STUDY OF THE DIFFERENT TYPES OF CURRICULUM, RELATED TEACHING / LEARNING METHODS AND EXPECTED OUTCOMES, USING FRMS

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Abstract: In this paper we study the various kinds of curriculum, teaching/learning methods and the corresponding expected outcomes using Fuzzy Relational Maps (FRMs), introduced by W.B. Vasantha Kandasamy and Yasmin Sultana (2000). This paper consists of four sections. Section one gives the historical perspective of different types of curriculum and related teaching/learning methods. It summarizes the survey of literature on the different kinds of curriculum, related teaching/learning methods and the expected outcomes. Section two gives the description of FRM models. Section three details the attributes taken for domain space and range space relating to the different types of curriculum, related teaching/learning methods and the expected behavioral outcomes from the target group and uses FRM model to analyze the interrelationship. Section Four gives the conclusion and suggestions based on the study.

Keywords: FRM model,fixed point, hidden pattern, relational matrix, limit cycle.

Introduction: Education is one of the foremost potential factors contributing to the human capital. Education is an investment. The corner stone of Education is curriculum. Each curriculum is framed with predetermined objectives. To realize the objectives, different methods of teaching/learning are adopted. Accordingly, they bring out different behavioral outcomes from the target group – viz, the students, or the participants of a training program or workshop. Curriculum differs from place to place, country to country, community to community depending upon the political philosophy, psychology of stakeholders and their religious and cultural background. In India we have had the Gurukula system of learning in the ancient days. Similarly in western countries, there were different curriculum and methods of teaching. Each curriculum had its own goals and objectives. During the past four to five decades, there had been intense and vigorous development of science curriculum based on research and development. The significant feature was the major shift of emphasis away from the teaching of science and technology as a body of established knowledge towards science and technology as human activities with increasing emphasis on experiences of the processes and procedures of science. As a result we find in history of education that there has always been a change from one type of curriculum to the other, based on research and development. Subject centered or content centered curriculum has given rise to child centered curriculum. Lecture method of teaching paved way to team teaching, group discussion, and brain storming session, heuristic method, Laboratory/Project Method, Field/Industrial visits and so on. The history of Outcome Based Education (OBE) ever since it was introduced in USA in seventeen till date will throw light on the dynamism of the process and the sensitivity of the issues involved in framing curriculum. When the concept of OBE was carried to Western Australia (WA) from US there were objections, in the name of PLATO (People Lobbying against the outcome). There were questions like what should be the outcome. Who has to decide on the outcome and so on. Ever since Russia fired SPUTNIK into the space in 1957, and then always had been competition between super powers to keep their technological superiority ahead of each other.This competition triggered constant revision on the 'outcome' to be realized through a particular curriculum that is followed in system of Education. Revising the literature on Outcome Based Education (OBE), (mostly from USA) for the Education Department of Western Australia (WA), Willis and Kissane (1995) identified three basic premises viz:

i) Decision about what to teach should be driven by the **outcomes** we would like the students to exhibit at the end of their education experience.

ii) All the students **can achieve** learning outcomes of significance so long as the conditions necessary for their success are met.

iii) **Accountability** for schools and school systems should be in terms of **student outcomes** (referred as outputs) rather than in terms of what is provided by way of curriculum, hours of instruction, staff student ratios, school buildings, equipments or text books or support services (referred to as inputs).

According to spady, there was a 'Standards Movement' that advocated 'No Child Left Behind' (NCLB), which assumed that every individual student is capable of achieving the predetermined outcomes so long as the conditions necessary for their success are met.

No wonder, in Indian Technical Education scenario,

Dr. K. C.G. Varghese the founder of one of the oldest Technical Education Centre in 1966 in Chennai started it with the motto, "To make every man a success and no man a failure".

There have been intense continuous transformations in the curriculum that were envisaged at different times with different motives.Traditional curriculum, classical curriculum, thematic unit study, programmed and Technological learning. There existed a school of thought that called a curriculum as 'no curriculum' which covered all those areas untouched by the existing curriculum in vogue. Besides Educational Institutions, Religious Institutions, Political Institutions, Revolutionary as well as orthodox groups have had their own curriculum to suit their expected outcomes. Every curriculum had its related methods of teaching/learning. Traditional curriculum had its own rigid methods of teaching which were orthodox, autocratic and content centered. But different school of thoughts vibrated and interacted to give rise to child centeredness where the teacher turned out to be a friend, philosopher, guide and facilitator, following democratic norms, allowing the free will of the students in learning concepts in their own way. Team teaching, heuristic method, inductive/deductive method, brain storming session, group discussion, team learning, debate, field exploration/visit, demonstration laboratory method, project implementation, exhibition, viz. and varied other methods of learning formed part of teaching/learning process where the clarification of concepts had given rise to cramming of content; life skill professionalism had given rise to str? value based authoritarian downpour through lecture/discourse. In this paper, significant curriculum, methodology of teaching/learning and the related outcomes are analyzed through Fuzzy Relational Map (FRM) Model introduced by W.B. Vasantha Kandasamy & Sultana in 2000.

2. Fuzzy Relational Map (FRM) Model:

2.1Fuzzy Relational Map (FRM): Initially the causal associations are divided into two disjoint units. To define a Fuzzy Relational Map these two disjoint units are taken as a domain space and a range space. Here the term disjoint we mean the sense of concepts which we have taken. Further it is assumed that no intermediate relations exist among the domain elements itself and within the elements of the range space. In general, the number of elements in the range space need not be equal to the number of elements in the domain space. In this discussion, the elements of the domain space are from the real vector space of dimension n and the range space is of dimension m. Here n need not be equal to m. The domain space and the range space are denoted by D and R respectively. Thus $D = \{D_1, D_2, \ldots, D_n\}$ is the domain space, where each $D_i = \{(x_1, x_2, \ldots, x_n) \mid x_j = 0 \text{ or } 1\}$, for $i = 1, \ldots, n$. Similarly $R = \{R_1, R_2, \ldots, R_m\}$ is the range space, where $R_i = \{(x_1, x_2, \ldots, x_m) \mid x_j = 0 \text{ or } 1\}$ for $i=1, 2, \ldots, m$.

Definition: 2.1.1: A FRM is a directed graph or a map from Domain Space to Range Space with concepts like policies or events etc. as nodes and causalities as edges. It represents casual relations between spaces D and R.

Definition 2.1.2: The directed edge from D to R denotes the casuality of D on R, called relations. Every edge in the FRM is weighted with a number in the set {0, 1}.

Definition 2.1.3: Let D_i and R_j denote the two nodes of an FRM. Let e_{ij} be the weight of the edge $D_i R_j$, $e_{ij}\{0.1\}$. The weight of the edge D_iR_j is positive if increase in D_i implies increase in R_j or decrease in D_i implies decrease in R_j. i.e., casuality of D_i on R_j is 1. If $e_{ij} = 0$ then D_i does not have any effect on R_j. We do not discuss the cases when increase in D_i implies decrease in R_j or decrease in D_i implies increase in R_j. When the nodes of the FRM are fuzzy sets, then they are called fuzzy nodes, FRMs with edge weights {0, 1} are called simple FRMs. Let $D_1, \ldots, D_n$ be the nodes of the domain space D of an FRM and $R_1, \ldots, R_m$ be the nodes of the range space R of an FRM.

Definition 2.1.4: Let the matrix E be defined as $E = (e_{ij})$ where e_{ij} {0, 1}; is the weight of the directed edge D_iR_j(or R_jD_i), E is called the relational matrix of the FRM. It is pertinent to mention here that unlike the FCMs, the FRMs can be a rectangular matrix; with rows corresponding to the domain space and columns corresponding to the range space. This is one of the marked differences between FRMs and FCMs.

Definition 2.1.5: Let $D_1, \ldots, D_n$ and $R_1, \ldots, R_m$ be the nodes of an FRM. Let D_iR_j(or R_jD_i) be the edges of an FRM, $j = 1, 2, \ldots, m$, $i = 1, 2, \ldots, n$. The edges form a directed cycle if it possesses a directed cycle. An FRM is said to be a cycle if it does not possess any directed cycle.

Definition 2.1.6: An FRM with cycles is said to have a feed back when there is a feed back in the FRM, i.e. when the casual relations flow through a cycle in a revolutionary manner the FRM is called a dynamical system.

Definition 2.1.7: Let D_iR_j(or R_jD_i), $1 \le j \le m$, $1 \le i \le n$. When R_j(or D_i) is switched on and if causality flows through edges of the cycle and if it again causes $R_i(D_j)$, we say that the dynamical system goes round and round. This is true for any node R_j(or D_j) for $1 \le i \le m$, (or $1 \le j \le n$). The equilibrium state of this dynamical system is called the hidden pattern. If the equilibrium state of the dynamical system is a unique state vector, then it is called a fixed point. Consider

an FRM with R_1... R_m and D_1... D_n as nodes. For example let us start the dynamical system by switching on R_1or D_1. Let us assume that the FRM settles down with R_1 and R_m (or D_1 and D_n) on i.e. the state vector remains as (1 0 ... 0 1) in R [or (1 0 ... 0 1) in D], this state vector is called the fixed point. If the FRM settles down with a state vector repeating in the form A1 → A2→....→Ai→ A1or (B1 → B2 ... Bi→ B1) then this equilibrium is called a limit cycle.

2.1.8 Determination of Hidden pattern:

Let R_1, ...,R_m and D_1, ..., D_n be the nodes of a FRM with feedback. Let M be the relational matrix. Find a hidden pattern when D_1 is switched ON, that is when an input is given as vector A_1 = (1 0 0 ... 0) in D the data should pass through the relational matrix M. This is obtained by multiplying A_1 with the relational matrix M. Let A_1M = (r_1, ...,r_m) after thresholdingand updating the resulting vector A_1M we get a vector B. Now we pass on B onto M^T to obtain BM^T. We update and threshold the vector BM^T so that the thresholded BM^T is equal to A_2. This procedure is repeated till we get a limit cycle or a fixed point.

3. Analysis of Emerging trends in curriculum, methodology of learning/teaching and the expected outcome using FRM.

We have taken as the concepts / nodes of domain only 9 notions which pertain to the curriculum.

D_1- Outcome based curriculum
D_2- Team teaching
D_3- Project method
D_4- Content centered curriculum
D_5- Lecture method
D_6- Democratic curriculum
D_7- Inductive/Deductive method
D_8- Industrial visit/ Field visit
D_9- Child centered method

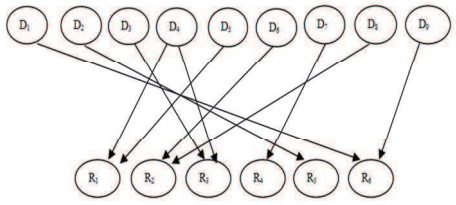
where D_1, D_2,... , D_9 are the elements related to the curriculum and methods of teaching/learning which are taken as the elements in the domain space.

We have taken only 6 nodes / concepts related to the outcomes of the students in this study.

These concepts form the range space which is listed below.

R_1- Understands the basic concepts
R_2-Develops social behaviour and responsibility
R_3- Acquire interest and gain knowledge
R_4- Develops creativity
R_5- Improves communication skill
R_6-Develops individuality and learns to face the challenges put forth by the modern world

The directed graph is given below



The associated matrix is given below

$$E_1 = n \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

3.1 State vector in which the node D_5 (Lecture Method) is kept in 'on-state':

Consider the node D_5'Lecture Method' to be in the on state and rest of the nodes in the off state.

i.e G_1= (0 0 0 0 1 0 0 0 0)

Then G_1E_1= (1 0 0 0 0 0) = H_1

$H_1E_1^T$= (0 0 0 1 1 0 0 0 0) = G_2

G_2E_1= (2 0 1 0 0 0) ⟶ (1 0 1 0 0 0) = H_2

$H_2E_1^T$= (0 0 1 2 1 0 0 0 0) ⟶ (0 0 1 1 1 0 0 0 0) = G_3

G_3E_1= (2 0 2 0 0 0) ⟶ (1 0 1 0 0 0) = H_2

When the node D_5 'Lecture Method' is in the on state we find that D_3 'Project method' and D_4 'Content centered curriculum' in the Domain space and R_1 'Understands the basic concepts' and R_3 'Acquire interest and gain knowledge' in the Range space come up in the on-state.

The associated fixed pair is (0 0 1 1 1 0 0 0 0), (1 0 1 0 0 0).

The following chain is

G_1 ⟶ H_1 ⟶ G_2 H_2 G_3 H_2⟶

3.2 State vector in which the node D_1 (Outcome based curriculum) is kept in 'on-state':

Consider the node D_1 'Outcome based curriculum' to be in the on state and rest of the nodes in the off state.

i.e G_1= (1 0 0 0 0 0 0 0 0). Then G_1E_1= (0 0 0 0 0 1) = H_1

$H_1E_1^T$= (1 0 0 0 0 0 0 0 1) = G_2

G_2E_1= (0 0 0 0 0 2) ⟶ (0 0 0 0 0 1) = H_1

When the node D_1 'Outcome based curriculum' is in the on state we find that D_9 'Child centered method'

in the domain space and R_6 'Develops individuality and learns to face the challenges put forth by the modern world' in the range space come up in the on-state.

The associated fixed pair is (1 0 0 0 0 0 0 0 0 1), (0 0 0 0 0 1)

The following chain is

$G_1 \longrightarrow H_1 \longrightarrow G_2 \longrightarrow H_1$

Thus we reach to the fixed point.

Now we analyze from the range the set

3.3 State vector in which the node R_1 (Understands the basic concepts) is kept in 'on-state': Consider the node R_1 'Understands the basic concepts' to be in the on state and rest of the nodes in the off state.

i.e.S_1= (1 0 0 0 0 0).

$S_1E_1^T$ = (0 0 0 1 1 0 0 0 0 0) = T_1

T_1E_1= (2 0 1 0 0 0) $\longrightarrow$ (1 0 1 0 0 0) = S_2

$S_2E_1^T$ = (0 0 1 2 1 0 0 0 0 0) $\longrightarrow$ (0 0 1 1 1 0 0 0 0 0) = T_2

T_2E_1= (2 0 2 0 0 0) $\longrightarrow$ (1 0 1 0 0 0)= S_2

The following chain is

$S_1 \longrightarrow T_1 \longrightarrow S_2 \longrightarrow T_2 \longrightarrow S_2$

The associated fixed pair is (0 0 1 1 1 0 0 0 0 0), (1 0 1 0 0 0).

When the node R_1 'Understands the basic concepts' is kept in the on state we find that R_3 'Acquire interest and gain knowledge' in the Range space and D_3 'Project method', D_4 'Content centered curriculum' and D_5 'Lecture method', in the Domain space turn out to be in the on-state.

3.4 State vector in which the node R_6 (Develops individuality and learns to face the challenges put forth by the modern world) is kept in 'on-state':

Consider the node R_6 'Develops individuality and learns to face the challenges put forth by the modern world' to be in the on state and rest of the nodes in the off state.

i.e. S_1= (0 0 0 0 0 1).

$S_1E_1^T$ = (1 0 0 0 0 0 0 0 0 1) = T_1

T_1E_1= (0 0 0 0 0 0 2) $\longrightarrow$ (0 0 0 0 0 1) = S_2

$S_2E_1^T$ = (1 0 0 0 0 0 0 0 0 1) = T_1

The following chain is

$S_1 \longrightarrow T_1 \longrightarrow S_1$

The associated fixed pair is (1 0 0 0 0 0 0 0 0 1), (0 0 0 0 0 1).

When the node R_6 'Develops individuality and learns to face the challenges put forth by the modern world' is kept in the on state we find that D_1 'Outcome based curriculum' and D_9 'Child centered method' in the Domain space turn out to be in the on-state.

Conclusion And Suggestion: The analysis of inter-relationship between the type of curriculum and teaching methods and the related behavior outcomes clearly indicate the fact that, the lecture method should be coupled with student's involvement by way of engaging them to do a project based on the lecture to make them understand the basic concept. The second experts view shows that the method of teaching should be child-centered and the curriculum should pre-determine the outcome expected from students point of view. Only then the system can produce strong individuals who can boldly face the challenges put forth by the modern world. From the third experts view we come to know that a combination of teaching methods required to kindle interest among students to understand the basic concepts being taught.

From the analysis we conclude that the Lecture who takes up the profession of teaching should be given orientation not only in the basic concepts they teach; But more importantly they need to be given sufficient orientation on students psychology and on the different methods of teaching.

The management should take keen interest in providing proper physical environment such as 'Smart Class rooms', 'Library' and 'Laboratory' besides offering periodical training to teachers (FDP). Above all the teacher need to be provided security of job, leave facilities and sufficient financial incentives. Only then we can expect the teachers to be more professional in their work and concentrate only on their teaching profession.

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