Fuzzy Clustering Algorithm-based Research Framework on College Students’ Crisis Intervention Model

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Abstract

College students are under great stress dealing with jobs, relationships and other issues of their life. They are subject to psychological crisis as the stress keeps mounting up. It is, therefore, imperative for universities and educational authorities to take the problem seriously and intervene in a timely fashion. From psychological point of view, crisis intervention is an effective way to prevent mental health problems. In daily psychological care, school faculties should reach out to those who are struggling with mental health issues, and help them to restore balance and return to normal life. This study focuses on college students’ crisis intervention model based on fuzzy clustering algorithm, in the hope of providing some theoretical support to the scholars working in the field of crisis intervention.

Keywords: Fuzzy Clustering Algorithm, College Students, Crisis Intervention, Model Creation.

1. INTRODUCTION

1.1 Background

Reports of suicides and assaults among college students manifest the looming of a widespread mental health problems, affecting normal campus life and setting bad examples for the general public. As a result, China’s Ministry of Education and Ministry of Health have issued advice on how to improve the mental health of college students, in which crisis intervention is designated as high priority. The public has been on high alert over mental health problems (Jiang, 2013). A number of factors contribute to this psychological crisis: firstly, more students are raised by single parents as the divorce rates in China are on the increase in recent years. These young people are more fragile and readily to snap under stress and danger. Secondly, they are susceptible to psychological problems during the transition from an easy campus life to workforce. As it is not enough to solve the crisis from simply the students’ angle, creating a crisis intervention model is essential.

1.2 Literature review

Psychological crisis refers a condition of an individual becoming imbalanced on facing unexpected changes and problems. According to Psychologist Caplan's study on this type of crisis which he has begun in 1954, the imbalance is a consequence of trauma in reaction to stimulus and shock from outside world. When an individual is faced with a situation that he/she could not cope with his/her past experience, perplex, even for a short period of time, will appear. And this perplex is what we call psychological crisis (Guo, 2014). Apart from the non-psychology reasons such as stress, relationships and culture, in creating a prevention model for college students' mental health problems, there is bound to be lots of discussion about positive psychology. This is a branch of psychology that focuses on an individual's potential and good quality like inner virtue. Regarding as a step forward from the traditional practice of the field, it maintains to interpret mental phenomenon using positive thinking, so as to help people fulfill their full potential and bring out the best in them. It provides a theoretical basis for this study. In positive psychology, psychological crisis means opportunity as well as crisis. In opposition to the overreaction and harmful behavior that may be caused by the crisis, it also offers a possibility of personal growth and enrichment. From this perspective, psychological crisis among college students is a situation that combines negative and positive sides. In addition to positive psychology, Fuzzy Clustering Algorithm (FCA), an unmonitored machine learning technology, is used in this paper. Analyzing and creating model based on fuzzy theory, the algorithm introduces tests and arguments according to the indefinite classification of samples. FCA, having significant theoretical and practical value, continues to improve and is widely used in many fields (Tian, 2016).
2. FUZZY CLUSTERING ALGORITHM-BASED CRISIS INTERVENTION MODEL FOR COLLEGE STUDENTS’

2.1 Weight index with membership function

FCA differs according to subjects. For better results, we use Fuzzy C-means Algorithm (FCMA) here. FCMA has two membership function--1 and 0. But using these can not clearly describe the relationships between data. To correct this problem we will also be using the concept-Fuzzy Set. The essence of FCA is to get traditional classification fuzzy. In the case of an crisis intervention model, we found there is in literature review a successful algorithm to achieve this end, which is to add weight index with membership function to FCMA (Ye, 2012). In this algorithm, divide a quantity of N of vectors \( X_{i}(i=1,2...,n) \) into a quantity of C of fuzzy clusters, calculate cluster centroids of each set with the aim to reach every objective function at its minimum, that is \( 1<m<\infty \). Weight index with membership function is defined as:

\[
J_m(u, v) = \sum_{k=1}^{n} \sum_{i=1}^{c} (u_{ik})^m d(x_k, v_i) \quad (1)
\]

\[
\sum_{i=1}^{c} u_{ik} = 1, u_{ik} \in (0,1), \forall k, d(x_k, v_i) = \|x_k - v_i\|^2. \quad (2)
\]

Unlike FCMA, this algorithm includes fuzzy clock index \( m \). To reach minimum objective function, \( m \) in cluster centroid and membership is updated as follows:

\[
V_i = \frac{\sum_{k=1}^{n} u_{ik} d(x_k)}{\sum_{k=1}^{n} u_{ik}} \quad (i = 1, 2, ..., c) \quad (3)
\]

\[
u_{ik} = \frac{1}{\sum_{j=1}^{c} \frac{|x_k d(x_k)|}{d(x_k)}} \quad (i = 1, 2, ..., c; k = 1, 2, ..., n) \quad (4)
\]

2.2 Calculation of weight index with membership function

The calculation is simple and easy to work out. A good fit for model creation, it should be noted that Lagrange Multiplier should be applied during the process. Refer to relevant research for direction (Deng, 2012). Through changing metrical unit we obtain the Objective Function for the Crisis Intervention Model for college students.

\[
J = \sum_{k=1}^{m} \sum_{i=1}^{c} (u_{ik})^m d(x_k, v_i) \quad (5)
\]

Fuzzy C-means (FCM) and weight index with membership function is also obtained:

\[
u_k = 1 - \sum_{i=1}^{c} u_{ik} \quad (6)
\]

In this constraint, if FCMA results are the same as opposed to the reality, it should be noted that we should utilize FCM to provide data support for the model creation in accordance with the constraint.

3. CASE STUDY

3.1 Subject

The subjects in this study consist of 68 college students from Beijing, including 43 male and 24 female, who are regarded as having a tendency for mental health problems as a consequence of experiencing difficult events. Among these students, 12 are studying liberal arts, 56 science. Data are collected from the school’s mental health record from the year 2006-2016. According to the definition of psychological crisis, this paper listed the information of the 68 students in Table 1 and 2.
Table 1 Basic Information of Students

<table>
<thead>
<tr>
<th>Degree</th>
<th>Grade</th>
<th>Number</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate</td>
<td>Freshman</td>
<td>15</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Sophomore</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Junior</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Senior</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Master</td>
<td>First grade</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Second grade</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three grade</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Doctor</td>
<td>First grade</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Second grade</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three grade</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Classification of Psychological Crisis Event

<table>
<thead>
<tr>
<th>Crisis types</th>
<th>High fall</th>
<th>Medication</th>
<th>Hanging</th>
<th>Cut wrist</th>
<th>Down river</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suicide success</td>
<td>10</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Attempted suicide</td>
<td>9</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>Suicide idea</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

Note: One college student adopted three methods, high dropping rates, taking medicine and cutting wrist

3.2 Methodology

Case study and qualitative research are two main methodology in this study. Analyze the psychological crisis events in each case from an objective angle, tracking its sequence from original records, and draw conclusions. Multiple tools were used here: Record of Psychological Crisis Events for College Students, including data from recent ten years; Diagnosis Form, through which psychological crisis events were being identified and used as reference (Lu, 2015); hospital records; interviews with students and faculties, in which 68 students and 41 school faculties were being interviewed (fewer number of faculties being interviewed due to loss of samples during ten years), compiled into Interview and Record of Factors Affecting Psychological Crisis Events.

3.3 Results analysis and conclusion

This Study shows that multiple factors contributing to the psychological crisis of college students, which could be categorized into four main aspects - individual, family, social and interpersonal. Other factors (Dan, 2013) are not the focal point of this study. The following Table is created to better analyze the contributing factors and provide reference for creating a prevention model.

Table 3 Factors Contributing to Psychological Crisis Event

<table>
<thead>
<tr>
<th>Influence factor</th>
<th>Concrete embody</th>
<th>Number</th>
<th>Percentage</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal factors</td>
<td>Inferiority</td>
<td>20</td>
<td>29.4%</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Self demanding</td>
<td>10</td>
<td>14.7%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Academic stress</td>
<td>7</td>
<td>10.2%</td>
<td></td>
</tr>
<tr>
<td>Family Factors</td>
<td>Family misfortune</td>
<td>6</td>
<td>8.8%</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Family poverty</td>
<td>5</td>
<td>7.3%</td>
<td></td>
</tr>
<tr>
<td>Interpersonal factors</td>
<td>Emotional problems</td>
<td>6</td>
<td>8.8%</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Communicative barriers</td>
<td>5</td>
<td>7.3%</td>
<td></td>
</tr>
<tr>
<td>Social factors</td>
<td>Employment situation</td>
<td>4</td>
<td>5.8%</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Social discrimination</td>
<td>5</td>
<td>7.3%</td>
<td></td>
</tr>
</tbody>
</table>
4. CRISIS INTERVENTION MODEL

4.1 First-level psychological crisis prevention

First-level psychological crisis requires intervention from school - a Crisis Intervention Team - to provide support and counsel for the concerned student. Dormitory superintendent and roommate should report immediately on finding anything unusual. Keep records on every psychological care for future reference (Xi et al, 2015). The Crisis Intervention Team is authorized by the school to take proper actions, including making arrangements for professional counseling and reasonably allocating resources. It is also the responsibility of team to keep in touch with students’ parents and friends in the hope of finding better cure. If the diagnosis is too grave for the school to handle, the concerned student should be transferred to a professional institution (Zhao and Chen, 2015). For crisis prevention, the school has the main responsibility, with family and society playing a part. Fig 1 shows the intervention model.

![Intervention Model of College Students’ Psychological crisis.](image)

4.2 Second-level psychological crisis prevention

Prevention at this level refers to the duty of informing relevant school faculties on finding problems, and of carrying out responsibilities that are within each unit’s job description.

a. On finding students with mental health issues, the school should, on the one hand create a special unit to take actions, on the other report to the Crisis Intervention Team. Dial 110 or 120 if the diagnosis is severe. All of the above should be done with the approval of the student’s parents, for the school should seek the parents’ help for finding solutions. A written approval should be obtained if the parents are unavailable at the point (Tian, 2015).

b. School logistics department should also play a part, for instance, sending the concerned student to hospital or arrange for his or her accommodation. The Office of Education Administration should see to what’s best for the student in terms of curriculum and credits.

c. Once a case of second-level crisis is established, school’s counseling center should talk to the patient immediately, evaluate the situation and take steps to placate the student group that has been affected. A severe patient should be transferred to professional institutions.

4.3 Third-level psychological crisis prevention

School authority should be briefed immediately once a case of third-level crisis breaks out. It is the responsibility of the Crisis Intervention Team to waste no time in getting to the scene and taking measures to help the patient.

a. Be discreet as to the influence the incident might have on the public, minimize the impact and try to avoid adverse public opinion (Chen, 2016).
b. School medical staff should immediately arrive at the scene to help the patient for further treatment. Security staff should be present to keep order, in case the chaos further worsens the patient’s condition. Logistics department ought to make arrangement for the student’s parents, and provide support for his or her treatment.

c. School mental health staff should reach out to those affected by the crisis, in prevention of adverse impact. It is their duty to track students' mental health and take actions when necessary (Ji, 2013).

5. CONCLUSION

Mental health problems among college students are not isolated events in recent years, causing wide public concern. Psychological crisis intervention has long been a way of alleviation to this, originally proposed by well-known psychologist Lindeman and developed by psychologist Caplan. From psychological point of view, crisis intervention refers to the act of an individual overcoming an uncontrollable situation or problem by navigating inner potential and restore balance, either by counselling or treatment (Li, 2015). It could be regarded as a pre-emptive or recovery phase of the treatment of psychological disorder. It is imperative for schools to undertake crisis intervention, offering its service to the nation by educating robust and healthy talents.

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