



CHAPTER 1



CHAPTER - 1

FUZZY ANALYSIS OF PROBLEMS FACED BY URCS USING FCMs and FRMs

This chapter is organized into four sections, the first section being introductory in nature. In the second section the problems faced by the Underprivileged Rural College Students (URCS) studying in Chennai city colleges are analysed using Fuzzy Cognitive Maps (FCMs) models. In section three, Fuzzy Relational Maps (FRMs) models are used to analyse the interrelation between teachers and underprivileged rural students studying in city colleges. In the final section, conclusions based on this study using these two models, are given.

1.1 INTRODUCTION

This section approaches and analyses the problems by taking a pilot survey of underprivileged rural college students studying in Chennai city colleges. The basic concepts about FCMs and FRMs models are given in the previous chapter of this thesis. This chapter is divided into two sections. Section one studies the problems faced by the Underprivileged Rural College Students (URCS) studying in Chennai city colleges using FCMs and section two analyses the interrelation between students and their teachers. A pilot data was collected and FCMs was used to analyse and study the problems faced by the URCS studying in city colleges.

From this study we formulated an elaborate questionnaire and using this questionnaire collected data from underprivileged students hailing from rural areas, studying in various city colleges. The analysis and study of the data collected using the elaborate questionnaire led to several facts, two of them, which are important, is given below:

1. Students lacked language skills for they were not in a position to write proper statements either in English or in Tamil.
2. Teachers were also responsible for this in some form or the other. We strongly felt after the analysis of the collected data, we cannot completely base our study on the feedback from the elaborate questionnaire, as they did not express themselves properly.

Since teachers were responsible to a very large extent in the problems of the rural students and their performance in their studies as well as in the overall development of their personality we felt it essential to analyse the interrelation between these students and their teachers. Accordingly we have collected a data from teachers by interviews/ questionnaire/discussions and used the FRMs model to study the inter-relational problems between teachers and these students described in section three of this chapter.

Conclusions drawn from this study led to the following:

At this juncture, we had to make another set of short questionnaire in which they were given the possible answers of questions so that it was easy for them to answer this questionnaire and respond properly as they were not in a position to express themselves. This data serves also as experts' opinion in the construction of DSFRMs model in chapter three of this thesis.

Further we, from the collected data and study of the FRMs model indicated above, wanted to use both students and teachers as experts as several of the students said teachers were incapable of communicating with them in class or some of them ill treated them as they had no good back ground in English. Many teachers felt that rural underprivileged students in general are not interactive or intelligent in class. So, we have collected data from teachers and students by way of discussions / interviews to assess their merits/ shortcomings, as a study of students' problems without inducting both students and teachers would be incomplete.

We conclude that this data, would be used as experts' opinion for further analysis of this URCS problems and in the construction of new and appropriate mathematical models.

1.2 FUZZY ANALYSE OF PROBLEMS FACED BY URCS USING FCMS

In this section for the first time we study the problems faced by underprivileged rural students studying in Chennai city colleges using Fuzzy Cognitive Maps (FCMs) model. This section has two subsections. In subsection one the problems faced by these students as taken from data collected from them is described and justification for using FCMs is also given. Subsection two gives the two FCMs models given by students and teachers.

1.2.1 Description of the problems and justification for using FCMs

We have taken from 60 rural underprivileged students studying in the Loyola College, Chennai, the problems faced by them in the classroom, hostel and in the college premises (campus). This is taken as a write up from them. After analyzing the written data the following attributes S_1, S_2, \dots, S_{14} are taken as the problems faced by the students. Each of the attribute is described in a line or two to make this study a self contained one and the context or the reason for analyzing the problem. However our study in this thesis is only related with curriculum so we have not analysed their problems in hostels using fuzzy models; but we have taken their demands and suggestions which is incorporated in the last chapter of this thesis.

Description of the attributes S_1, S_2, \dots, S_{14} are as follows:

S₁ – Poverty: Most of the students are very poor or poor; only a very few of them are from middle class. So poverty is one of the major problems which is dominant; as they start to write by

first saying they are very poor (poor) to think of higher education. This poverty or the economic strata of them plays a role in their education and hinder them from leading a normal life in the city.

- S₂** – General appearance: This includes their dress and their overall appearance (personality).
- S₃** – Family Problems: They face very many family problems which holds them back due to their economic background, as their parents suffer from unemployment or under employment or as daily wagers. (No bulk saving to pay fees).
- S₄** – Proper guidance: They are the first one to be educated; so in most cases they do not get any guidance. Also majority of the teachers in the schools where they study are as ignorant as their parents.
- S₅** – Inferiority complex: Majority of them suffer inferiority complex due to several reasons. (Way of communication, dress, style, attitude, etc.)
- S₆** – Self confidence level which is generally very poor due to language and communication problems.
- S₇** – English language both spoken and written is a problem. Also they say they are not only incapable of expressing in English but they are also incapable of understanding when teachers teach in English in the classroom.
- S₈** – Teachers illtreat them as they are poorly dressed and lack appearance and communication skills.
- S₉** – Classmates / other students also illtreat them; several of them say they are disgraced by classmates who are from city.

- S₁₀** – Sophistication (they lack sophistication and artificiality).
- S₁₁** – City students do not mix with poor rural students in the campus / class.
- S₁₂** – Regularity to classes.
- S₁₃** – Good employment opportunities for underprivileged rural students.
- S₁₄** – Communication skills.

These were the main problems mentioned by majority of the students.

These 14 attributes are taken in the construction of the FCMs model.

The justification for using FCMs model is given below.

- (1) The data related with the problems is an unsupervised one; so we cannot use any statistical method to analyse the problem. In this situation Fuzzy Cognitive Maps (FCMs) happens to be best suited.
- (2) FCMs are best suited for each of the attributes that are interrelated with one or more attributes. So the data easily yields for the cognitive maps.
- (3) FCMs model can give the hidden pattern for any ‘ON’ state of the attributes which are used in the dynamical system.
- (4) The limit cycle or the fixed point inference summarizes the joint effect of all the interacting fuzzy knowledge.

1.2.2 FCMs models given by the experts

In this section FCMs models of the problems faced by the rural students in city colleges using the attributes S_1, \dots, S_{14} given in the subsection one are analysed.

The directed graph for the FCMs model given by students who are experts is as follows:

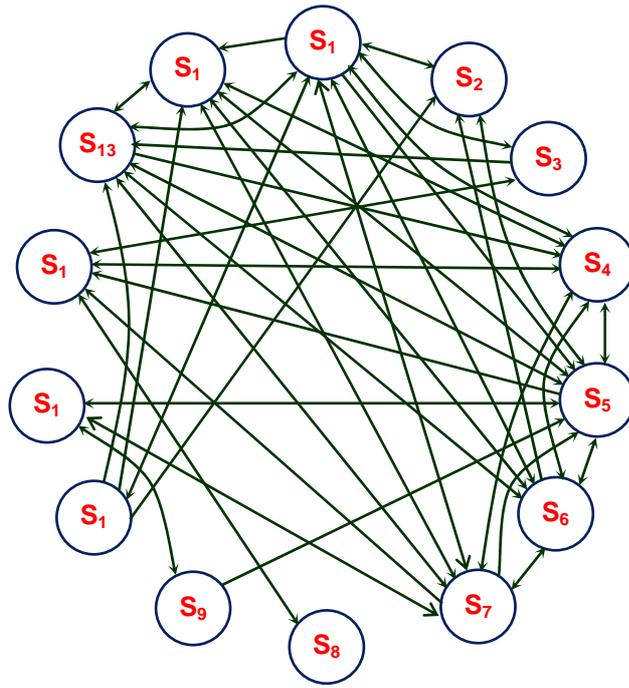


FIGURE: 1.2.2.1

Using the directed graph we have obtained the FCM connection matrix M which is as follows.

$$\text{Let } M = \begin{matrix} & \begin{matrix} S_1 & S_2 & S_3 & S_4 & S_5 & S_6 & S_7 & S_8 & S_9 & S_{10} & S_{11} & S_{12} & S_{13} & S_{14} \end{matrix} \\ \begin{matrix} S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_5 \\ S_6 \\ S_7 \\ S_8 \\ S_9 \\ S_{10} \\ S_{11} \\ S_{12} \\ S_{13} \\ S_{14} \end{matrix} & \begin{bmatrix} 0 & -1 & 1 & -1 & 1 & -1 & 1 & 0 & 0 & -1 & 0 & 0 & -1 & -1 \\ -1 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & -1 & 0 \\ -1 & 0 & 0 & 0 & -1 & 1 & -1 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & -1 & 0 & -1 & 0 & -1 & 0 & 0 & 0 & 0 & 1 & -1 & -1 & -1 \\ -1 & 1 & 0 & 1 & -1 & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & -1 & 1 & -1 & 0 & 0 & 0 & 0 & 1 & -1 & -1 & -1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 1 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 1 & -1 & 1 & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & -1 & 1 & -1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \end{matrix}$$

Now we analyze the effect of the state vectors using the dynamical system M and determine the hidden patterns.

Suppose the expert is interested in finding the hidden pattern for the state vector in which the node poverty S_1 alone is in the ON state.

Let $A = (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$. To find the effect of A on the dynamical system M ; that is $AM = (0\ -1\ 1\ -1\ 1\ -1\ 1\ 0\ 0\ -1\ 0\ 0\ -1\ -1)$ after thresholding and updating we get $AM \leftrightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0) = A_1$ (say) (Note “ \leftrightarrow ” symbol denotes the resultant vector AM that has been thresholded and updated).

$$\begin{aligned} A_1 M &\leftrightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 0) &= A_2 \text{ (say)} \\ A_2 M &\leftrightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) &= A_3 \text{ (say)} \\ A_3 M &\leftrightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) &= A_4 \text{ (say)}. \end{aligned}$$

We see $A_3 = A_4$. Hence the hidden pattern of the state vector A is a fixed point which clearly states, poverty is the cause of family problem (S_3), inferiority complex (S_5), poor expression in English language (S_7), classmates insult them (S_9) and city students do not mix well with them S_{11} . This is the effect of poverty on the rural underprivileged students.

Next we see the effect of inferiority complex (S_5) in the ON state on the dynamical system M .

Let $B = (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$, i.e., only the node S_5 is in the ON state and all other nodes are in the OFF state. The effect of B on M is given by

$$\begin{aligned} BM &\leftrightarrow (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0) &= B_1 \text{ (say)} \\ B_1 M &\leftrightarrow (0\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) &= B_2 \text{ (say)}. \\ \text{Now } B_2 M &\leftrightarrow (1\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) &= B_3 \text{ (say)} \\ B_3 M &\leftrightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) &= B_4 \text{ (say)} \\ B_4 M &\leftrightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) &= B_5 \text{ (say)} \end{aligned}$$

$B_5 = B_4$ is a fixed point.

Thus we see from our analysis that poverty and inferiority complex go hand in hand as the same set of nodes come to ON state both in case of poverty and inferiority complex suffered by the rural students.

Now we see the effect of the state vector in which only the node S_6 i.e., self confidence is in the ON state. The effect of $C = (0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$ on the dynamical system M is given by

$$CM \quad \leftrightarrow \quad (0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1) \quad = \quad C_1 \text{ (say)}$$

$$C_1M \quad \leftrightarrow \quad (0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1) \quad = \quad C_2 \text{ (say);}$$

$C_1 = C_2$ is a fixed point.

When one has self confidence he / she has a better or generally good appearance poses cheerfully and holds one self brightly, has a better or generally good appearance, the family problems cannot hold him back, good employment opportunities follow as he/she is endowed with properly developed communication skills.

Suppose we wish to study the effect of S_9 alone to be in the ON state i.e., let

$D = (0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0)$. To find the effect of D on M .

$$DM \quad \leftrightarrow \quad (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 0) \quad = \quad D_1 \text{ (say)}$$

$$D_1M \quad \leftrightarrow \quad (0\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) \quad = \quad D_2 \text{ (say)}$$

$$D_2M \quad \leftrightarrow \quad (1\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) \quad = \quad D_3 \text{ (say)}$$

$$D_3M \quad \leftrightarrow \quad (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) \quad = \quad D_4 \text{ (say)}$$

$$D_4M \quad \leftrightarrow \quad (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) \quad = \quad D_5 \text{ (say).}$$

We say $D_4 = D_5$ thus the hidden pattern of the state vector D is a fixed point.

Thus when the node S_9 is in the ON state i.e., classmates / other students also, who are in the city; we see they are mostly underprivileged rural students (S_1), and they are the ones who succumb to family problems (S_3), they suffer from inferiority complex (S_5), because of inferiority complex

and feeling frustrated due to poverty and lack of good communication in English (S_7) and city students do not mix with them (S_{11}).

Suppose (S_7) alone is in the ON state and all other nodes are in the OFF state.

To find the effect of the state vector $T = (0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$ on M .

$$\begin{aligned} TM &\leftrightarrow (1\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 0) &= T_1 \text{ (say)} \\ T_1M &\leftrightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 0) &= T_2 \text{ (say)} \\ T_2M &\leftrightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) &= T_3 \text{ (say)} \\ T_3M &\leftrightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) &= T_4 \text{ (say)} = T_3. \end{aligned}$$

Thus if S_7 alone is in the ON state it makes S_1, S_3, S_5, S_7, S_9 and S_{11} to ON state, the underprivileged rural students lack in all finer qualities, the hidden pattern again is a fixed point.

Now consider the ON state of the two nodes S_1 and S_6 to be in the ON state.

Let $X = (1\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$ be the related state vector.

To find the effect of X on the dynamical system M .

$$\begin{aligned} XM &\leftrightarrow (1\ 0\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = X_1 \text{ (say)} \\ X_1M &\leftrightarrow (1\ 0\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = X_2 = X_1 \text{ (a fixed point)}. \end{aligned}$$

Thus the ON state of S_1 and S_6 results only in the ON state of S_3 i.e., the effect of self confidence with poverty reflects in the person suffering from family problems alone.

Now we study the ON state of the nodes S_1 and S_4 and all the other nodes remain in the OFF state, i.e., the underprivileged rural students get proper guidance.

Let $Z = (1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$ be the related state vector. Effect of Z on M is given by

$$ZM \leftrightarrow (1\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0) = Z_1 \text{ (say)}$$

$$Z_1M \leftrightarrow (1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0) = Z_2 \text{ (say)}$$

$$Z_2M \leftrightarrow (1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0) = Z_3 = Z_2 \text{ a fixed point.}$$

Thus the ON state of S_1 and S_4 makes only one to be regular to classes who has taken interest in studies and nothing more, where as the node S_4 alone in the ON state yields a different hidden pattern.

Let $P = (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$ be the state vector with S_4 in the on state.

$$PM \leftrightarrow (0\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 1) = P_1$$

$$P_1M \leftrightarrow (0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 1) = P_2 \text{ (say)}$$

$$P_2M \leftrightarrow (0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 1) = P_3 \text{ (say)} = P_2.$$

Thus when the underprivileged rural students get proper guidance this leads to good appearance (S_2), self confidence (S_6), regularity to classes (S_{12}), good employment opportunities (S_{13}) and good communication skills (S_{14}).

Hence proper guidance can lead to the over all development of the underprivileged rural students.

From the study of the hidden pattern one observes that every resultant vector is a fixed point which is an indication of the fact that these problems do not repeat but only when these problems exist results are fixed points that is they do not fluctuate.

Next we give the opinion of an expert who is a teacher.

At the outset the nodes S_2, S_8, S_9, S_{10} and S_{11} were deleted and the expert works with the rest of the nodes.

The directed graph given by him is as follows:

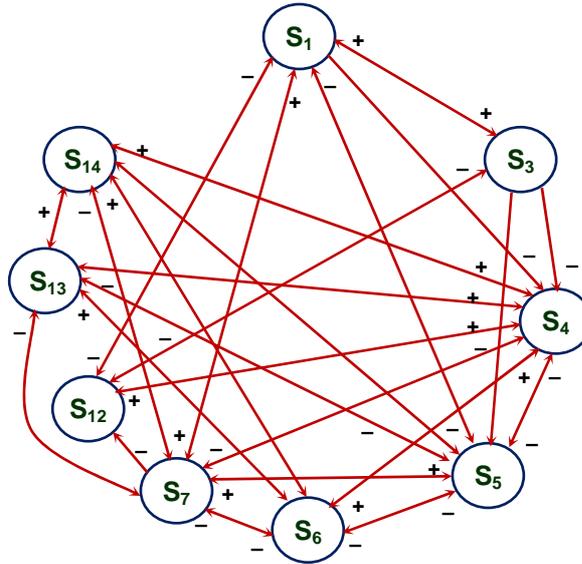


FIGURE 1.2.2.2

The adjacency matrix related to the above graph is as follows.

$$\begin{array}{c}
 \begin{array}{cccccccccc}
 & S_1 & S_3 & S_4 & S_5 & S_6 & S_7 & S_{12} & S_{13} & S_{14} \\
 S_1 & \left[\begin{array}{cccccccccc}
 0 & 1 & -1 & -1 & 0 & 1 & -1 & 0 & 0 \\
 1 & 0 & -1 & -1 & 0 & 0 & -1 & 0 & 0 \\
 0 & 0 & 0 & -1 & 1 & -1 & 1 & 1 & 1 \\
 -1 & 0 & -1 & 0 & -1 & 1 & 0 & -1 & -1 \\
 0 & 0 & 1 & -1 & 0 & -1 & 0 & 1 & 1 \\
 1 & 0 & -1 & 1 & -1 & 0 & -1 & -1 & -1 \\
 -1 & -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 1 & -1 & 1 & -1 & 0 & 0 & 1 \\
 0 & 0 & 1 & -1 & 1 & -1 & 0 & 1 & 0
 \end{array} \right]
 \end{array} \\
 N =
 \end{array}$$

Suppose we consider a state vector $X = (1 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0)$, i.e., only the node poverty is in the ON state and all other nodes are in the OFF state.

The effect of X on N is given by

$$XN \quad \hookrightarrow \quad (1 \ 1 \ 0 \ 0 \ 0 \ 1 \ 0 \ 0 \ 0) \quad = \quad X_1 \text{ (say)}$$

$$X_1N \quad \hookrightarrow \quad (1 \ 1 \ 0 \ 0 \ 0 \ 1 \ 0 \ 0 \ 0) \quad = \quad X_2 \text{ (say).}$$

Thus the hidden pattern of X is a fixed point as $X_1 = X_2$.

We see poverty is in the ON state, this leads to family problems and the students are poor in spoken / written English.

Let us consider S_6 alone to be in the ON state and all nodes are in the OFF state. Suppose $Y = (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0)$ is the state vector.

Effect of Y on the dynamical system N is given by

$$YN \leftrightarrow (0\ 0\ 1\ 0\ 1\ 0\ 0\ 1\ 1) = Y_1 \text{ (say)}$$

$$Y_1N \leftrightarrow (0\ 0\ 1\ 0\ 1\ 0\ 0\ 1\ 1) = Y_2 (=Y_1).$$

Thus the hidden pattern is a fixed point resulting in the ON state of the nodes S_4 , S_{13} and S_{14} , i.e., those students with self confidence are the ones who have obtained proper guidance, who have good job opportunities and communication skills.

Suppose proper guidance alone is in the ON state and all other nodes are in the OFF state. Let $X = (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0)$ be the state vector.

Effect of X on N is given by

$$XN \leftrightarrow (0\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1) = X_1$$

$$X_1N \leftrightarrow (0\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1) = X_2;$$

$X_2 = X_1$. Hence a fixed point.

The teacher feels that if a rural student has proper guidance, they have good confidence level S_6 , regularity to classes S_{12} , good job opportunities and good communication skills S_{14} .

1.3 FUZZY RELATIONAL MAPS (FRMS) TO ANALYSE THE INTERRELATION BETWEEN TEACHERS AND URCS STUDYING IN CITY COLLEGES

In this section we are using the data collected both from the students and teachers of city colleges to analyse the interrelated problems using Fuzzy Relational Maps (FRMs). This section is organized into two subsections.

Subsection one defines attributes related with the teachers and the students from the questionnaire of the pilot survey; also in this subsection we justify the use of the FRMs model for this study. In subsection two, experts' opinion from the teachers and the students are taken to form the FRMs models.

1.3.1 Description of the attributes used and justification for using the FRMs model

In this subsection we study the teacher-student relationship using the FRMs model. We first describe the attributes/concepts related with the teacher in a line or two. Likewise students' problems are also described. We are justified in using FRMs model as the study involves two disjoint attributes which are related with students and teachers. Further the data is only an unsupervised one. Only this model can give a hidden pattern which is a pair of state vectors one for the teacher and the other for the students; which are infact interdependent.

Attributes/ Concepts related with the teachers:

- T₁** : Disciplined - The teacher comes in time to class, does not while away the time or cancel the lecture; besides that he/she teaches well and has a good command over the subject.
- T₂** : Impartial - Teacher does not show any form of discrimination either in class or while evaluating the answer sheets.
- T₃** : Ill behaved - Teacher is partial openly in the class, temperamental, irregular to classes and shows favoritism.
- T₄** : Clears doubts and is available to students.
- T₅** : Special care is given to the poor and rural students who are rather poor or disinterested in studies; calls such students and discusses with them their personal and overall problems that bother them and the ones related to their studies as well.

- T₆** : Takes extra efforts to complete the syllabus; does justice to the subject they handle.
- T₇** : Teachers who just hurt the feelings of the rural students openly which may have disastrous effect on the students (insensitive to the feelings of the students).
- T₈** : Teachers who come to class and while away the time irresponsibly without properly imparting the subject or any form of knowledge on the subject to the students.

We describe the attributes related to students (focus of URCS):

- S₁** : Rural underprivileged students feel comfortable and are composed in the class room.
- S₂** : Students are bored and restless in the class room.
- S₃** : Students fear hence they just sit quiet without learning the subject or understanding the subject.
- S₄** : Students never wish to miss a single class as they adore the teacher and the subject.
- S₅** : Students are dejected as the teacher has no knowledge of the subject.
- S₆** : The best in the students do not come out because the teacher is partial and undisciplined in the class.
- S₇** : Students show good grasp of the subject and exhibit extraordinary understanding of the subject.
- S₈** : Students are punctual, attentive and disciplined in the class and freely communicate with the teacher.

S_9 : Students get enough motivation from the teacher both on the subject and on the life-skills for their future.

S_{10} : Students do not fear the teacher and clarify their doubts in the subject.

1.3.2 Analysis of the experts' opinion using the FRMs model

We now give the related directed graph of the expert who is teacher.

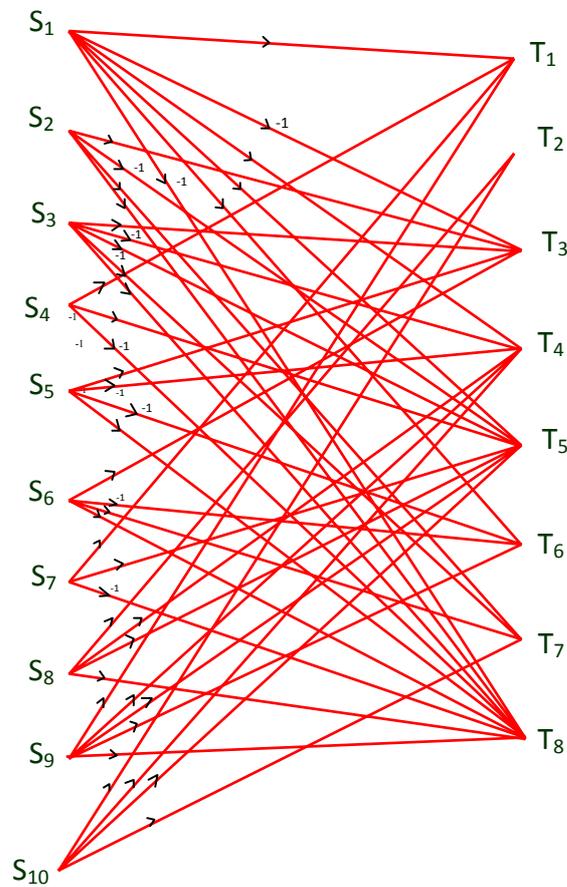


FIGURE 1.3.2.1

We take the attributes related with the students as the domain space of the FRMs and that of the teachers as the range space of the FRMs.

Using the directed graph we obtain the relational connection matrix of the dynamical system and denote it by M_1 .

$$M_1 = \begin{matrix} & T_1 & T_2 & T_3 & T_4 & T_5 & T_6 & T_7 & T_8 \\ S_1 & \left[\begin{array}{cccccccc} 1 & 0 & -1 & 1 & 1 & 1 & 0 & -1 \end{array} \right. \\ S_2 & \left[\begin{array}{cccccccc} 0 & 0 & 1 & 0 & -1 & 0 & 1 & 1 \end{array} \right. \\ S_3 & \left[\begin{array}{cccccccc} 0 & 0 & 1 & -1 & -1 & 0 & 1 & 1 \end{array} \right. \\ S_4 & \left[\begin{array}{cccccccc} 1 & 0 & 0 & 0 & 1 & 0 & 0 & -1 \end{array} \right. \\ S_5 & \left[\begin{array}{cccccccc} 0 & 0 & 1 & -1 & 0 & -1 & 0 & 1 \end{array} \right. \\ S_6 & \left[\begin{array}{cccccccc} 0 & 0 & 1 & 0 & 0 & -1 & 1 & 1 \end{array} \right. \\ S_7 & \left[\begin{array}{cccccccc} 1 & 0 & 0 & 0 & 1 & 0 & 0 & -1 \end{array} \right. \\ S_8 & \left[\begin{array}{cccccccc} 0 & 1 & 0 & 1 & 1 & 0 & 0 & -1 \end{array} \right. \\ S_9 & \left[\begin{array}{cccccccc} 1 & 0 & 0 & 1 & 1 & 1 & 0 & -1 \end{array} \right. \\ S_{10} & \left[\begin{array}{cccccccc} 0 & 1 & 0 & 1 & 1 & 0 & -1 & 0 \end{array} \right. \end{matrix}.$$

Suppose the experts want to study the node T_2 in the 'ON' state. To study the effect of T_2 on the dynamical system M_1 .

Let $X = (0 \ 1 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0)$; to find the effect of X on M_1 .

$$XM_1^T \hookrightarrow (0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 1 \ 0 \ 1) = Y \text{ (say)}$$

(\hookrightarrow denotes the vector has been thresholded).

$$\text{Now } YM_1 \hookrightarrow (0 \ 1 \ 0 \ 1 \ 1 \ 0 \ 0 \ 0) = X_1 \text{ (say)}$$

(after thresholding and updating).

$$X_1 M_1^T \hookrightarrow (1 \ 0 \ 0 \ 1 \ 0 \ 0 \ 1 \ 1 \ 1 \ 1) = Y_1 \text{ (say)}$$

$$Y_1 M_1 \hookrightarrow (1 \ 1 \ 0 \ 1 \ 1 \ 1 \ 0 \ 0) = X_2 \text{ (say)}$$

$$X_2 M_1^T \hookrightarrow (1 \ 0 \ 0 \ 1 \ 0 \ 0 \ 1 \ 1 \ 1 \ 1) = Y_2 \text{ (say)}.$$

We have $Y_2 = Y_1$ thus

$$Y_2 M_1 \hookrightarrow X_2.$$

That is $Y_2 = Y_1$; the hidden pattern of the state vector is a fixed pair of state vectors given by $\{(1 \ 1 \ 0 \ 1 \ 1 \ 1 \ 0 \ 0), (1 \ 0 \ 0 \ 1 \ 0 \ 0 \ 1 \ 1 \ 1 \ 1)\}$.

From this it is observed if the teacher is impartial then the teacher invariably happens to be disciplined, clears the doubts and is freely available

to students, takes special care of the poor and rural students and takes extra effort to help the students in studies.

Further we see when the teacher is not partial the students feel comfortable in the class and are contended. Also they don't wish to miss the classes, the best is brought out by the teacher, they show good grasp of the subject and come to class in time and they are not inhibited with the teacher but clarify their doubts in the subject.

Next the state vector is taken from the domain space with the ON state of the node S_4 alone and all other nodes remain in the OFF state.

Let $X = (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0)$. The effect of the state vector X on the dynamical system M_1 is given by

$$XM_1 \leftrightarrow (1\ 0\ 0\ 0\ 1\ 0\ 0\ 0) = Y \text{ (say).}$$

Now

$$YM_1^T \leftrightarrow (1\ 0\ 0\ 1\ 0\ 0\ 1\ 1\ 1\ 1) = X_1 \text{ (say)}$$

$$X_1M_1 \leftrightarrow (1\ 1\ 0\ 1\ 1\ 1\ 0\ 0) = Y_1 \text{ (say)}$$

$$Y_1M_1^T \leftrightarrow (1\ 0\ 0\ 1\ 0\ 0\ 1\ 1\ 1\ 1) = X_2 \text{ (say).}$$

$X_1 = X_2$ this forces $X_2M_1 = Y_2 = Y_1$, thus once again the resultant is a fixed pair.

Further we see the hidden pattern of the state vector from the domain space $X = (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0)$ gives the same resultant or the same hidden pattern when the state vector $(0\ 1\ 0\ 0\ 0\ 0\ 0\ 0)$ from the range space was taken with the ON state of T_2 .

Thus we see surprisingly both these state vectors give the same pair of fixed points viz; $\{(1\ 1\ 0\ 1\ 1\ 1\ 0\ 0), (1\ 0\ 0\ 1\ 0\ 0\ 1\ 1\ 1\ 1)\}$.

Further the impact of impartial teacher and the students never miss the class go hand in hand giving the same hidden pattern.

Next we work with the ON state of the node T_7 from the range space and all other nodes remain in the OFF state.

Let $Y = (0\ 0\ 0\ 0\ 0\ 0\ 1\ 0)$; the effect of Y on the dynamical system M is given by

$$Y M_1^T \leftrightarrow (0\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0) = X \text{ (say)}$$

$$X M_1 \leftrightarrow (0\ 0\ 1\ 0\ 0\ 0\ 1\ 1) = Y_1 \text{ (say)}$$

$$Y_1 M_1^T \leftrightarrow (0\ 1\ 1\ 0\ 1\ 1\ 0\ 0\ 0\ 0) = X_1 \text{ (say)}$$

$$X_1 M_1 \leftrightarrow (0\ 0\ 1\ 0\ 0\ 0\ 1\ 1) = Y_2 \text{ (say)}.$$

We see $Y_1 = Y_2$ which forces $X = X_1$.

Hence the hidden pattern is a fixed point given by $\{(0\ 0\ 1\ 0\ 0\ 0\ 1\ 1), (0\ 1\ 1\ 0\ 1\ 1\ 0\ 0\ 0\ 0)\}$. Thus when the teacher is very careless and hurts the feelings of the rural students we see the teacher is an ill behaved one who whiles away the time without any responsibility of imparting education to the students that is T_3 and T_8 come to ON state.

We see that this attitude of the teacher makes the nodes S_2, S_3, S_5 and S_6 to ON state of the domain space; thereby proving that if the teacher is careless and hurts the students feelings, students are bored and restless in the class room, they fear the teacher hence sit quiet without learning or understanding the subject, they also remain dejected as the teacher lacks good knowledge of the subject and the best in the students do not come out because the teacher is undisciplined.

1.4 CONCLUSION

In this section we give the conclusions based on the two fuzzy models FCMs and FRMs. This section has two subsections. Subsection one gives the conclusions based on the use of FCMs model and subsection two gives the conclusions and suggestions from the study of using the FRMs model.

1.4.1 Conclusion from FCMs model

Here we give the conclusions based on the use of FCMs model to study the URCS problems.

1. Proper guidance is vital for the students to get self confidence and employment. So it was suggested that the college authorities hold weekly two classes to guide and council URCS towards their goal. Hard work at all costs will pay them the best and there is no shortcut to success, this should be inculcated in their minds. Once they prove to be good at studies and regular to the classes, everything will come to them, is one of the conclusions from the hidden pattern given by the 'ON' state of proper guidance alone.

Further from the hidden pattern we see that proper guidance will lead to self confidence and we see self confidence in rural poor shows that he/she should have got proper guidance.

Thus it is suggested guidance classes should be given atleast twice weekly by the authorities of the institution atleast in the first year of their joining the college. For the hidden pattern when self confidence is in the ON state we see in both models it makes the nodes S_6 , S_{12} , S_{13} and S_{14} in the ON states. Hence URCS improvement lies in giving them proper guidance!

2. It is seen from the model that the ON state of any of the negative attributes like poverty, inferiority complex, not knowing proper English etc., turns other negative attribute/nodes to ON state.

However the models show that by giving proper guidance all the negative attributes can be overcome in the URCS studying in city colleges.

Further it is observed that ON state of certain nodes like poverty, family problems, inferiority complex, lack of skill in English language, classmates ill-treating them give the same hidden pattern which clearly shows the presence of any one of the negative attributes in the URCS leads the person to get all other negative attributes enlisted in subsection 1.2.2 of this chapter. It is felt that proper guidance alone can wipe out these negative attributes. For providing any other help is not going to improve them, feel the experts.

3. However it is seen from the data that some classes in spoken English may be initiated in the college for their development in English, which can give them better job opportunities and better communication skills.
4. From the data we derive that most of them suffer from family problems, which makes them not up to the mark in their studies; for they ruminate about the family problems whenever they find time. Instead of using time in a productive way they waste their time thinking / day dreaming which has a negative influence on their performance. The college can give them part time employment after class hours which can certainly help them in overcoming their worries and be productive. Further no one is free of problems in this world; this should also be inculcated in their minds to make them think of the fact that they are indeed gifted.
5. Most of them have come to city for the first time and this has given them a cultural shock. That is why they are worried about their appearance and so on. If they are taught that all these are secondary

and their performance in studies alone is primary, certainly they can be uplifted this is evident by the hidden pattern of the FCMs model. Thus the mathematical analysis repeatedly show proper guidance is very important for them.

6. Further these models gave hidden patterns which were only fixed points indicating that the URCS had no fluctuation or rise and fall that is a cyclic change in their problems. They were consistent and uniform with these attributes.
7. The data reveals that the students are very dissatisfied with the schools in which they have studied. For, their school teachers have not properly guided them or properly motivated them which has resulted in deepening their problems.

Thus it is suggested that the school teachers may be given intense training by the educationalists/government/agencies to motivate and guide the school students properly atleast in the 11th and 12th standards.

8. The college city students and teachers must be given advice to mix without difference with the underprivileged rural students and try to help them in their studies, for, after all they should realize that they are only the fellow beings and it is their duty to help them. Basically education must mould the teachers and city students to help the deprived and not laugh at them!
9. Finally it is observed that Government must force the city bred teachers to work in remote village schools and village teachers to work in city schools atleast for a minimum period of 3 years so that they can impart guidance and at large motivate the students.

1.4.2 Conclusion from FRMs model

In this subsection we give the conclusions and suggestions not only based on the FRM model but also from the response to the questionnaire given by the students and teachers and also from the personal discussions we had with them.

1. The Study shows that the students best performance or otherwise is highly dependent on the teachers' behavior. For if the teacher is impartial and takes interest in the welfare of the rural students certainly we feel that the students not only become motivated but also are channelized and the best comes out of them. Thus at this juncture, it is suggested that special short term (say a week long courses) be given to teachers to be disciplined and learn the psychology of teaching, handling and imparting education to the adolescent children with care. Further, during this course, a special test should be given to the teachers to know his/her nature and help them to remain in the same profession with adequate skills and capacities or disqualify them for their careless behavior that would mar the future generations. Unless such steps are taken the development of the nation remains at stake; for the future generations are not prepared by the teachers upto expectations.
2. The study further shows that teachers who are self disciplined invariably posses almost all the good qualities of a teacher. These teachers should be spotted and should be encouraged with small amount of bonus or some recognition certificate so that this will indirectly have impact at least on a few bad teachers, and at the same time, the teacher, having been encouraged, will try to continue to do his/her best. Further it is noted that such teachers certainly motivate the students in a positive way and this will certainly make some good progress among the URCS who form the considerable portion of the students' community.

3. Study shows that most of the teachers are not even true in evaluating themselves; which has really pained the researchers.
4. Study shows that most of the teachers lack good communication skills and real devotion to their profession.
5. We see from our study that majority of the students are true and frank while expressing their views on teachers.
6. We have decided to take up as our future study the factors hindering the students from concentrating / contributing well in their studies in general and in class in particular.
7. Also our study establishes that students never wish to miss the classes or be insincere, if the teacher happens to be good and above all impartial. Thus keeping this attribute in mind the administration or the government should take steps to build good teachers as the future generation happens to be much brighter and sensitive to the issues they face and teachers in colleges should be evaluated and tested every five years and if found unfit should be sent home or make all appointments of teachers in colleges on a contract basis such was suggested even by Infosys Narayanamurthy and is mentioned in preface of this thesis.
8. The students should be given extra classes on the values of life so that they are not only motivated in studies but also have strength of mind to face the world and take disappointments in life in a positive way.