

Analysis of the problems faced by poor rural students studying in chennai city Colleges using FCM models

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Abstract

In this paper for the first time we study the problems faced by poor rural students studying in Chennai city colleges using Fuzzy Cognitive Maps (FCMs) model. This paper has four sections. In section, one the problems faced by these students as taken from data collected from them is described and justification for using FCMs is also given. Section two briefly describes the FCM model. Section three gives the two FCM models given by students and the teachers. The hidden pattern and the conclusions based on this study is given in the final section.

Key words: FCM, hidden pattern, thresholding, updating, adjacency matrix, state vectors, limit cycle, fixed point.

Introduction

1 Description of the problem and justification for using FCM models :

We have taken from 60 rural poor students studying in the Loyola College, Chennai, the problems faced by them in the classroom, hostel and in the college premises (campus). This is taken either as a write up from them or as interviews/discussions. After analyzing the written data and the discussions the following attributes are taken as most of the students face these problems. Each of the

attribute is described in a line or two for the reader should know the context or the reason for considering those attributes.

The attributes are numbered or denoted as S_1, S_2, \dots, S_{14} .

S_1 – Poverty: Most of the rural students who come to city for education are very poor or poor; only a very few are from middle class. So poverty is one of the major problems which is dominant as they start to write by first saying they are very poor (poor) to think of higher

education. This poverty or the economic strata plays a role in their personality.

S₂ – General appearance: This includes their dress, colour and the overall attire.

S₃ – Family Problems: They face many problems like unemployment or under employment or as daily wagers and the main consequences of which is denying education to their children as they are uneducated.

S₄ – Proper guidance: They are the first one to be educated; so in most cases they do not get any guidance as their parents are uneducated. Also the schools they study is as ignorant as their parents.

S₅ – Inferiority Complex: Majority of them suffer inferiority complex due to poverty and the sudden city set up in contrast to the rural one.

S₆ – Self confidence level.

S₇ – English language both spoken and written is a problem. Also they say they are not only unable to express in English but also unable to understand when they teach in English or talk in English.

S₈ – Teachers ill-treat them as they are poorly dressed, lack appearance and communication.

S₉ – Classmates / other students also ill treat them; due to their attire and lack of communication in english; several of them say they are disgraced by their own classmates who are from city.

S₁₀ – Sophistication (A look of superiority and

superfluous in behaviour).

S₁₁ – City students do not mix with poor rural students in the campus / class due to basic class/ cultural differences in behaviour.

S₁₂ – Regularity to classes (attending the classes or colleges regularly).

S₁₃ – Good employment opportunities for poor rural students is not possible due to lack of communication.

S₁₄ – Communication skills:

These were the main problems mentioned by majority of the students.

These 14 attributes are taken in the FCM model as the attributes or nodes.

Justification for using FCM model :

1. The data related with the problem is an unsupervised one. So we cannot use any statistical method to analyse the problem. In this situation Fuzzy Cognitive Maps (FCMs) happens to be best suited.
2. FCMs are best suited for each of the attributes are related to one or more attributes. So the data can be best analysed or studied using cognitive maps.
3. This model can give the hidden pattern for any of the 'on state' of the attributes.
4. The limit cycle or the fixed point inference summarizes the joint effects of all the interacting fuzzy knowledge (only FCM can do this job).

2. Description of the Fuzzy Cognitive Maps (FCMs) model :

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 casual relations between classes. FCMs are signed directed graphs with feedback. The directed edge e_{ij} from casual concept C_i to concept C_j measures how much C_i causes C_j . Here C_1, \dots, C_n are concepts or nodes of FCMs. The edge weights or casualities C_{ij} are taken from the set $\{-1, 0, 1\}$. The directed graph is drawn using edge weights e_{ij} . The matrix E is defined by $E = (e_{ij})$, where e_{ij} is the weight of the directed edge $C_i C_j$. E is called the adjacency matrix of the FCM. We just sketch the functioning of the dynamical system. For more information please refer^{1,2,3}.

Let C_1, \dots, C_n be the nodes of the FCM. $M = (e_{ij})$ denote the adjacency matrix associated with the FCM. Clearly M is a $n \times n$ matrix whose diagonal entries are zeros as the weight of the edge $C_i C_i$ does not exist as the edge $C_i C_i$ does not exist. Let $A = (a_1, \dots, a_n)$ where $a_i \in \{0, 1\}$. A is called the instantaneous state vector and it denotes the on or off state or position of the node at an instant.

$a_i = 0$ if a_i is off and

$a_i = 1$ if a_i is on; for $i = 1, 2, \dots, n$.

An FCM is called a dynamical system if the casual relation flow through a cycle in a revolutionary way. The equilibrium state for this dynamical system is called the hidden pattern.

If the equilibrium state of a dynamical

system is a unique state vector then it is called a fixed point. If the FCM settles down with a state vector in the repeating form then this equilibrium is called a limit cycle.

Let $A = (a_1, \dots, a_n)$ be the state vector which is passed into the dynamical system M . Then $AM = (a'_1, \dots, a'_n)$. This vector (a'_1, \dots, a'_n) is thresholded and updated as follows:

If $a_i = 1$ then if $a'_i = 0$ then a'_i is made into 1. This is known as updating. i.e., on the state of the nodes in the initial state vector must remain in the on state till the hidden pattern is found. In FCMs, thresholding is done in this special way. If $a_i \leq 0$ then a_i is replaced by 0, if $a_i > 0$ then a_i is replaced by 1.

Let $A' = (b_1, \dots, b_n)$ be the resultant of (a'_1, \dots, a'_n) after thresholding and updating. We find $A'M$; this procedure is repeated until we arrive at a fixed point or the limit cycle, which gives the hidden pattern. (For more about this model refer¹⁻³).

3. FCM models given by the experts :

In this section FCM models of the problems faced by the rural students in city colleges using the attributes S_1, \dots, S_{14} given in section 1 are analysed.

The directed graph for the FCM model given by students who are the experts as follows:

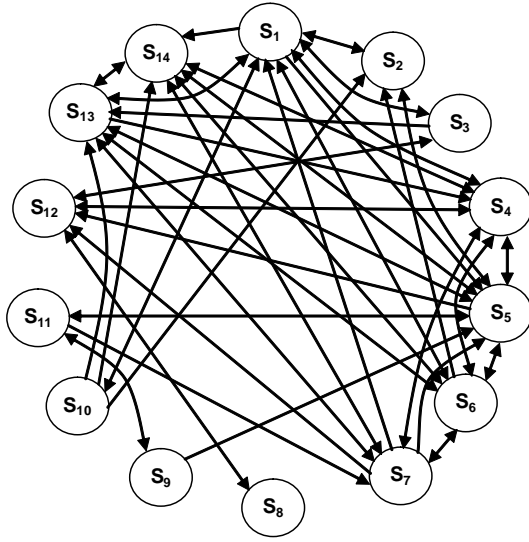


FIGURE: 1

Using the directed graph we have obtained the adjacency 14×14 matrix M.

	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}
S_1	0	-1	1	-1	1	-1	0	0	0	-1	0	0	-1	-1
S_2	-1	0	0	0	-1	0	0	0	0	0	0	0	0	0
S_3	1	0	0	0	0	0	0	0	0	0	0	-1	-1	0
S_4	-1	0	0	0	-1	1	-1	0	0	0	0	1	0	1
S_5	0	-1	0	-1	0	-1	0	0	0	0	1	-1	-1	-1
S_6	-1	1	0	1	-1	0	-1	0	0	0	0	0	1	1
S_7	1	0	0	-1	1	-1	0	0	0	0	0	-1	-1	-1
S_8	0	0	0	0	0	0	0	0	0	0	0	-1	0	0
S_9	0	0	0	0	1	0	0	0	0	0	1	0	0	0
S_{10}	-1	1	0	0	0	0	0	0	0	0	0	0	1	1
S_{11}	0	0	0	0	1	0	1	0	1	0	0	0	0	0
S_{12}	0	0	-1	1	0	0	0	-1	0	0	0	0	0	0
S_{13}	-1	0	0	1	-1	1	-1	0	0	0	0	0	0	1
S_{14}	0	0	0	1	-1	1	-1	0	0	0	0	0	1	0

Now we analyze the effect of the state vectors using the dynamical system M and determine the hidden pattern.

Suppose the expert is interested in finding the hidden pattern for the state vector

in which the node poverty alone is in the on state. Let $A = (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$. To find the effect of A on the dynamical system $M.AM = (0\ -1\ 1\ -1\ 1\ -1\ 0\ 0\ 0\ -1\ 0\ 0\ -1\ -1)$ after thresholding and updating we get $AM \rightarrow (1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = A_1$ (say) (Note “ \rightarrow ” symbol denotes the resultant vector AM that has been thresholded and updated).

$$A_1 M \rightarrow (1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0) = A_2 \text{ (say)}$$

$$A_2 M \rightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = A_3 \text{ say}$$

$$A_3 M \rightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = A_4 \text{ (say)}$$

We see $A_3 = A_4$. Hence the hidden pattern of the state vector A is a fixed point which clearly states, poverty is the cause of family problem (S_3), inferiority complex (S_5), poor expression in English language (S_7), classmates insult them (S_9) and city students do not mix well with them. This is the effect of poverty on the rural poor students.

Next we see the effect of inferiority complex (S_5) in the on state on the dynamical system M.

Let $B = (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$, i.e., only the node S_5 is in the on state and all other nodes are in the off state. The effect of B on M is given by

$$BM \rightarrow (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0) = B_1 \text{ (say)}$$

$$B_1 M \rightarrow (0\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = B_2 \text{ (say)}$$

$$B_2 M \rightarrow (1\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = B_3 \text{ (say)}$$

$$B_3 M \rightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = B_4 \text{ (say)}$$

$B_3 = B_4$ is a fixed point. Thus we see from our analysis that poverty and inferiority complex go hand in hand as the same set of nodes come

to on state both in case of poverty and inferiority complex suffered by the rural students.

Now we see the effect of the state vector in which only the node S_6 ie self confidence is in the on state. The effect of $C = (0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$ on the dynamical system M is give by

$$CM \rightarrow (0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1) = C_1 \text{ (say)}$$

$$C_1M \rightarrow (0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1) = C_2 \text{ (say);}$$

$C_1 = C_2$ is a fixed point. When one has self confidence he / she has a better or generally good appearance, has a better or generally good appearance, has no family problems, good employment opportunities followed by proper communication skills.

Suppose we wish to study the effect of S_9 alone to be in the on state ie. let $D = (0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0)$. To find the effect of D on M .

$$DM \rightarrow (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = D_1 \text{ (say)}$$

$$D_1M \rightarrow (0\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = D_2 \text{ (say)}$$

$$D_2M \rightarrow (1\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = D_3 \text{ (say)}$$

$$D_3M \rightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = D_4 \text{ (say)}$$

$$D_4M \rightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = D_5 \text{ (say).}$$

We say $D_4 = D_5$ is a fixed point. Thus when the node S_9 is in the on state *i.e.*, classmates/ other students also... who are in the city, we see that are affected by poverty (S_1), family problems (S_3), inferiority complex (S_5), lack of good communication in English (S_7) and city students do not mix with them.

Suppose (S_7) alone is in the on state and all other nodes are in the off state. To find the effect of the state vector $T = (0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0)$ on M .

$$TM \rightarrow (1\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = T_1 \text{ (say)}$$

$$T_1M \rightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 0) = T_2 \text{ (say)}$$

$$T_2M \rightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = T_3 \text{ (say)}$$

$$T_3M \rightarrow (1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0) = T_4 = T_3.$$

Thus if S_7 is on it makes S_1, S_3, S_5, S_7, S_9 and S_{11} to on state, the lack all finer qualities. Now consider the on state of the two nodes S_1 and S_6 to be in the on state.

Let $X = (1\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$ be the related state vector. To find the effect of X on M .
 $XM \rightarrow (1\ 0\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = X_1 \text{ (say)}$
 $X_1M \rightarrow (1\ 0\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0) = X_2 = X_1$
 (a fixed point).

Thus the on state of S_1 and S_6 results only in the on state of S_3 ie the effect of self confidence with poverty results in family problems.

Now we study the on state of the nodes S_1 and S_4 and all the other nodes remain in the off state.

Let $Z = (1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$ be the state vector. Effect of Z on M is given by

$$ZM \rightarrow (1\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0) = Z_1 \text{ (say)}$$

$$Z_1M \rightarrow (1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0) = Z_2 \text{ (say)}$$

$$Z_2M \rightarrow (1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0) = Z_3 = Z_2$$

a fixed point.

Thus the on state of S_1 and S_4 makes

only one to be regular to classes and nothing more, where as the node S_4 alone in the on state yields a different hidden pattern.

Let $P = (0\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$

be the state vector with S_4 in the on state.

$PM \rightarrow (0\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 1) = P_1$

$P_1M \rightarrow (0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 1) = P_2$ (say)

$P_2M \rightarrow (0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 1) = P_3 = P_3$

Thus proper guidance leads to good appearance (S_2), self confidence (S_6), regularity to classes (S_{12}), good employment opportunities (S_{13}) and good communication skills (S_{14}).

Thus proper guidance can lead to the over all development of the poor rural students.

Next we give the opinion of an expert who is a teacher.

At the outset the nodes S_2, S_8, S_9, S_{10} and S_{11} were deleted and the expert works with the rest of the nodes.

The directed graph given by him is as follows:

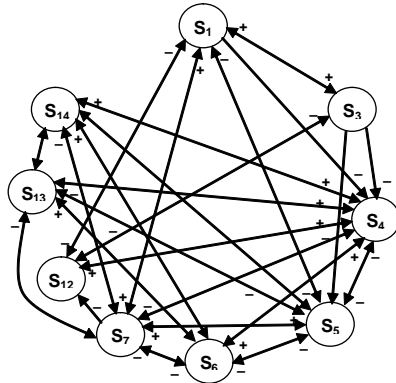


FIGURE 2

The adjacency matrix related to the above graph is as follows.

$$N = \begin{matrix} & \begin{matrix} S_1 & S_3 & S_4 & S_5 & S_6 & S_7 & S_{12} & S_{13} & S_{14} \end{matrix} \\ \begin{matrix} S_1 \\ S_3 \\ S_4 \\ S_5 \\ S_6 \\ S_7 \\ S_{12} \\ S_{13} \\ S_{14} \end{matrix} & \begin{bmatrix} 0 & 1 & -1 & -1 & 0 & 1 & -1 & 0 & 0 \\ 1 & 0 & -1 & -1 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & -1 & 1 & -1 & 1 & 1 & 1 \\ -1 & 0 & -1 & 0 & -1 & 1 & 0 & -1 & -1 \\ 0 & 0 & 1 & -1 & 0 & -1 & 0 & 1 & 1 \\ 1 & 0 & -1 & 1 & -1 & 0 & -1 & -1 & -1 \\ -1 & -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & -1 & 1 & -1 & 0 & 0 & 1 \\ 0 & 0 & 1 & -1 & 1 & -1 & 0 & 1 & 0 \end{bmatrix} \end{matrix}$$

Suppose we consider a state vector $X = (1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0)$, i.e., only the node poverty is in the on state and all other nodes are in the off state.

The effect of X on N is given by

$XN \rightarrow (1\ 1\ 0\ 0\ 0\ 1\ 1\ 0\ 0) = X_1$ (say)

$X_1N \rightarrow (1\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 0) = X_2$ (say)

$X_2N \rightarrow (1\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 0) = X_3$ (say)

$X_3N \rightarrow (1\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 0) = X_4$ (say) = X_3 .

Thus the hidden pattern of X is a fixed point.

We see poverty in the on state leads to family problems and the students are poor in spoken / written English.

Let us consider S_6 alone to be in the on state and all nodes are in off state.

Suppose $Y = (0\ 0\ 0\ 0\ 1\ 0\ 0\ 0\ 0)$ is the state vector. Effect of Y on N is given

$$YN \rightarrow (0\ 0\ 1\ 0\ 1\ 0\ 0\ 1\ 1) = Y_1 \text{ (say)}$$

$$Y_1N \rightarrow (0\ 0\ 1\ 0\ 1\ 0\ 0\ 1\ 1) = Y_2 (=Y_1).$$

Thus the hidden pattern is a fixed point resulting in the on state of the nodes S_4 , S_{13} and S_{14} , i.e. those students with self confidence are the ones who have obtained proper guidance, who have good job opportunities and communication skills.

Suppose proper guidance alone is in the on state and all other nodes are in the off state. Let $X = (0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0)$ be the state vector. Effect of X on N is given by

$$XN \rightarrow (0\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1) = X_1$$

$$X_1N \rightarrow (0\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1) = X_2$$

$X_2 = X_1$. Hence a fixed point. The teacher feels that if a rural student has proper guidance, they have good confidence level S_6 , regularity to classes S_{12} , good job opportunities and good communication skills S_{14} .

4. Observations and conclusion from the interviews as well as the FCM model :

In this section we give the conclusions not only based on the hidden pattern got from the FCM models but also based on the analysis of the questionnaire and the discussions held with the students.

1. Proper guidance is vital for the students to get self confidence and employment. So it was suggested that the college authorities held weekly two classes and guide them towards their goal. Hard work at all costs will pay them the best and there is no shortcut

to success, this should be inculcated in the students mind. Once they prove to be good at studies, everything will come to them, say the experts.

2. Proper guidance will lead to self confidence and from the hidden pattern we see self confidence in rural poor shows that he should have got proper guidance leading to good employment and communication skills. Thus it is suggested guidance classes should be given atleast twice weekly. For the hidden pattern when self confidence is in the on state we see in both the models it makes the nodes S_6 , S_{12} , S_{13} and S_{14} in on states. Hence rural students' improvement lies in giving them proper guidance!
3. It is seen from the models that the on state of any of the negative attributes like poverty, inferiority complex, not knowing proper English ... turns other negative attribute/nodes to on state. However the models show that by giving proper guidance all the negative attributes can be overcome.
4. Further it is observed that on state of certain nodes like poverty, family problems, inferiority complex, lack of skill in English language, classmates ill-treating them give the same hidden pattern which clearly shows the presence of any one of the negative attributes leads the person to get all the negative attributes enlisted in section 1 of this paper. It is felt proper guidance alone can wipe out these negative attributes. For providing any other help is not going to improve them, feel the experts.
5. However it is seen from the data that some classes in spoken English may be initiated in the college for their development in English, which can give them better job opportunities and better communication skills.

6. From the data we derive that most of them suffer from family problems, which makes them not up to the mark in studies; for they ruminate about the family problems whenever they find time. Instead of using time in a productive way they waste their time thinking/day dreaming which has a negative influence in their overall performance. The college can give them part time employment after class hours which can certainly help them in over coming their worries.
7. Most of them have come to city for the first time and this has given them a cultural shock. That is why they are worried about their looks, colour, dress and so on. If they are taught that all these are secondary and their performance in studies alone is primary, certainly they can be uplifted.
8. Further these models gave hidden patterns which were only fixed points indicating that the poor rural students had no fluctuation or rise and fall in their problems. They were consistent and uniform with these attributes.
9. The data reveals that the students are very dissatisfied with the schools in which they have studied. For, their school teachers have not properly guided them or properly motivated them which has resulted in their problems. Thus it is suggested that the school teachers may be given intense training by the colleges/ government to motivate and guide the students properly.
10. The college students and staff must be given advice (or counselling) to mix without difference with the poor rural students and try to help them in their studies, for, after all they should realize that they too are human and it is their duty to help them. Basically education must mold the teachers and students to help the deprived and not laugh at them!

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