A Study of Quality in Primary Education Combined Disjoint Block Neutrosophic Cognitive Maps (CDBNCM)

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Abstract

Quality in primary education has been classified into five factors involving learners, content, processes, environment and outcomes. In this paper we analyzed, quality in primary education in Chennai and find out its solution using Neutrosophic cognitive maps (NCMS), which is the generalization of fuzzy cognitive maps (FCMS) defined by W.B. Vasantha Kandasamy and Florentine Smarandache. This paper has five sections. First section gives information about development of fuzzy cognitive maps and Neutrosophic cognitive maps. Second section gives the preliminaries of FCMS and NCMS. In section three, we give the description of the problem; final section gives the conclusion based on our study.

1 Introduction:

IN 1965, L.A. Zadeh has introduced a mathematical model called Fuzzy cognitive Maps. After a decade in the year 1976, Political scientist R. axelord[7] used this fuzzy model to study decision making in social and political systems. Then B.Kosko [1], [2], [3], enhanced the power of cognitive maps considering fuzzy vales for the concepts of the cognitive map and fuzzy degrees of interrelationships between concepts. FCMs can successfully represent knowledge and human experience, introduced concepts to represent the essential elements and the cause and effect relationships among the convenient simple and powerful tool, Which is used in numerous fields such as social economical and medical etc. In this paper we use the Neutrosophic cognitive maps (NCMs) created by and Florentine Smarandache [8],[9], which is an extension/ combination of the fuzzy cognitive maps (FCMS) in which inderminacy is included. It has also become very essential that the notation of Neutrosophic logic plays a vital role in several of the real world problems like law, medicine, industry, finance, IT, stocks and share etc. Here we defining about education.

Quality education includes:

- Learners who are healthy, well-nourished and ready to participate and learn, and supported in learning by their families and communities;
- Environments that are healthy, safe, protective and gender-sensitive, and provide adequate resources and facilities;
- Content that is reflected is relevant curricula and materials for the acquisition of basic skills, especially in the areas of literacy, numeracy and skills for life, and knowledge in such areas as gender, health, nutrition, HIV/AIDS prevention and peace.
- Processes through which trained teachers use child-centered teaching approaches in well-managed classrooms and schools and skillful assessment to facilitate learning and reduce disparities.
- Outcomes that encompass knowledge, skills and attitudes, and are linked to national goals for education and positive participation in society

This definition allows for an understanding of education as a complex system embedded in a political, cultural and economic context. It is important to keep in mind education's systemic nature, however; these dimensions are interdependent, influencing each other in many ways.

2 Preliminaries

Fuzzy Cognitive Maps (FCMs) are more applicable when the data in the first place is an unsupervised one. The FCMs work on the opinion of experts. FCMs model the world as a collection of classes and causal relations between classes.

2.1 Definition

A NCMs is a directed graph with concepts like policies, events etc, as nodes and causalities as edges. It represents causal relationship between concepts.

2.2 Definition

When the nodes of the NCM are fuzzy sets then they are called as fuzzy nodes.

2.3 Definition

NCMs with edge weights or causalities from the set {-1, 0, 1, *I*} are called simple NCMs.

2.4 Definition

Let C_i and C_j denote the two nodes of the NCM. The directed edge from C_i to C_j denotes the causality of C_i on C_j called connections. Every edge in the NCM is weighted with a number in the set {-1, 0, 1, *I*}. Let e_{ij} be the weight of the directed edge $C_i C_j$, $e_{ij} \in \{-1, 0, 1, I\}$. $e_{ij} = 0$ if C_i does not have any effect on C_j, $e_{ij}=1$ if increase (or decrease) in C_i causes increase (or decreases) in C_j. $e_{ij} = -1$ if increase (or decrease) in C_i causes decrease (or increase) in C_j. $e_{ij} = I$ if the relation or effect of C_i on C_j is an indeterminate.

2.5 Definition

Let $C_1, C_2, \ldots, C_n$ be nodes of a NCM. Let the neutrosophic matrix N(E) be defined as N(E)=(e_{ij}) where e_{ij} is the weight of the directed edge CiCj, where eij ∈ {-1, 0, 1, *I*}. N(E) is called the neutrosophic adjacency matrix of the NCM.

2.6 Definition

Let C1, C2,…, Cn be the nodes of an NCM. A= (a1, a2,…, an) where ai ∈ {0, 1, *I*}. A is called the instantaneous state neutro-sophic vector and it denotes the on-off-indeterminate state position of the node at an instant. ai = 0 if ai is off (no effect) ai = 1 if ai is on (has effect) ai = *I* if ai is indeterminate (effect cannot be deter-mined) for i = 1, 2,…, n.

2.7 Definition

Let C1, C2,…, Cn be the nodes of and FCM. Let be the edges of the NCM. Then the edges form a directed cycle. An NCM is said to be cyclic if it possesses a directed cyclic. An NCM is said to be acyclic if it does not possess any directed cycle.

2.8 Definition

An NCM with cycles is said to have a feedback.

2.9 Definition

When there is a feedback in an NCM, i.e, when the causal relations flow through a cycle in a revolutionary manner the NCM is called a dynamical system.

2.10 Definition

Let be a cycle. When Ci is switched on and if the causality flows through the edges of a cycle and if it again causes Ci, we say that the dynamical system goes round and round. This is true for any node Ci for i =1, 2,…, n. The equilibrium state for this dynamical system is called the hidden pattern.

2.11 Definition

If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point. Consider a NCM with C1, C2,…, Cn as nodes. For example let us start the dynamical system by switching on C1. Let us assume that the NCM settles down with C1 and Cn on i.e., the state vector remain as (1, 0, 0,…, 1) this neutrosophic stage vector (1, 0, …, 0, 1) is called fixed point.

2.12 Definition

If the NCM settles down with a neutrosophic state vector re-peating in the form A1→A2→…→Ai→A1 then this equilibrium is called a limit cycle of the NCM.

2.13 Definition

Finite number of NCMs can be combined together to produce the point effect of all the NCMs. If N(E1), N(E2),…,N(Ep) be the neutrosophic adjacency matrices of a NCM with nodes C1, C2,…, Cn then the combined NCM is got by adding all the neu-trosophic adjacency matrices N(E1), N(E2),…,N(Ep). We de-note the combined NCMs adjacency neutrosophic matrix by N(E) = N(E1)+N(E2)+…+N(Ep).

3 Method of Determining the Hidden Pattern

Let C1, C2,…, Cn be the nodes of an NCM, with feedback, Let E be the associated adjacency matrix. Let us find the hidden pattern when C1 is switched on when an input is given as the vector A1 = (1, 0,…, 0), the data should pass through the neutrosophic matrix N(E). This is done by multiplying A1 by the matrix N(E). Let A1N(E) = (a1, a2,…, an) with the threshold operation that is by replacing ai by 1 if ai > k and ai by 0 if ai < k (k-a is a suitable positive integer) and ai by *I* if ai is not integer. We update the resulting concept; the concept C1 is included in the updated vector by making the first coordinate as 1 in the resulting vector. Suppose A1N(E)→ A2 then consider A2N(E) and repeat the same procedure. This procedure is repeated till we get a limit cycle or a fixed point.

4. Concepts of the problem:

What does quality mean in the context of education? Many definition of quality in education exist, testifying to the complexity and multifaceted nature of the concept. The terms efficiency, effectiveness, equity and quality have often been used synonymously. The objective of the study is to assess the quality in primary education. For that, using linguistic questionnaire and the expert's opinion we have taken the following concepts.

The following concepts are taken as the main nodes of our problem.

B_1 – Good health and nutrition.

B_2–Early childhood psychological development experiences.

B_3 – Regular attendance for learning.

B_4 – Family support for learning.

B_5 – Quality of school facilities.

B_6 – Interaction between school infrastructure and other quality dimensions.

B_7 – Class size/Class strength

B_8 – Peaceful, Safe environments for children

B_9 – Teachers' behaviours that affect safety

B_{10}– Effective school discipline polices

B_{11}– Inclusive environments

B_{12}– Non-violence

B_{13}– Provision of health services

B_{14}– Student-centred, non-discriminatory, standards-based curriculum structures

B_{15}– Student access to subjects taught at school

B_{16}– Uniqueness of local and national content

B_{17}– Literacy

B_{18}– Numeracy

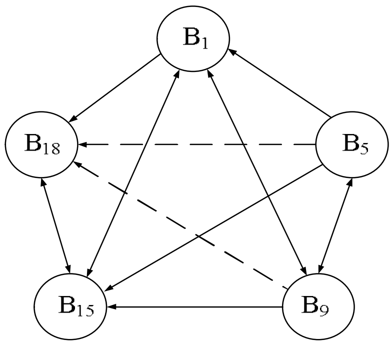
B_{19}– Life skills

B_{20}– Peace education

These 20 attributes are divided into 4 classes C_1, C_2, C_3, C_4 with 5 in each class.

Let C_1={ B_1, B_5, B_9, B_{15}, B_{18} }, C_2={B_4, B_7, B_{10}, B_{13}, B_{17} }, C_3={B_2, B_6, B_{12}, B_{16}, B_{20}} and C_4={B_3, B_8, B_{11}, B_{14}, B_{19} }.

Now we take the expert opinion for each of these classes and take the matrix associated with the combined disjoint block NCMs.

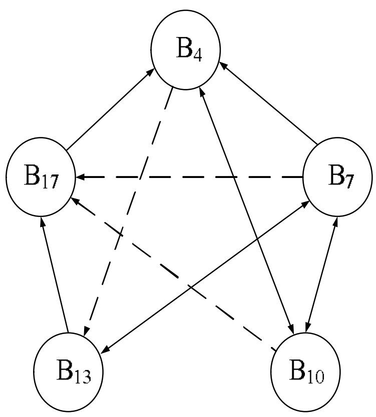


The expert's opinion for the class C_1={ B_1, B_5, B_9, B_{15}, B_{18} } in the form of the directed graph.According to this expert, the attribute good health and nutrition is interrelated to teacher's behaviours that affect safety. The attribute student access to subjects taught at school is interrelated to Numeracy. The attribute good health and nutrition is interrelated to student access to subjects taught at school.

The related connection matrix M_1 is given by

$$M_1 = \begin{bmatrix} 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & I \\ 1 & 0 & 0 & 1 & I \\ 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

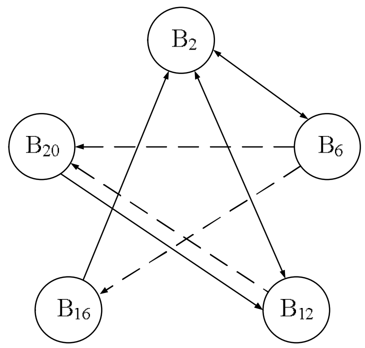
The directed graph is given by the expert on B_4, B_7, B_{10}, B_{13}, B_{17} which forms the class C_2.



According to this expert, the attribute class size/class strength is interrelated to provision of health services. The related connection matrix $M_2$is given by

$$M_2 = \begin{bmatrix} 0 & 0 & 0 & I & 0 \\ 1 & 0 & 1 & 1 & I \\ 0 & 0 & 0 & 0 & I \\ 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

The expert's opinion for the class C_3={B_2, B_6, B_{12}, B_{16}, B_{20}} in the form of the directed graph.

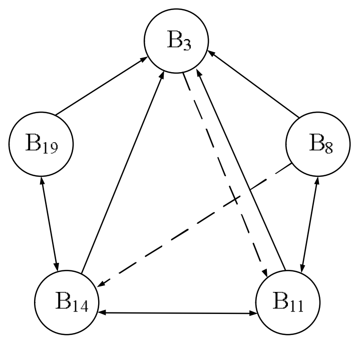


According to this expert, the attribute early childhood psychosocial development experiences is interrelated to non-violence.

The related connection matrix M_3 is given by

$$M_3 = \begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & I & 0 \\ 1 & 0 & 0 & 0 & I \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

The expert's opinion for the class C_4={B_3, B_8, B_{11}, B_{14}, B_{19} } in the form of the directed graph.



The related connection matrix is given by

$$M_4 = \begin{bmatrix} 0 & 0 & I & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 \\ 1 & I & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 \end{bmatrix}$$

According to this expert, the attribute peaceful, safe environments for children is interrelated to inclusive environment. The attribute inclusive environments is interrelated to student- centered, non- discriminatory, standards-based curriculum structures. The attribute student- centered, non- discriminatory, standards-based curriculum structures is interrelated to life skills.

$$
\begin{array}{c}
B_1\\ B_2\\ B_3\\ B_4\\ B_5\\ B_6\\ B_7\\ B_8\\ B_9\\ B_{10}\\ B_{11}\\ B_{12}\\ B_{13}\\ B_{14}\\ B_{15}\\ B_{16}\\ B_{17}\\ B_{18}\\ B_{19}\\ B_{20}
\end{array}
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0\\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0\\
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1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0\\
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0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0\\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}
$$

Suppose we consider the ON state of the attribute Good health and nutrition and all other states are OFF the effect of **X = (1000000000000000000)** on the CDBFCM is given by

XT = (010001000001000I000I) = X_1 (Say)

X_1T =(010001000001000I000I)= X_2 (Say)= X_1

X_1 is a fixed point of the dynamical system.

Let **Y = (101000000000000000000)** state vector depicting Good health and nutrition and regular attendance for learning is ON state, dynamical system B is given by

YT = (000000010I000000100) = Y_1 (Say)

Y_1T =(10I0000I10I00I100100) = Y_2 (Say)

Y_2T=(10I0000I10I00I100100) = Y_3 (Say)= Y_2

Here Y_2 is a fixed point of the dynamical system.

5. Conclusion

The paper demonstrates by this analysis that programmes must encompass a broader definition involving learners, content, processes, environments and outcomes.

Definitions of quality must be open to change and evolution based on information, changing contexts, and new understandings of the nature of education's challenges. New research — ranging from multinational research to action research at the classroom level — contributes to this redefinition. Continuous assessment and improvement can focus on any or all dimensions of system quality: learners, learning environments, content, process and outcomes.

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