency table mentioned above in Table 3. Frequency table of disease and graph is illustrating Anxiety and Depression-level (Graph 1). The Data that was being collected by 500 University Students for computing their level of Anxiety and Depression (Normal, Borderline and Abnormal) and among these students (collected data) 24.4% are experiencing anxiety at the normal stage and 34.4% are at borderline and 41.2% are suffering from the abnormal stage. And in case of depression among 500 students 44.8% are experiencing Depression at the normal stage and 30.6% are at borderline and 24.6% are suffering from the abnormal stage.



**Graph 1:** Histogram of between frequency and disease.

Level of Illness	Anxiety		Depression	
	Frequency	Percentage	Frequency	Percentage
Normal	224	44.8	122	24.4
Borderline	153	30.6	172	34.4
Abnormal	123	24.6	206	41.2
Total	500	100	500	100

**Table 3:** Frequency table of disease.

### Conclusion and Future Work

The determination of this research was to observe the consequence of hypothetical stress and learned resourcefulness on overall academic outcomes and performance. It was hypothesised that academic stress would be linked with a low level of academic routine. Results presented authority for this supposition by justifying a important negative effect of academic pressure/stress on academic performance.

The results clearly show that around 75% of students are experience in anxiety or at border line and around 55% of students having depression problem or at border line. So that's mean the performance of around 60% students are suffering due to psychological disorder.

The results clearly show that around 30% - 35% students falling under the range of abnormality. Therefore, it was required that a system should be designed to evaluate technological based assessment and relief mechanism to increase a performance of the students. There is no real time Stress and Anxiety release mechanism so, in order to make it possible we are working over it.

In future, we are further going to develop a cure mechanism by using technological ways i.e., psychological games, videos, automatic appointment scheduling and meditation therapies to decrease the level of mental illness that will make the brain less stressed so that they can accomplish their work in better way.

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