PRIORITIZING THE OBSTACLES INBUILDING SWIPE AND TOUCH CLASS ROOM ENVIRONMENT USING BLENDED METHOD

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Abstract

The field of education in the developing nations has joined its hands with technology to boost the quality of education, which is braced by the pillars of teaching and learning. In the upcoming days, the conventional tools of teaching and learning are being replaced with digital gadgets to make the learning environment more flexible and compatible for the learners. The embark of digital environment in a class room will certainly facilitate remarkable changes in the field of education and such start-ups will open the gateway of digital portals to the students to get login into their digital learning system. The swipe and touch classroom environment is characterized by several attributes which demands uniform implementation in almost all types of educational institutions, but it remains at passive state due to the intervention of many obstacles. Decision makers and policy formulators of educational sector are taking strenuous efforts to make the dream of digital India come true by conjoining academic world to digital world; this can be made possible by weeding out the prime obstructions. This research work proposes a new method of prioritization by blending the two concepts of fuzzy hypergraphs and fuzzy cognitive maps. The former concept enables to determine the key stumbling blocks of building swipe and touch classroom environment and the later establishes interrelational impacts between the prime obstructions. The efficiency of the proposed blended method is measured by prioritizing the obstacles in building swipe and touch classroom environment based on several expert’s opinion.

Keywords

Blended method, fuzzy hypergraph, fuzzy cognitive maps, swipe and touch, environment

Introduction

Decision making is a complicated system, involving the influences of various criteria and perceptions of several persons which still make the process of attaining the optimal decision more complicated. A decision become optimal; only if it is an outcome of intense analysis of inters relational impacts of the factors considered for decision making and the optimality depends on the nature of decision making environment. The likelihood of deterministic temperament is very less in realistic situations, as it is highly dominated by uncertainty. To minimize the degree of such ambiguity, scientific and logical mathematical models have to be integrated to make the decision making process simple. These models have to be viable and be efficient in resolving the complications.

A decision making situation becomes highly challenging, if several factors are taken into consideration. The only tool of diluting such difficulty is to cater the concentration merely on the core factors to choose the prime of it, and eliminating the other less significant factors. The integrity in selection and elimination of the factors demands the involvement of many experts. For instance, if prioritizing the causative factors of a disease is to be decided, a panel of doctors called the experts will initially group the factors and each doctor will weigh the factors based on their perception associated with experience, medical knowledge and other related phenomenon. Then the most primary factor will be determined based on inter relational impacts between the chosen factors. It is quite vivid that the primary factor will be the leading factor to other causative factors of the study. But then the process of arriving at the key factor is an arduous task. To handle such onerous situations, a blended method is put forward in this paper. This method is an amalgamation of the two techniques namely fuzzy hypergraph and fuzzy cognitive maps.

Nivetha.et.al [6] has proposed student's low academic performance appraisal model with hypergraphic approach in fuzzy cognitive maps and justified the need of incorporating the notion of hypergraph in FCM models. The newly proposed approach mitigated the complexity in decision making by reducing the initially considered 15 factors to 8 and it was also feasible for finding inter relational impacts. But still this approach has certain limitations. In the hypergraphic representation, each hyperedge is the reflection of each expert's opinion, but the significance given by the expert is not expressed in the hypergraph. In the proposed SLAPMmodel, two of the hyperedges (representing two expert's opinion) say e_1 = {F11, F13,F14,F15},e_2 = {F1, F3, F4, F10, F12, F13}, though F13 is present in both the edge set, the significance or the weightage of F13 in both the edge set remains vague. This has paved the way for the origin of blended method, which conjoins fuzzy hypergraph with FCM models.

Kaufmann initiated the concept of fuzzy hypergraphs and Lee-Kwang&S.M.Chen[4] proposed it as an extension of hypergraph in fuzzy set theory. Fuzzy hypergraphhas wide scope of applications in organization of portfolio, assembling of neural cells and decision making in CAD system and it was extended by K.M.Lee. The fuzzy hypergraphs has much manifestation as biopolar fuzzy hypergraph, intuitionistic fuzzy hypergraph, hesitant fuzzy hypergraph and it has been outspreaded by many researchers, to mention a few Muhammad Akram [1], T.K.Samanta,Dudek, Wieslaw. The notion of fuzzy hypergraph is highly workable and its competence can be enhanced by adjoining with FCM models. FCM's are decision making models that play a vital role in investigating the interrelational impacts, which favour the dynamics of decision making. The FCM model was first proposed by Kosko [2] and it was extended and applied to several fields of science and technology. The extensive functioning nature of FCM was briefed by Nivetha.et.al.

FCM models are very undemanding as the representations and computations are free from complexity. The inter relation between the factors is represented by either1,-1 or 0 if it has positive, negative and zero impacts on one another, such FCM models are classified as simple FCM. If the representation of the inter relation takes the values from [-1,1] then the FCM models are termed as weighted FCM. Researchers have also formulated Linguistic FCM models to make the representations of inter relational impacts more realistic and pragmatic using linguistic variables. As both the conceptual frameworks of fuzzy hypergraphs and fuzzy cognitive maps revolves on a common axis, fuzzy set theory these two concepts can be merged to a blended method to minimize the difficulty levels in decision making process.

The proposed blended method is substantiated with the decision making problem of prioritizing the obstacles in building swipe and touch classroom environment. The paper is organized as follows: section 2 presents briefly the blended method; section 3 consists of the methodology; section 4 comprises the validation of the blended method with thedecision making problem of prioritization; section 5 discusses the results and the last section concludes the research work.

2. Blended Method

The fusing of fuzzy hypergraphs with FCM models is the basic working principle of the blended method. It is the extension of the integration of hypergraph with FCM model which was proposed earlier by Nivetha.et.al. In the blended method, the fuzzy hypergraph representation is made which comprises of fuzzy hyper edges. For instance if a decision making problem involves four factors say F1, F2, F3 & F4. Let us see the efficiency of fuzzy hypergraphic representation over hypergraphic representation and Fig 2.1 and 2.2 represents the same.

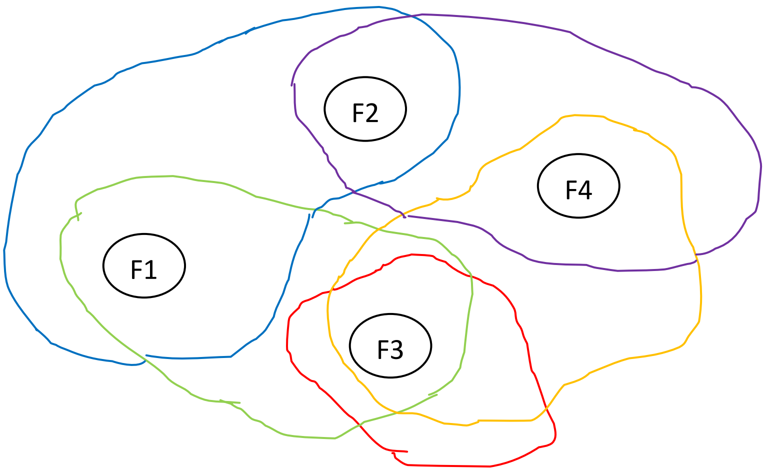

Fig.2.1. Hypergraphic representation of the factors

Let us take the hyperedge set of this hyper graph as $\{e_1,e_2,e_3,e_4,e_5\}$

Where $e_1 = \{F3\}$, $e_2 = \{F1,F3\}$, $e_3 = \{F1,F2\}$, $e_4 = \{F3,F4\}$, $e_5 = \{F2,F4\}$

Each hyperedge set is taken as an expert's opinion, the factor F1 appears in e_2& e_3, F2 appears in e_3&e_5, F3 appears in e_1, e_2& e_4 F4 appears in e_4& e_5 but the likeliness of the occurrences is not expressed in hypergraphic representation, or in other words the significance of F1 being in e_2& $e_3$is not differentiated so as for other factors too.

In case of fuzzy hypergraphs, the fuzzy hyper edge sets will be of the form

$e_1 = \{(F3,0.5)\}$, $e_2 = \{(F1,0.2),(F3,0.7)\}$, $e_3 = \{(F1,0.6),(F2,0.7)\}$, $e_4 = \{(F3,0.4),(F4,0.6)\}$, $e_5 = \{(F2,0.7),(F4,0.3)\}$

The representation of fuzzy hyper edge set explicitly signifies the presence of the factors in each e_i's. This demonstrates the pragmatic feasibility of fuzzy hypergraphic representation over hypergraphic representation. Amidst the four factors the factors which have maximum weights are taken as the prime factors.

F1	F2	F3	F4
0.8	1.4	1.6	0.9

In this case the factors F2 & F3 can be considered as the core factors and others can be eliminated. The same procedure can be applied for the situation involving several factors and the inter relational impacts can be determined by using FCM model, which is a directed graph comprising of core factors as vertices and their associations as edges.

3. Methodology

This section presents the algorithm of the blended method.

Step I: The factors associated with the decision making problem are considered based on the opinion of the experts

Step II: The factors are taken as the vertices and the experts are assigned the task of grouping the factors into fuzzy hyperedges with weights ranging from [0, 1].

Step III: The factors which have maximum weights (say > α) are taken as the core factors and a simple FCM is sketched.

Step IV: The connection matrix R with simple weights representing interrelational impacts between the core factors is formulated.

Step V: An initial state vector X (1000....0) is passed into R and the resultant vector is threshold and each component is considered individually and passed into R and being threshold . The resulting vector having maximum occurrences of 1's is taken as the succeeding vector and the procedure is repeated until the precedent and the successive vectors are alike.

4. Blended method in prioritizing the obstacles in building Swipe and Touch classroom environment

Based on the linguistic questionnaire and the expert's opinion the following factors are considered as the obstacles in building Swipe and Touch classroom environment.

O1	Difficult to exercise control over the students
O2	Confrontation of the institutions with contemporary learning portals
O3	Crisis related to integrity and security of data
O4	Teacher student interface gets wide apart
O5	Demands huge capital investment
O6	Deficit in effective execution of the digital learning strategies
O7	Hardships in time management
O8	Routine practice of upgradation and replacement of technology
O9	Confinement of learning through digital modes makes it incomplete

O10	Development of overall personality will be shallow
O11	High rate of piracy of learning materials
O12	Lack of teachers with sound technical skills
O13	Complexity in software management
O14	Complications in accessibility
O15	The domain of social interaction becomes static

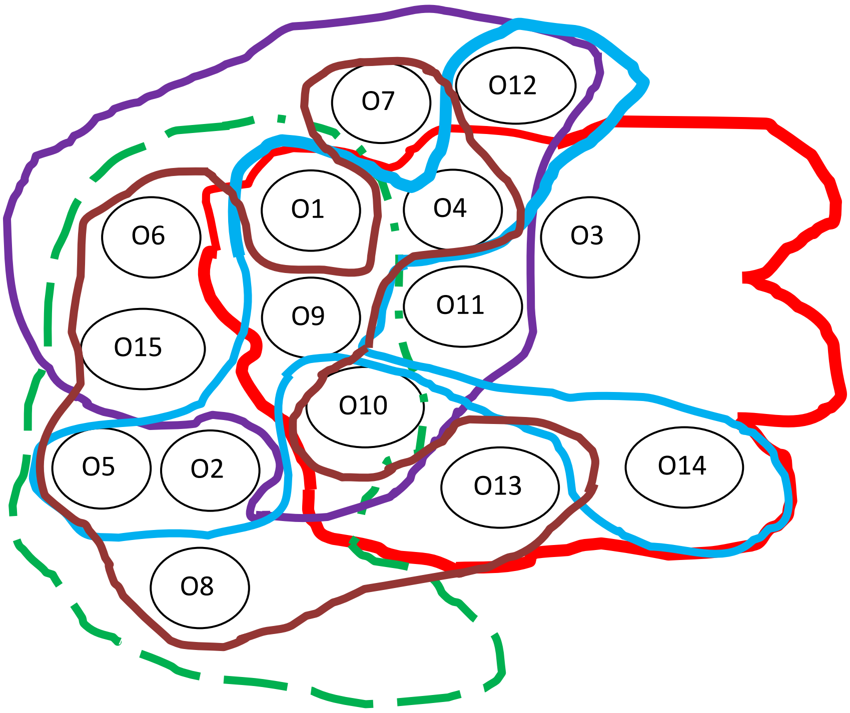

Fig.2.2. Fuzzy Hypergraphic representation of the factors

The fuzzy hyper edge set of the fuzzy hypergraphic representation is presented below, where each edge set corresponds to each expert's opinion.

e_1 = {(O1,0.7), (O3,0.6), (O4,0.8), (O9,0.6),(O10,0.8), (O11,0.8), (O13,0.5), (O14,0.5)}
e_2 = {(O1,0.5),(O2,0.5),(O5,0.6),(O6,0.6) ,(O8,0.7),(O9,0.5),(O10,0.4),(O15,0.5)}
e_3 = {(O1,0.8),(O4,0.5),(O6,0.4),(O7,0.5),(O9,0.6),(O10,0.6),(O11,0.5),(O12,0.5),(O15,0.6)}
e_4={(O1,0.6),(O2,0.3), (O4,0.5),(O5,0.4),(O9,0.5),(O12,0.4),(O14,0.4)}
e_5={(O2,0.6), (O4,0.6),(O5,0.4),(O6,0.7),(O7,0.6),(O8,0.4), (O9,0.3), (O13,0.5),(O15,0.5)}

O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	O13	O14	O15
2.6	1.1	0.6	1.9	1	1.7	1.1	1.2	2.5	1.8	1.3	0.9	1	0.9	1.6

The core factors are O1,O4,O6,O9,O10,O15 and they are taken as F1,F2,F3,F4,F5,F6 and the interrelational impacts are determined and represented as connection matrix R as follows

F1 F2 F3 F4 F5 F6

F1	0	1	0	0	1	1
F2	1	0	1	1	1	1
F3	1	0	0	0	1	0
F4	0	0	0	0	1	1
F5	0	0	0	1	0	0
F6	0	1	1	1	1	0

Let X = (100000)
X* R = (010011)
→ (110011) = X1
$X1_1$*R ≈
(100000)*R = (010011)
(010000)*R = (101111)
(000010)*R = (000100)
(000001)*R = (011110)
Let X2 = (101111)
X2*R = (1 2 1 2 4 2)
→ (111111) = $X2_1$
$X2_1$*R ≈
(100000)*R = (010011)
(010000)*R = (101111)
(001000)*R = (100010)
(000100)*R =(000011)
(000010)*R = (000100)
(000001)*R = (011110)
X3 = (101111)
F1 →F2→F2

Let X = (010000)
X* R = (101111)
→ (111111) = X1
$X1_1$*R ≈
(100000)*R = (010011)
(010000)*R = (101111)
(001000)*R = (100010)
(000100)*R =(000011)
(000010)*R = (000100)
(000001)*R = (011110)
X2 = (101111)

X2*R = (121242)→ (111111)

$X2_1$*R ≈
(100000)*R = (010011)
(010000)*R = (101111)
(001000)*R = (100010)
(000100)*R =(000011)
(000010)*R = (000100)
(000001)*R = (011110)
F2→F2→F2

Let X = (001000)

X*R = (100010)

→ (101010) = X1

$X1_1$*R ≈

(100000)*R = (010011)

(001000)*R = (100010)

(000010)*R = (000100)

X 2 = (010011)

X2*R = (1 1 2 3 2 1)

→ (111111) = $X2_1$

$X2_1$*R ≈

(100000)*R = (010011)

(010000)*R = (101111)

(001000)*R = (100010)

(000100)*R =(000011)

(000010)*R = (000100)

(000001)*R = (011110)

X3 = (101111)

X3*R → (111111) = $X3_1$

$X3_1$*R ≈

(100000)*R = (010011)

(010000)*R = (101111)

(001000)*R = (100010)

(000100)*R =(000011)

(000010)*R = (000100)

(000001)*R = (011110)

X4 = (101111)

F3 → F1 → F2→F2

Let X = (000100)

X*R = (000011)

→ (000111)= X1

$X1_1$*R ≈

(000100)*R =(000011)

(000010)*R = (000100)

(000001)*R = (011110)

Let X2 = (011110)

X2*R = (2 0 1232)

→ (101111)

$X2_1$*R ≈

(100000)*R = (010011)

(001000)*R = (100010)

(000100)*R =(000011)

(000010)*R = (000100)

(000001)*R = (011110)

X3 = (011110)

F4→ F6→F6

Let X = (000010)

X*R = (000100) → (000110) = X1

$X1_1$*R ≈

(000100)*R = (000011)

(000010)*R = (000100)

X2 = (000011)

X2*R = (011210)→ (011110)

$X2_1$*R ≈

(010000)*R = (101111)

(001000)*R = (100010)

(000100)*R =(000011)

(000010)*R = (000100)

X3 = (101111)

X3*R → (111111)

$X3_1$*R ≈

(100000)*R = (010011)

(001000)*R = (100010)

(000100)*R =(000011)

(000010)*R = (000100)

(000001)*R = (011110)

X4 = (011110)

X4*R = (201232)→ (101111)

(100000)*R = (010011)

(010000)*R = (101111)

(001000)*R = (100010)

(000100)*R =(000011)

(000010)*R = (000100)

(000001)*R = (011110)

X5 = (101111)

F5 → F4 →F2→F2

Let X = (000001)

X*R = (011110) → (011111) = X1

(010000)*R = (101111)

(001000)*R = (100010)

(000100)*R =(000011)

(000010)*R = (000100)

(000001)*R = (011110)

X2 = (101111)

X2*R → (111111)

$X2_1$*R ≈

(100000)*R = (010011)

(010000)*R = (101111)

(001000)*R = (100010)

(000100)*R =(000011)

(000010)*R = (000100)

(000001)*R = (011110)

X3 = (101111)

F6 → F2→F2

Thus the triggering pattern is determined at each ON position of the core factors.

5. Results and Discussion

Table 5.1 shows the triggering pattern of the factors obtained at times of the ON position of the factors.

Table 5.1 Triggering Pattern of the Core Factors

On Position of Factor	Triggering Pattern
(100000)	F1 →F2→F2
(010000)	F2→F2→F2
(001000)	F3 → F1 → F2→F2
(000100)	F4→ F6→F6→ F2→F2
(000010)	F5 → F4 →F2→F2
(000001)	F6 → F2→F2

The below graphical representation in Fig 5.1 illustrates inter relational impacts between the core factors.

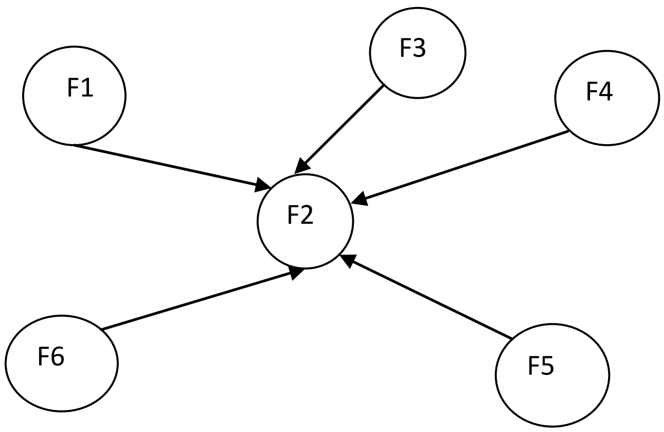

Fig. 5.1 Inter relational impacts between the core factors

The core factors are F1 -Difficult to exercise control over the students, F2 -Teacher student interface gets wide apart, F3 -Deficit in effective execution of the digital learning strategies, F4 - Confinement of learning through digital modes makes it incomplete, F5 -Development of overall personality will be shallow, F6-The domain of social interaction becomes static. The fixed point vector obtained at each epoch of the ON state of the factors is (101111), which clearly reveals that F1,F3,F4,F5,F6 are the implicated factors and the factor F2 is the terminal node. The above said core factors are acting as the obstacles to swipe and touch classroom environment and then they finally end in factor 2. Thus inter relational impacts between the corefactors are investigated through induced FCM model. Each of the core factors will duly end in F2 and it is the fact indeed. The widened gap between teachers and the learners in the contemporary techno classrooms is the reason for not nourishing digital portals of teaching and learning. Ultimately the core factors also contribute the same.

Conclusion

The proposed blended method is highly workable as it reduces the levels of difficulty in decision making process. As the process of making a decision requires the participation of the experts, the blending of fuzzy hypergraph with FCM model fits to it. The methodology comprising of induced FCM model also adds advantage to the proposed model. The substantiation of the blended method with the task of prioritization of the obstacles in swipe and touch classroom environment justifies the merits of the blended method. This blended method is highly compatible than hypergraphic approach in FCM models and this proposed method will certainly pave way for other hybrid methods.

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