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Fuzzy Matrix Theory in Recognizing the Qualities of Teacher

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Abstract: Teacher quality plays a major role in students learning. Hence teacher quality is considered to be important. Researches take a great interest in finding the quality of a teacher. Many policy makers and researchers have given the effectiveness, as the teachers' contribution to the student, as an important aspect of teacher quality. This research is to find the component of a teacher quality and Teacher Quality Index (TQI) is applied to find the qualities of a teacher and also fuzzy relational maps (FRM) for educational developments of institutions.

I. INTRODUCTION

Fuzzy set theory was initialized by Zadeh about 40 years ago in the scientific community. Fuzzy set theory have a base of classical set theory, that is given universe χ and A as a subset of it, any elementx of χ, instead as degree oh membership either 0 or 1as postulated in classical set theory. They have a membership value $\mu A\ (x) \in [0,1]$ in a set A as a representation of degree of its belonging to A. Fuzzy logic is a superset of conventional logic, which has the concept of partial truth ,they are between "completely truth" and "completely false ". Vasanta Kandaswamy introduced the notion of Fuzzy Relational Maps (FRMs). It is analogous to Fuzzy Contro Maps(FCMs)described and discussed earlier. In FCMs he promotes the correlations between causal associations among concurrently active units. But in FRMs he divide the very causal associations into two disjoint units, for example, the relation between a teacher and a student or relation between an salesman and a customer or a relation between doctor and patient and so on. Using the model described by Kandaswamy, we will try to make out the Qualities of Teacher for the management of educational institute .This work will be helpful to characterize the quality of teacher, which gives the best outcomes for students as well good management gives better future too. The intention of this study is to research educationists' perception of teacher quality and whether it derives meaning from a social construct of both policy—No Child Left Behind— and environmental factors.

II. PRELIMINARY

1) *Definition 2.1:* A FRM is a directed graph or a map from T to S with concepts like policies or events etc as nodes and causalities as edges. It represents causal relation between spaces Tand S.
2) *Definition 2.2:* Let T_1… Tn be the nodes of the domain space T of an FRM and $S_1,\ldots,S_m$ be the nodes of the range space R of an FRM. Let the matrix E be defined as E= (eij) where eij is the weight of the directed edge TiSj (or SjTi), E is called the Relational matrix of the FRM.
3) *Definition 2.3:* Let T_1, ..., Tn and S_1,…, Sm denote the nodes of the FRM. Let TiSj(or SjTi),be the edges of an FRM, j = 1, 2,…, m and i= 1, 2,…, n. Let the edges forma directed cycle.
4) *Definition 2.4:* When there is a feedback in the FRM, ie. when the causal relations flow through a cycle in a revolutionary manner, the FRM is called a dynamical system,

Let DiRj (or RjDi),$1 \le j \le m$, $1 \le i \le n$. When Ri (or Dj) is switched on and if

Causality flows through edges of the cycle and if it again causes Ri (or Dj), we say thatthe dynamical system goes round and round. This is true for any node Rj (or Di) for 1

$\le i \le n$, (or $1 \le j \le m$). The equilibrium state of this dynamical system is called the hidden pattern.

If the FRM settles down with a state vector repeating in the form,

A1→ A2 → A3 → … → Ai → A1 (or B1 → B2 → …→ Bi → B1)

Then this equilibrium is called a limit cycle.

A. Fuzzy Matrix

In this study we recollect some of the basic properties of fuzzy matrix and their operations. All over this study [0,1] denotes the unit interval.

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B. Definition: A fuzzy associative matrix express fuzzy logic rules in tabular form ,the fuzzy logic rules usually takes to two variables as input, mapping certainly to a 2 dimensional matrix. Whereas theoretically a matrix of any number of dimensions is possible.

Now we continue to describe various types of fuzzy matrices without moving deep into their structure. We take

$$B = \begin{bmatrix} 2 & 7 & 5 & 2 & 0 \\ 4 & 2 & 3 & 4 & 1 \\ 1 & 5 & 2 & 4 & 7 \end{bmatrix}$$

to be fuzzy matrix of 3×3 order. We also take B also 3× 3 matrix. Therefore all fuzzy matrices are matrices but not every matrix is not fuzzy matrix.

C. Multiplication of Fuzzy Matrix

The product of two fuzzy matrices as a ordinary matrix multiplication is not a fuzzy matrix. So we define a compatible operation analogous to product that the product again happens to be a fuzzy matrix. Still for this operation if the product AB is to be defined, the number of A should be equal to the number of rows of B. The max-min operation and min-max operation are the two type of operations. Let

$$X = \begin{bmatrix} 0.3 & 1 & 0.8 \\ 1 & 0.9 & 0.2 \\ 0.7 & 0 & 0.1 \end{bmatrix}$$ be 3×3 fuzzy matrix and let

$$Y = \begin{bmatrix} 0 & 1 & 0.2 \\ 0.5 & 0.8 & 0.3 \\ 0.2 & 0.4 & 1 \end{bmatrix}$$ be 3×3 matrix

Then the XY matrix is defined using max. min function.

$$X \times Y = \begin{bmatrix} C11 & C12 & C13 \\ C21 & C22 & C23 \\ C31 & C32 & C33 \end{bmatrix}$$

Where, C11= max {min (0.3, 0), min (1, 0.5), min (0.8, 0.2)
=max {0, 0.5, 0.2}
=0.5
C12=max {min (0.3, 1), min (1, 0.8), min (0.8,0.4)}
=max{0.3,0.8,0.4}
=0.8 and so on

$$X \times Y = \begin{bmatrix} 0.5 & 0.8 & 0.8 \\ 0.5 & 1 & 0.3 \\ 0.1 & 0.7 & 0.2 \end{bmatrix}$$ is a 3*3 matrix

Thus fir the same X and Y ,we can follow the min-.max operation.

Teacher: A teacher or educator is a person who teaches or educates others.
Student: A student or leaner is a person who studies at any educational institutions.

D. Method

We are presenting here a simple example to understand the FRM method as recommended by
Kandasamy.

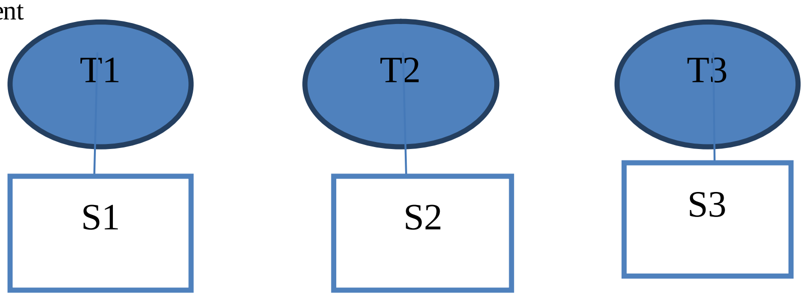
Assume the domain space as the belonging to the teacher say T1,…, T3 and the range space as the belonging to the student say S1, S2 and S3, describe as follows

E. Domain Space

T1- Teaching is nice
T2- Teaching in normal
T3- teaching is low

F. Range Space

S1-good student
S2-moderate student
S3- poor student



The relational matrix R from the map above is

$$R = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

If $A = (1\ 0\ 0)$ is passed on the relational matrix R, then the instantaneous vector is,

$$AR = (1\ 0\ 0)\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Then $AR = (1\ 0\ 0)$ shows that the student is examined as a good student.

Assume $AR = A_1$

$$\text{Then } A_1 E^T = (1\ 0\ 0)\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= (1\ 0\ 0)$$

Show the result as that the student as a good student.

III. CONCLUSION AND RESULTS

Teachers quality plays a vital role in effective student learning. Every teacher should satisfy the academic qualification standard and teacher capability. Teacher capability qualifications are attended by getting higher education certificate. The effective quality of teachers were studied through the set of statements in each category

A. Teacher with a good personality.
B. Clear planning and time management
C. A deep knowledge of subject which makes a effective teaching.

IV. RESULT

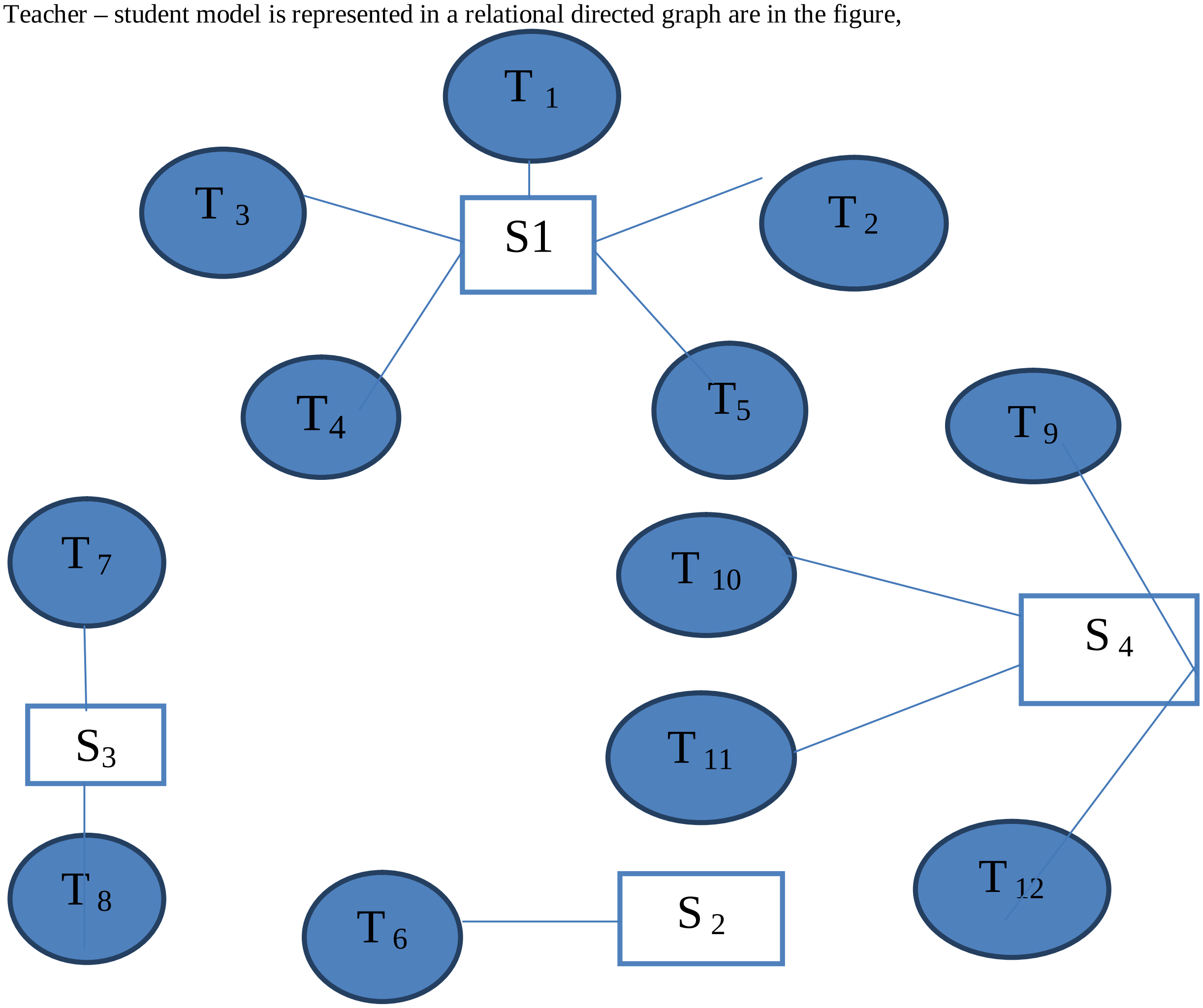
Assume the domain space as the belonging to the teacher say T1,…,T3 and the range space as the belonging to the student say S1, S2 and S3, as follows:

T_1 - Teacher has excellent teaching skill and also encourages the student.
T_2 -Teacher uses the developed technology and variations in teaching.
T_3 - Teachers' thought to know the student individually.
T_4 - Affection towards the student.
T_5 - Changing students attitude by positive influence.
T_6 -Normal teaching.
T_7 - Old method of teaching.
T_8 - Average teaching.
T_9 - Poor subject knowledge.
T_{10} - No thinking of students.
T_{11} - Short tempered.
T_{12} - Lack of listening.

A. Range Space

S_1 - Good student (well disciplined ,know ledged ,kind hearted)
S_2 -Moderate student (Interactive, regular, disciplined)
S_3 - Poor student (Lack of concentration)
S_4 – Bad student (Not interested in studies)

The Teacher – student model is represented in a relational directed graph are in the figure,



$$\text{Relational martrix R} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\text{If } A = \begin{bmatrix} 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$AR = \begin{bmatrix} 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

AR= [1 0 0 0] is a good student

Now let AR = A_1

$$A_1 E^T = \begin{bmatrix} 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Hence we had again found the five best qualities of teacher which denote the good studentas: Teacher has excellent teaching skill and also encourages the student.

Teacher uses the developed technology and variations in teaching
Teachers' thought to know the student individually.
Affection towards the student.
Changing students attitude by positive influence.
Now we again put $A_1 E^t = A_2$

$$A_2E = \begin{bmatrix}1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0\end{bmatrix}\begin{bmatrix}1&0&0&0\\1&0&0&0\\1&0&0&0\\1&0&0&0\\1&0&0&0\\0&1&0&0\\0&0&1&0\\0&0&1&0\\0&0&0&1\\0&0&0&1\\0&0&0&1\\0&0&0&1\end{bmatrix}$$

$A_2E = [\,5\ 0\ 0\ 0\,]$
$= [\,1\ 0\ 0\ 0\,]$ which says that student is good student.

$A_2 E = A_3$

$$A_3 E^T = [\,1\ 0\ 0\ 0\,]\begin{bmatrix}1&1&1&1&1&0&0&0&0&0&0&0\\0&0&0&0&0&1&0&0&0&0&0&0\\0&0&0&0&0&0&1&1&0&0&0&0\\0&0&0&0&0&0&0&0&1&1&1&1\end{bmatrix} \quad A_3 E^T = \begin{bmatrix}1&1&1&1&1&0&0&0&0&0&0&0\end{bmatrix}$$

We had again found the five best qualities of teachers.
After updating, the chain must be obtain at the each stage of instantaneous vector as:

$$A1 \to A2 \to A3 \ldots \to Ai \to A1$$

Hence A_1 is a fixed point and the equilibrium a limit circle. We can conclude that when the teacher have a effective teaching skills, then the student brings a excellent results and also the institution have the advantage of bringing out better knowledge from the student.

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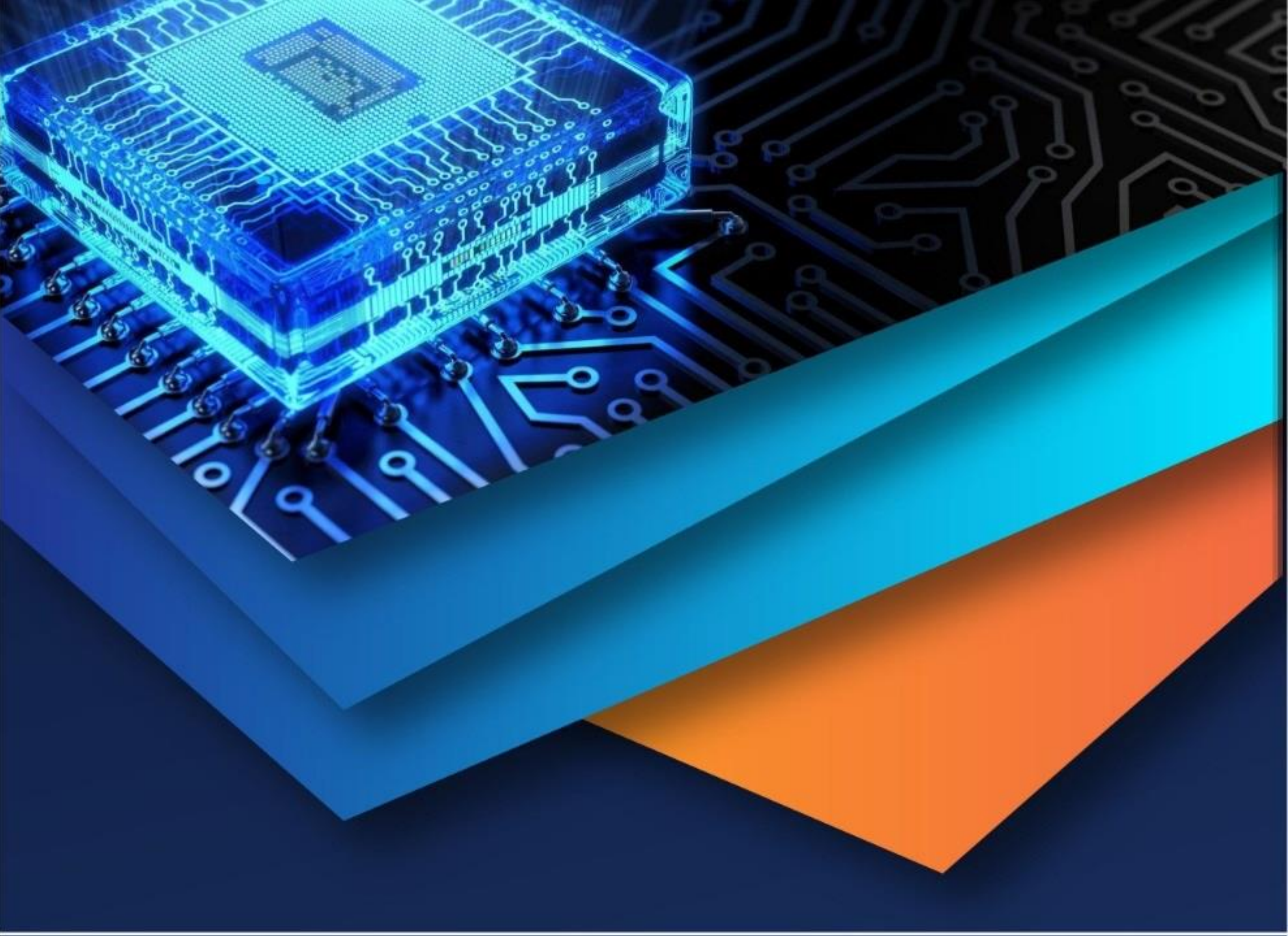

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