

Fuzzy Matrix Solution for the Study of Teacher's Evaluation

Vivek Raich, Archana Gawande* and Seema Modi**

*Govt. Autonomous Holkar Science College, A.B. road Indore M.P., India

**Christian Eminent College, RSS Nagar Indore, M.P., India
Affiliated to Devi Ahilya University, Indore, M.P.

Email: drvivekraich@gmail.com, gawandearchana@gmail.com,
seemamodi17@yahoo.com

Received 19 September 2013; accepted 30 September 2013

Abstract. Researchers who study teacher quality put a great interest in investigating the quality of effective teacher. A number of policy makers and researchers have proposed that effectiveness, as determined by teachers' contribution to student learning, should be an important component of assessing teacher quality. Therefore, teacher quality measurement is important. Fuzzy relation provides solutions of our daily life problems depend on two different situations. In this paper we will try to obtain conclusion about teachers performance by giving membership grades to his/her quality from 0 to 1 in the fuzzy relation matrix R_o (an occurrence relation obtained by observations on sufficient number of teacher), R_c (a conformability relation confirmed by expert in education sector) and R_s (a matrix which contains degree of specialty seen by educationist for testing the model).

Keywords: FMS, Max. Min. Rule, Min. Max. Rule, Education system, Teacher quality

AMS Mathematics Subject Classification (2010): 08A72, 15B15

1. Introduction

Zadeh was the first mathematician who tried to overcome such problems of uncertainty by introducing Fuzzy set theory about 60 year ago, which is a generalization of classical set theory, in the sense that a given universe χ and a subset A of it, any element x of χ , instead of having a degree of membership either 0 or 1 in A as postulated under the classical set theory, can have a membership value $\mu_A(x) \in [0,1]$ in a set A which represents the degree of its belonging to A . In other word, A is a fuzzy subset of universe χ , characterized by the membership function $\mu_A(x)$, $x \in \chi$.

Teacher quality matters a great deal in terms of student's performance.

The teacher has three levels of responsibility to his students in relation to giving advice:

1. The first is fulfillment of the prerequisite of getting to know his students individually, to probe the innermost depths of their hearts as well as examining the outer details of

Vivek Raich, Archana Gawande and Seema Modi

their lives. As the teacher's familiarity grows, so the potency of his advice deepens proportionately.

2. Secondly, the teacher must express love and affection toward his students. It is this affection that dissolves the students' natural tendency to resist being told what to do. Thus, the advice can penetrate more deeply and effectively.
3. Finally, the teacher must take time to reflect upon his students' progress, refining and adjusting his vision of how best to influence them toward positive change. This is an ongoing requirement because students quickly "outgrow" old advice, and the categories of what is beautiful and what is ugly change with each new stage of growth.

The purpose of this study was to research educators' perception of teacher quality and whether it derives meaning from a social construct of both policy—No Child Left Behind—and environmental factors.

The purpose of this study is three fold

1. to review how the terms excellence and quality are shaped by socially constructed realities
2. to identify how educators perceive teaching quality, and
3. to review how school districts develop teacher quality.

The research questions include

1. How does the social construction of reality interplay with the terms quality/excellence?
1. How does the No Child Left Behind law shape a definition of quality teaching?
2. How is student achievement connected to teacher quality?
3. What are administrators' and teachers' perceptions of quality teaching attributes?
4. How do educators who are identified by administrators as quality teachers identify and Develop attributes of teacher quality in them?
5. How do school districts cultivate quality?

Fuzzy Matrix Theory provides fuzzy relation matrix R_o (an occurrence relation obtained by observations on sufficient number of teachers), R_c (a conformability relation confirmed by expert in education sector) and R_s (a matrix which contains degree of specialty seen by educationist for testing the model). R.Vivek, et.al.[4,6] apply Fuzzy Modeling Approach for Predicting Diarrhea Stage. and Prediction of diarrhea stages Using FMS, are basic papers to develop this work.

The aim of this paper is to assess the Teacher quality which is suitable for different types student using F.M.S.(Fuzzy matrix solution) for the improvement of student performance in the education institute.

2. Definition and Methodology

Definition 2.1. The Study of Occurrence relation R_o and Conformability relation R_c in education sector using fuzzy matrices is useful because a Specialty may likely to occur with a given award but may also commonly occur with several other distinctions, therefore limiting its power as a discriminating factor among them is important. On the other hand, another Specialty may be relatively with a given awards.

Definition 2.2. An, Occurrence relation R_o provides knowledge about the tendency or

Fuzzy Matrix Solution for the Study of Teacher's Evaluation

frequency of appearance of Specialty when the specific distinction is present i.e. How often does the Specialty occur with award.

Definition 2.3. A Conformability relation R_c describes the discriminating power of the Specialty to confirm the presence of the award i.e. how, strongly does the Specialty confirm awarded. The distinction between occurrence and conformability is important because a specialty may occur with given award may be commonly occur with several other awards.

Remark: The above said relations are determined from expert in education system as well as from psychologist and observation over the related teacher in the school education system. By giving membership grades to linguistic terms always, often, unspecific, seldom, and never 1, .75, .5, .25, or 0 respectively in fuzzy relation R_o and R_c investigator can draw different types of conclusions about the problem. This can be explained with an example given in our main result.

Definition 2.4. Product of two fuzzy matrices:

Since product of two fuzzy Matrix multiplications under usual method is not a fuzzy matrix. So we need to define a compatible operation analogous to product that the product again happens to be a fuzzy matrix. However even for this new operation if the product XY is to be defined we need the number of columns of X is equal to the number of rows of Y . The two types of operations which we can have are max-min operation and min-max operation. Let

$$X = \begin{pmatrix} 0.3 & 1.0 & 0.7 & 0.2 & 0.5 \\ 1.0 & 0.9 & 0.0 & 0.8 & 0.1 \\ 0.8 & 0.2 & 0.3 & 1.0 & 0.4 \\ 0.5 & 1.0 & 0.6 & 0.7 & 0.8 \end{pmatrix}$$

be a 4x5 fuzzy matrix and

$$Y = \begin{pmatrix} 0.8 & 0.3 & 1 \\ 0.7 & 0 & 0.2 \\ 1 & 0.7 & 1 \\ 0.5 & 0.4 & 0.5 \\ 0.4 & 0 & 0.7 \end{pmatrix}$$

be a 5x3 fuzzy matrix.

XY defined using max. min Rule

$$XY = \begin{pmatrix} C_{11} & C_{12} & C_{13} \\ C_{21} & C_{22} & C_{23} \\ C_{31} & C_{32} & C_{33} \\ C_{41} & C_{42} & C_{43} \end{pmatrix}$$

where,

$$C_{11} = \max \{ \min (0.3, 0.8), \min (1, 0.7), \min (0.7, 1), \min (0.2, 0.5), \min (0.5, 0.4) \}$$

$$= \max \{ 0.3, 0.7, 0.7, 0.2, 0.4 \}$$

$$= 0.7.$$

$$C_{12} = \max \{ \min (0.3, 0.3), \min (1, 0), \min (0.7, 0.7), \min (0.2, 0.4), \min (0.5, 0) \}$$

$$= \max \{ 0.3, 0, 0.7, 0.2, 0 \}$$

$$= 0.7 \dots \text{ and so on.}$$

$$XY = \begin{pmatrix} 0.8 & 0.4 & 1 \\ 0.8 & 0.4 & 0.8 \\ 0.7 & 0.6 & 0.7 \end{pmatrix} \text{ is a } 3 \times 3 \text{ matrix.}$$

Now suppose for the same X and Y we adopt the operation as min. max Rule we get

$$D = \begin{pmatrix} D_{11} & D_{12} & D_{13} \\ D_{21} & D_{22} & D_{23} \\ D_{31} & D_{32} & D_{33} \\ D_{41} & D_{42} & D_{43} \end{pmatrix}$$

where

$$D_{11} = \min \{ \max (0.3, 0.8), \max (1, 0.7), \max (0.7, 1), \max (0.2, 0.5), \max (0.5, 0.4) \}$$

$$= \min \{ 0.8, 1, 1, 0.5, 0.5 \}$$

$$= 0.5.$$

$$D_{12} = \min \{ \max (0.3, 0.3), \max (1, 0), \max (0.7, 0.7), \max (0.2, 0.4), \max (0.5, 0) \}$$

$$= \min \{ 0.3, 1, 0.7, 0.4, 0.5 \}$$

$$= 0.3 \dots \text{ and so on.}$$

Thus we have

$$D = \begin{pmatrix} 0.5 & 0.3 & 0.5 \\ 0.4 & 0.1 & 0.7 \\ 0.4 & 0.4 & 0.2 \\ 0.6 & 0.5 & 0.7 \end{pmatrix}$$

2.5 Methodology for Calculation

For calculation of our main result we can use following steps

Step 1: Obtain the matrix for occurrence relation $R_O = S \times D$, (indicates the frequency of occurrence of specialty with awards D)

Step 2: Obtain the matrix for confirmative relation $R_c = S \times D$, (corresponds to the degree to which specialty confirms the award D.)

Step 3: Now assuming a fuzzy relation $R_S = P \times S$ construct fuzzy matrix (specifying the degree of presence of specialty S_1, S_2, S_3 , for the teachers. This indicates the degree to which the specialty is present in teachers P.)

Step 4: Using relations R_S, R_O , and R_C four different indication relations will be calculated as below,

The occurrence indication relation R_1 calculated by $R_1 = R_S * R_O$

The conformability indication relation R_2 is calculated by $R_2 = R_S * R_C$

The nonoccurrence indication relation R_3 calculated by $R_3 = R_S * (1 - R_O)$

Finally, the non-symptom indication relation R_4 is calculated by $R_4 = (1 - R_S) * R_O$

Fuzzy Matrix Solution for the Study of Teacher's Evaluation

Step 5: The process of fuzzy matrix multiplication is tedious and time consuming. So we calculate it by a computer program using Java Language as developed in [4, 5].

3. Main results

The Model prescribed by Raich at al [4, 5] is used in our case study as below. Consider, three sets S, D, P Where,
Set of Specialty/ Nature/ quality of Teachers, $S = \{S_1, S_2, S_3\}$

$S_1 =$ Teacher has quality of passionate about teaching, and tries to motivate his student. He has uses the latest technology in teaching, uses creativity and variety.

He has the quality of Computer Aided Instructor (CAI).

He has the fulfillment of the prerequisite to get to know his student individually. He has expression and affection towards his student.

Influencing his student towards positive change

$S_2 =$ Teaching is effective.

Teaching is good.

In teaching he uses of Teaching aid Made by own Low Cost Teaching Aid). Teaching Method used according to the students and content demand

(For example-Demonstration, Method, Inductive-Deductive Approach, Project, Role playing, Problem Solving etc.)

$S_3 =$ Teaching style by traditional methods.

Problem solution is average.

Teaching is not well.

He never spend time thinking about student.

Often gets angry and Doesn't listen to students.

$D = \{D_1, D_2, D_3\}$

where,

$D_1 =$ represent the Excellent Teachers (Suitable for Excellent Student)

$D_2 =$ represent Good Teachers (Suitable for Good Student)

$D_3 =$ represent Average Teachers (Suitable for Average/ Bad Student)

$P = \{P_1, P_2, P_3\}$ set of teachers considered for testing in our study.

Using Computer program software Fuzzy matrix solution (FMS) developed by Raich, Tripathi, Dalal [4], Raich, Gawande, Tripathi,[5] we can obtain conclusion matrix shown in the following figure.

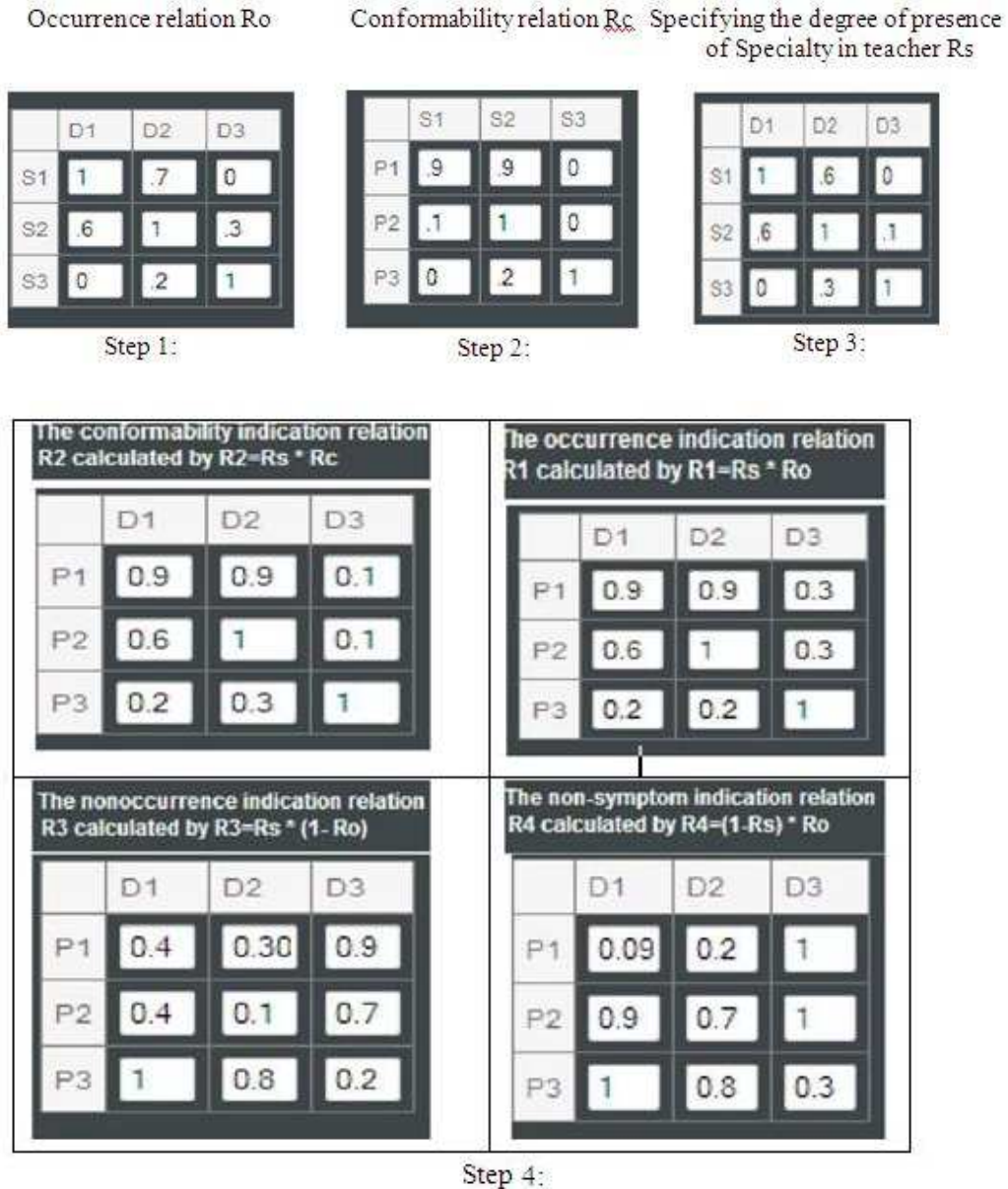


Figure 1:

4. Conclusion and Results

In R_1 , (P_2, D_2) and $(P_3, D_3) = 1$ shows that teacher P_2 occur good category and P_3 occur average category.
 In R_2 again (P_2, D_2) and $(P_3, D_3) = 1$ it means it is confirm by expert and our observation.
 In non occurrence indication relation R_3 the value of $(P_3, D_1) = 1$ shows P_3 never occurred excellent teacher.
 At last non symptom indication relation R_4 , (P_1, D_3) , (P_2, D_3) and $(P_3, D_1) = 1$ shows

Fuzzy Matrix Solution for the Study of Teacher's Evaluation
that, P_1 , P_2 has no any symptoms to be average teacher and P_3 as excellent teacher.

REFERENCES

1. A.Di Nola, W.Pedrycz, S.Sessa and E.Sanchez, Fuzzy relation equations theory as a basis of fuzzy modeling: an overview, *Fuzzy Sets and Systems*, 40 (1991) 415.
2. M.Gavalec, Solvability and unique solvability of max-min fuzzy equations, *Fuzzy Sets and Systems*, 124 (2001) 385-393.
3. G.J.Klir and B.Yuan, *Fuzzy Sets and Fuzzy Logic: Theory and Applications*, Prentice-Hall, Englewood Cliffs, NJ, 1995.
4. R.Vivek, T.Rakesh and D.Sanat, Prediction of diarrhea stages using FMS, *Search and Research*, 1(3) (2010) 24 - 28.
5. R.Vivek, G.Archana and T.Rakesh, Assessment of school student using fuzzy matrix solution (FMS), *International Journal of Fuzzy Mathematics and Systems*, 3(3) (2013) 197-202.
6. R.Vivek, J Shaifli and S Rajesh, Fuzzy modeling approach for predicting diarrhea stage, *Indian Research Communication*, 3(2) (2009) 76 -84.