Identification of Reasons of Low GER of Higher Education of Rural Female Students using Clustering Technique: E-Learning based Education as a Plausible Way Out

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Abstract

India is going to have the largest number of youth in the world by 2020 and it is a great demographic advantage over other developing countries. The current demographic dividend of India can only be fully realized if this large number of youth can be utilized as productive work force with high value skilled output, rather than unskilled / low value output [23][24]. To materialise this dream each state of India is to be uplifted enough so that the GER of every state benchmarks the global GER. In our study the female students of West Bengal are targeted as the GER of female students in this state is exceptionally poor as compared with the national GER[9].

Identification of the reasons of large scale drop outs of female students in West Bengal is done along with the possible way outs to bring these dropouts back to the classrooms or alternative streams of education were pulled up. In this paper the key reasons of poor GER of female students are identified through hierarchical clustering technique. And an e-Learning based model is established with the objective to offer a plausible way out over the identified reasons. The model will be effectual to the young female students of West Bengal for continuing their higher studies and that will gradually increase the GER as well.

Keywords: GER, Hierarchical Clustering technique, Higher Education, E-Learning

1. Introduction

Gross Enrollment Ratio (GER) is a statistical parameter, introduced by United Nations to measure the index of education of a country. The Gross Enrollment Ratio (GER) or Gross Enrollment Index (GEI) is an Education Index to determine the number of students enrolled in school at several different grade levels (like elementary, middle school and high school), and examine it to analyse the ratio of the number of students who live in that country to those who qualify for the particular grade level [36][2].

Report of UGC (2001) regarding GER of state-wise distribution of educationally backward districts, says that West Bengal (8.63 per cent) is far below than Andhra Pradesh (14.19 per cent), Himachal Pradesh (16.12 per cent), Jharkhand (14.76 per cent) and Kerala (17.6 per cent) in the country [12]. This indicates that there is considerable scope for its improvement in West Bengal.

In social scenario it is seen that if the mother is educated, definitely girls (children) become educated. Reason is, educated mothers can understand the necessity of their girls' education. So, in the society the female students are to be highly educated; otherwise the drop outs of female students will increase day by day. Moreover if the year wise number of appeared students in higher education is

experimented, it will be seen that there is a huge differences between male and female students[4].

In Figure 1, it is clear that number of female students appeared in higher education is too low than the male students.
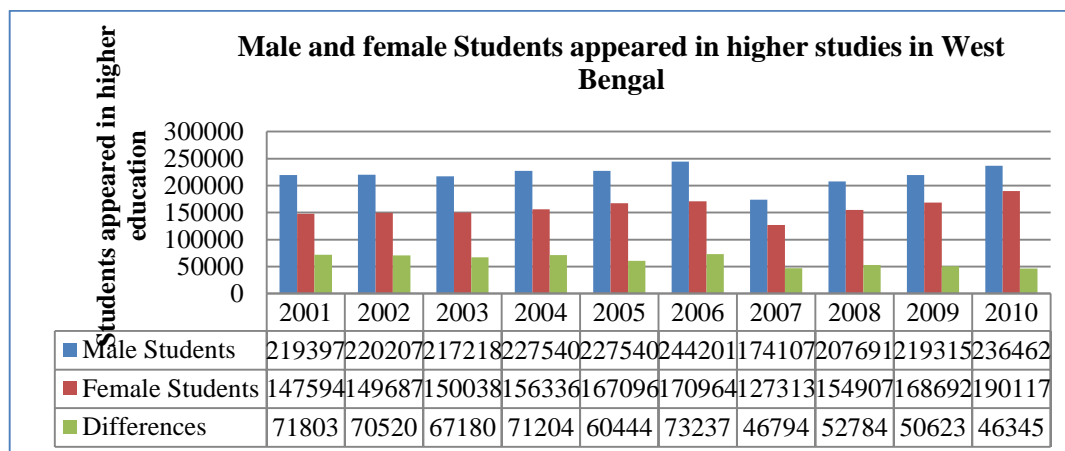
Figure 1. Male and female Students appeared in higher studies in West Bengal (Adapted from Annual Report 2010 Dept. of Higher Education, Govt. of West Bengal)

Not only that if the district wise enrollment record in higher education is analyzed, it is easy to identify that here also there are significant numbers of less enrollments of female students in higher studies. In Figure 2 the district wise enrollments (in percentages) in higher education for both male and female students are shown.
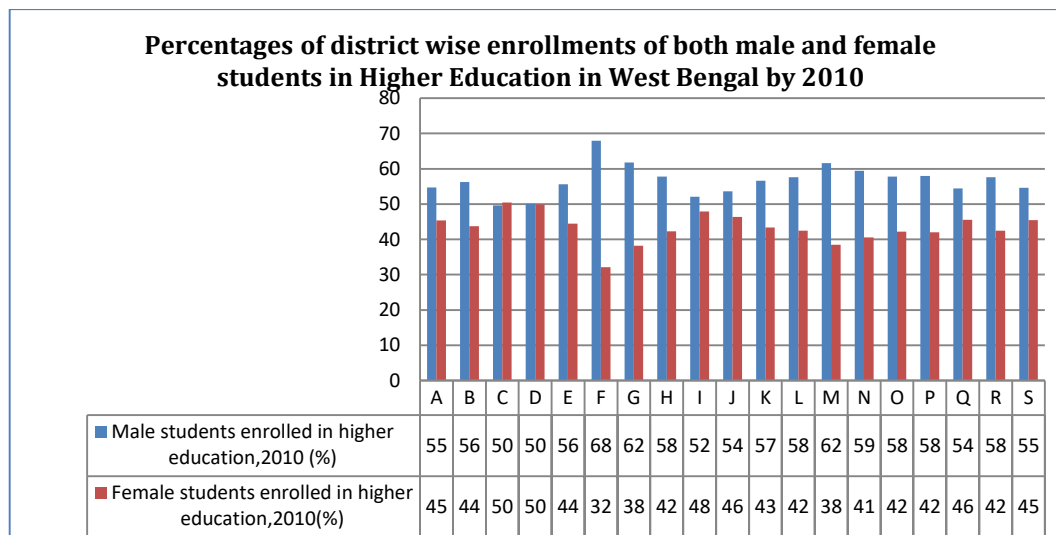
Figure 2. Percentages of District Wise Enrollments of both Male and Female Students in Higher Education in West Bengal by 2010

In Figure 2, A –S represents the names of the districts as follows:

A - Medinipore (E) **G** - Bankura **M** – Birbhum
B - 24 Parganas (S) **H** - Medinipore (W) **N** – Malda
C - Howrah **I** - Kolkata **O** - Dinajpur (S)
D - Hooghly **J** - 24 Parganas (N) **P** - Dinajpur (N)

E - Burdwan	**K** - Nadia	**Q** – Jalpaiguri
F - Purulia	**L** - Murshidabad	**R** – Coochbehar
		S – Darjeeling

The objective of our study is to identify the obstacles faced by the female students in enrolling in higher studies in West Bengal and to know whether through E-Learning the obstacles can be removed or not.

2. Literature Review

In the context of female students' enrollment there are several reasons like social and cultural barriers, economic barriers, psychological barriers, barriers caused by poor teaching learning conditions in schools, institutional barriers, barriers caused by family circumstances, geographical barriers, mental and physical barriers, barriers caused by armed conflict as opined by Dr. Min Bahadur Bista in *A Review of Research Literature on Girls' Education in Nepal* (August 2004) [6].

According to the projected region of research (2011), West Bengal is having only 26.23 per cent enrollments in higher education and the most pain striking fact is that only 6.8% of students of the primary enrollment move for higher secondary education in West Bengal [1][17]. N. Banerjee and M. Mukherjee (2000) have shown that early marriage of female students severely affects their education, employability and career [21]. Based on data from district level information system of West Bengal, K. K. Hati (2010) explains various educational indicators such as literacy, enrollment, dropouts *etc.*, in different stages of education system and constructs a composite Educational Development Index distinctly for different types of district distinctly [15].Two recent reports of Government of India such as the Report of Sachar Committee [10] (2006) and Report of Ranganath Misra (2007) [11] demonstrate in detail the educational issues in a specific religion or community.

Sukhadeo Thorat [30] brought out emerging issues related to assessing a projection study under him sponsored by UGC (University Grants Commission). He pointed out that the projected enrollment in Indian scenario based on the historical growth pattern may not be adequate in meeting the growing demand and the requirement of the Indian economy. In accordance with the projection, GER will enhance from 9.7 per cent in 2006-2007 to 11 per cent in 2011-2012, whereas NSSO (National Sample Survey Organisation) reflects that GER will increase from 11.2 per cent in 2006-2007 to 12.8 per cent in 2011-2012. In India, the GER of higher education *i.e.*, percentage of post secondary students is 11 per cent today, whereas the GER of developing countries are around 25 per cent in average. India is aiming to grow its GER into 15 per cent by the end of the Eleventh Five year Plan (2007-2012) and 21 per cent by the end of Twelfth Five year plan [9]. The Tenth Five year Plan had projected an increase of the rate of enrollment in higher education from 6 per cent to 10 per cent over the Plan period which meant that the enrollments in higher education should rise from 7.5 million (in 2002) to 12.5 million (in 2007) and on 31[st]March, 2006 the number of students enrolled in higher education was 11.2 million. In the Eleventh Five year Plan it is proposed that the GER be raised by 5 per cent as fast as possible which means 15% will be the enhanced GER by the end of the XI Plan. It leads to increasing the enrollments in higher education by about 84 lakh students within five years [25]. As per the statements of Union Minister for Human Resource Development- Govt. of India, Mr. Kapil Sibal, India is aiming at increasing the GER in higher education (presently 12.4 per cent) to 30 per cent by the year 2020 and to achieve this goal it is needed to make 150 million youth (age group 18-23 years) to be educated [8].

As proposed by the pilot report done by Ministry of Human Resource Development, Department of Higher Education-Government of India, Planning, Monitoring & Statistics Bureau 2011, higher education plays a vital role in building a knowledge based society of 21st century and with the growth of size along with diversity of higher education specifically in terms of courses, management and geographical coverage, it has already become integral to create an well equipped database on higher education as the existing database is outdated and inadequate in terms of today's scenario. Moreover, data collection and propagation of data is not up to the mark and it also becomes erroneous due to incomplete coverage. Owing to this partial report, Gross Enrollment Ratio does not echo the accurate reflection of the overall country's progress in higher education [22].

Some of the recent studies include reports of Kanbargi (2002) [14], Sujatha (2002) [29], Balagopalan and Subrahmanian (2003) [28], Velaskar (2005) [33], Jha and Jhingran (2005) [13], and Lewin (2007) [16] which were done in educational context in India.

As per the report of WR Hambrecht, [26] over conventional classroom higher education systems to facilitate knowledge in cost effective manner, education through e-Learning can be provided irrespective of place, time as well as intended person across the globe. It eliminates transportation cost and time. It facilitates just in time accessibility. Collaboration and interactivity among students can also be maintained effectively. E-Learning can be controlled mostly by learners according to their own pace *i.e.*, it is learner centric, uploading of up to date desired soft documents can be done swiftly etc.

Tushar Kanti Sen (2011) [31] claims that advancement of technologies like cost effective high speed broad band network connection in computers has radically revolutionised the way of teaching learning process. The study reflects the impact of WebCT along with blackboard technology enabled digital study material and conventional face to face classroom teaching on students at Curtin University, Perth, Australia. The students give their feedbacks and opinions in e-vaLUATE and they can have utmost satisfaction in terms of well deliberated lectures and course deliveries using technologies.

D. Zhang, *et al.*, (2004) [7] identified some advantages of traditional classroom learning like immediate feedback to the students, acquaintance of students with the experience as well as cultivation of social community. In contrast a blended learning approach with theoretical base assists the teachers to follow blend classroom teaching practices with the growing availability of Learning Management System.

Tripathi and Mishra (2011) [32] discussed an e-Learning environment for information security where learners can grasp knowledge in their own pace.

Sevgiozkam *et al.*, [27] proposed an e-Learning evolution model to comprise collective measures concerned with an e-Learning system.

Weiltu *et al.*, (2009) [34] discussed that the e-Learning environments are dissimilar from classical education system. A curriculum specific e-Learning environment is formed in this paper and this approach focuses on both how to teach the intended students along with the interaction between students and teachers as per the features of curriculum. It is concluded that student interaction and collaboration played a significant role in e-Learning environment, they proposed.

Zakaria, Watson and Edwards (2011) [18] describe an approach to adopt Web 2.0 in classrooms. Through a combination of qualitative or quantitative data collection and analysis, they have synergised the outputs and provided the adoption of Web 2.0 for learning by students and teachers both. They expected in yielding a better holistic view on the implementation issues related to e-Learning 2.0 concepts in recent higher education.

3. Preliminaries: Cluster Analysis

Cluster analysis or clustering is a task to assign a set of objects into groups *i.e.*, clusters such that the objects present in same cluster are more similar to each other than to other objects present in other clusters. Cluster Analysis is a common technique for analyzing statistical data in various fields like data mining, machine learning, pattern recognition, bio-informatics, image analysis, information retrieval *etc* [35].

The objective of a cluster may vary between clustering algorithms. Selective decisions can be pointed out by selecting appropriate clustering algorithm for a specific problem. In essence, clustering is a set of such clusters that contain all the objects present in data set. These clustering techniques can be distinguished in different cluster models like through hierarchical clustering, fuzzy clustering, strict partitioning clustering with/without outliers, overlapped clustering and subspace clustering.

As hierarchical clustering is based on the foundation of objects being more related to objects in close proximity than to beyond away; hierarchical clustering is used for analyzing our problem. Clustering algorithms basically connect objects to form clusters on the basis of their distances. Clusters can be described by maximum distance required to connect each and every part of the cluster. At certain different distances different clusters may form and these are symbolised through dendrogram which is basically to focus hierarchy of clusters that come together with each other objects at certain distances.

To find out clusters we have used Agglomerative hierarchical method which groups the most similar objects first then initial groups are merged in accordance with the similarities among them. These similarities eventually decrease all subgroups are occupied into a single cluster. The results of agglomerative method are represented through a two dimensional dendrogram. Hierarchical Agglomerative Method is based on linkage methods. Of various linkage methods the average linkage method is used to scrutinise our problem which is nothing but dependent on the average distance between the objects from different clusters. The merging of clusters under the average linkage method is illustrated as Figure 3:
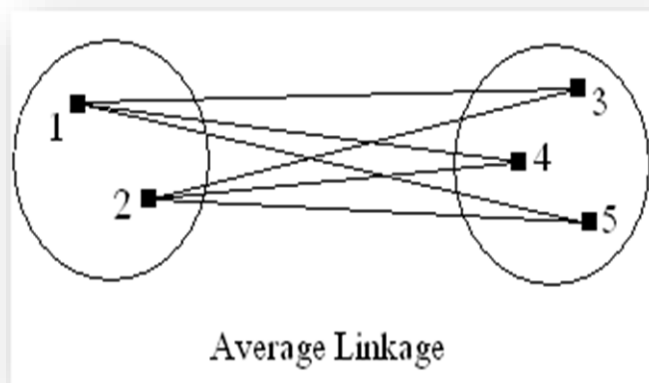
Figure 3. Average Linkage Method Followed while Applying Clustering Technique

$$\text{Average Linkage} = \frac{d_{13}+d_{14}+d_{15}+d_{23}+d_{24}+d_{25}}{6}$$

The agglomerative hierarchical clustering method follows an algorithm whose steps are following showing the merging and division of the dendrograms in this type of cluster analysis. And the algorithm [10] sets up the groups from total no. of N objects:

1. Start with N clusters, each containing a single entity and an N x N symmetric matrix of distances (or similarities) D = { d_{ik} }.

2. Search the distance matrix for the nearest (most similar) pair of clusters. Let the distance between "most similar" clusters U and V be d_{uv} .

3. Merge clusters U and V. Label the newly formed cluster (UV). Update the entries in the matrix by

(a) deleting the rows and columns corresponding to clusters U and V and

(b) adding a row and column giving the distances between cluster (UV) and the remaining clusters.

4. Repeat Steps 2 and 3 a total of (N – 1) times. (All objects will be in a single cluster after the algorithm terminates). Record the identity of clusters that are merged and the levels (distance or similarities) at which the mergers take place.

From observations of data a group of reasons were identified by a large number of students. These groups of reasons varied with different reasons and with the gender of the students. As cluster analysis offers a group of techniques to identify cluster of points having similar properties, we used the simplest of the cluster analysis method of agglomerative clustering using SPSS 16.0 to identify the most significant reasons of low GER.

4. Methodologies and Results

First a pilot survey was conducted in two districts of West Bengal namely Burdwan and Purba Medinipore. In the said two districts, ten (10) rural secondary school students of class X were considered as female student respondents at random as they are expected to go for higher studies. Fifty (50) female students were interviewed to know the reasons of low enrollments in higher studies. Next, they were understood the concepts of E-Learning in details, as a possible way out to the issues faced by them in traditional system of higher education. They were asked about their willingness to study through E-Learning based education. Several important pointes came out from the pilot survey based on which the main survey was conducted over 200 female students of rural secondary schools in eight (8) different districts of West Bengal namely, Burdwan, Bankura, Purulia, Purba Medinipore, Paschim Medinipore, Howrah, Hoogly and South 24 Parganas. From each district 5 schools were covered and randomly the respondents were chosen.

4.1. Female Students' Views: Obstacles in Traditional Higher Education System [4]

In accordance with the feedbacks some key reasons were identified as reflected in Figure 4.
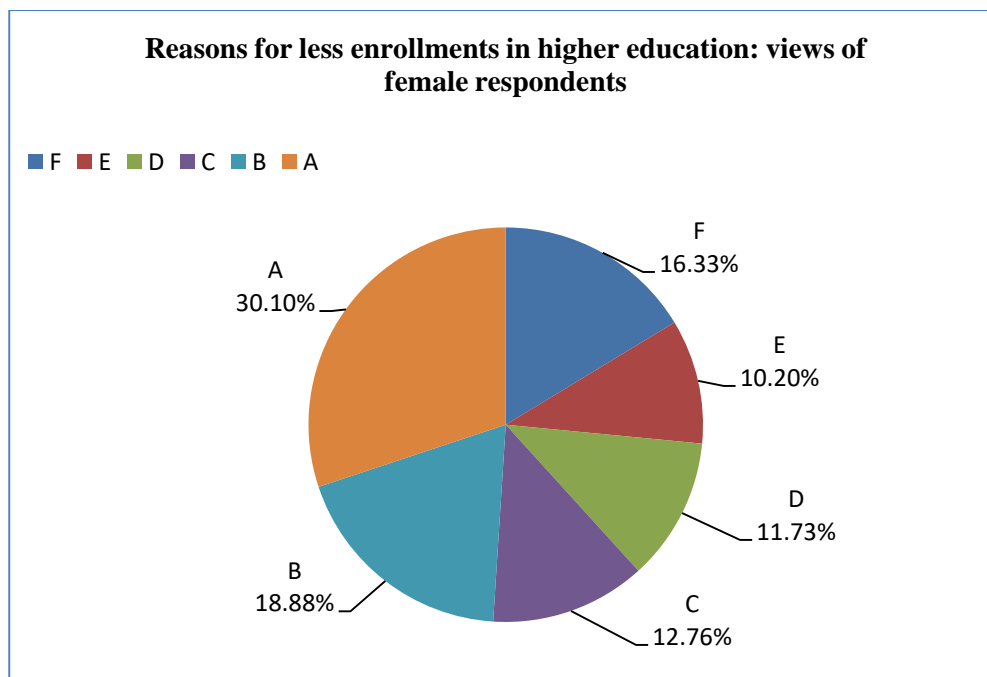
Figure 4. Key Reasons for Less Enrollments in Higher Education: Views of Female Respondents

In the Figure 4 the ordinates represent

A=Due to economically backward, unable to bear expenses to pursue higher education

B=Early marriage

C=Expensive higher education

D=For the absence of these family pressure, least interested for education

E=They do not know why they should go for it

F= Others [including improper guidance from family members, no such public transportation is there to go to higher education institutes, distance from home to higher education institute is around 10 km, so, it is impossible to continue higher education, due to draught, agriculture hampered, all the earning members (generally men) goes outside of the district or state in search of jobs, women have to handle family, they don't have sufficient food daily, why should they go for higher education, and as men are out of district or state it's not possible to carry on higher education after maintaining family.]

These four reasons (A,B,C,D) cover the 84.67 per cent obstacles of the female students. So, by taking necessary actions to remove these four obstacles may lead them to get engaged with higher studies.

4.2. Clustering Technique to Identify the Reasons of low GER for Female Students:[5]

From the survey several key barriers came out as focused by the students. The barriers are:

Reason 1: After fulfilling basic needs of family, it becomes difficult to bear expenses for higher education.

Reason 2: Due to engaged with family occupation; students, even those who are aspiring to higher education, get no time to study.

Reason 3: Distance along with transportation system between residence and higher education institutes are not that much good, which are key reasons for not going for it.

Reason 4: A very few numbers of seats and less opportunity are there in higher education institutes in West Bengal for mediocre students. So they are not getting chances for desired subjects due to competition.

Reason 5: Least interests of female students in higher education make them reluctant to it.

Reason 6: Students do not get proper guidance which leads them in not going for higher education but pressurised for early marriage

Reason 7: Involvements of politics in higher educational institutes in West Bengal affect the environment of education that leads to fewer enrollments in higher education.

Reason 8: Job opportunities of fresh secondary or below secondary students in retail based industries de-motivate student's higher education.

Our target is to extract the most effective reasons as specified by the female students. To perform this hierarchical clustering technique is applied to verify which reasons are getting prioritised over the data collected from female students only.

Table 1 canvases the proximity matrix of the distances among the reasons of low GER as provided by the female students.

Table 1. Proximity Matrix of the Distances among the Reasons of Low GER

Proximity Matrix

| Case	Matrix File Input							
	Reason 1	Reason 2	Reason 3	Reason 4	Reason 5	Reason 6	Reason 7	Reason 8
Reason 1	.000	633.000	448.000	191.000	583.000	124.000	145.000	772.000
Reason2	633.000	.000	335.000	488.000	354.000	585.000	490.000	345.000
Reason 3	448.000	335.000	.000	385.000	321.000	392.000	439.000	422.000
Reason 4	191.000	488.000	385.000	.000	496.000	171.000	182.000	667.000
Reason 5	583.000	354.000	321.000	496.000	.000	527.000	518.000	315.000
Reason 6	124.000	585.000	392.000	171.000	527.000	.000	221.000	746.000
Reason 7	145.000	490.000	439.000	182.000	518.000	221.000	.000	643.000
Reason 8	772.000	345.000	422.000	667.000	315.000	746.000	643.000	.000

The Agglomeration Schedule for cluster analysis is reflected in Table 2.

Table 2. Average Linkage (Between Groups)

Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	1	6	124.000	0	0	2
2	1	4	181.000	1	0	3
3	1	7	182.667	2	0	7
4	5	8	315.000	0	0	6
5	2	3	335.000	0	0	6
6	2	5	360.500	5	4	7
7	1	2	550.750	3	6	0

The dendrogram formed, using Average Linkage between groups, of the reasons said by female students is represented in Figure 5.
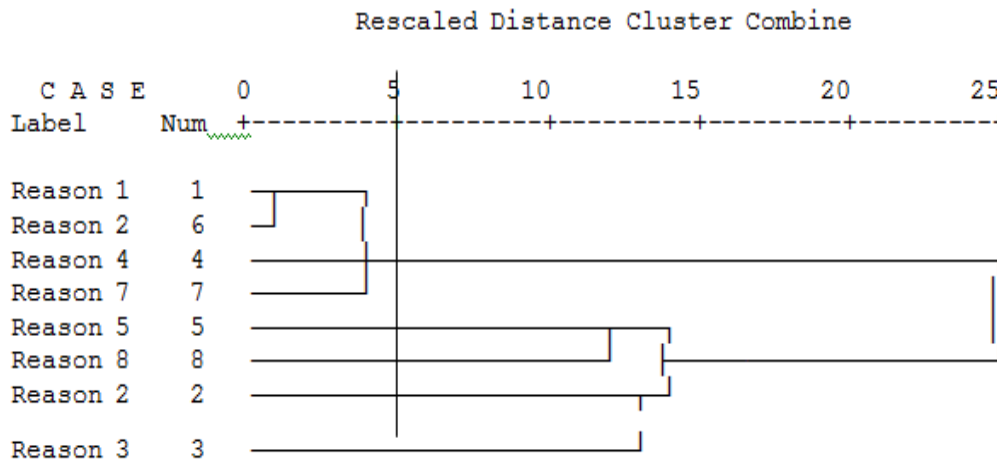
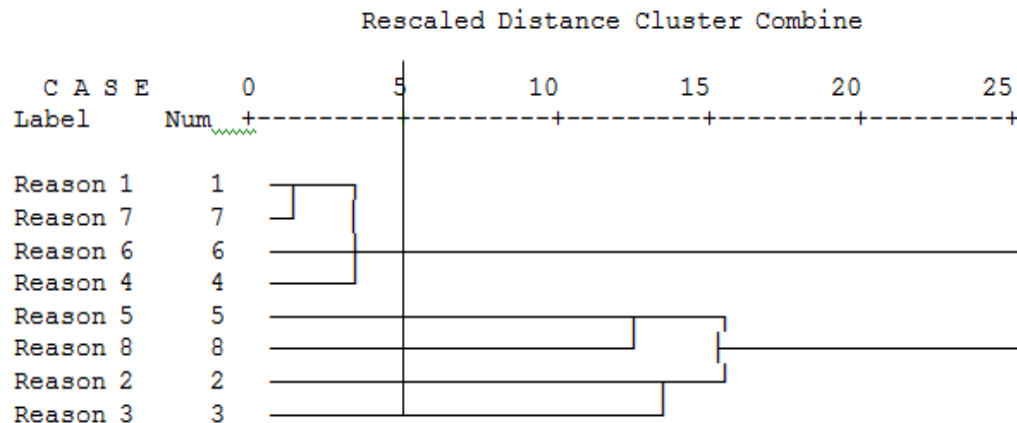**Figure 5. Dendrogram using Average Linkage (Between Groups) Responses from Female Students**

In the Figure 9, the cluster analysis up to the distance 5 through average linkage is considered and the reasons which are occupied in a cluster up to the said distance are reflected in the dendrogram. Up to distance 5 reason1, reason 6, reason 4, reason 7 are occupied in a cluster. So, the female student respondents prioritised these four reasons which are the key barriers of low enrollments in higher education in West Bengal.

Reason 1 indicates the reasons like, after fulfilling basic needs of family, it becomes difficult to bear expenses for higher education. Reason 6 signifies that students do not get proper guidance which leads them in not going for higher education but pressurised for early marriage. Reason 4 signifies that a very few number of seats and less opportunities are there in higher education institutes in West Bengal for mediocre students. So they are not getting chances for desired subjects due to competition. Reason 7 shows involvements of politics in higher educational institutes in West Bengal affect the environment of education that leads to fewer enrollments in higher education.

4.3. Cluster Analysis for the Female Student Respondents, willing to go for Higher Studies, in Response to low GER

As per the feedbacks of the female student respondents who are willing to go for higher studies, the reasons of low GER of higher education in West Bengal are collected. Then clustering technique is applied on the reasons to identify the most effective reasons of low GER.

The dendrogram formed, using Average Linkage between groups, of the reasons said by female student respondents who are willing to go for higher studies is pictorially presented in Figure 6.
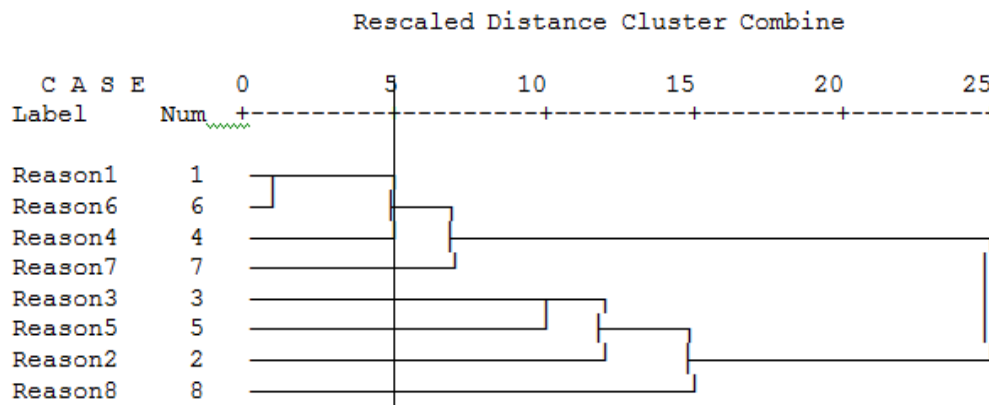

Figure 6. Dendrogram using Average Linkage (Between Groups) Responses from Female Respondents who are willing to go for Higher Studies

In the Figure 6, the cluster analysis up to the distance 5 through average linkage is considered and the reasons which are occupied in a cluster up to the said distance are reflected in the dendrogram. Up to distance 5, reason 1, reason 7, reason 6 and reason 4 are occupied in a cluster. So, the female student respondents who are willing to go for higher studies preferred these four reasons which are the obstacles of low enrollments in higher education in West Bengal.

4.4. Cluster Analysis for the Female Student Respondents, unwilling to go for Higher Studies, in Response to Low GER

From the feedbacks of the female student respondents who are unwilling to go for higher studies, the reasons of low GER of higher education in West Bengal are collected. Then clustering technique is applied on the reasons to identify the most effective reasons of low GER.

The dendrogram formed, using Average Linkage between groups, of the reasons said by female student respondents who are unwilling to go for higher studies is pictorially presented in Figure 7.

Figure 7. Dendrogram using Average Linkage (Between Groups) Responses from Female Respondents who are unwilling to go for Higher Studies

In the Figure 7, the cluster analysis up to the distance 5 through average linkage is considered and the reasons which are occupied in a cluster up to the said distance are reflected in the dendrogram. Up to distance 5, reason 1, reason 6 and reason 4 are occupied in a cluster. So, the female student respondents who are willing to go for higher studies preferred these three reasons which are the obstacles of low enrollments in higher education in West Bengal.

4.5. Insights: Post Application of Hierarchical Clustering Techniques on Female Respondents

In the Sections 4.2, 4.3 and 4.4, the Hierarchical Clustering technique is applied over the obtained reasons of low GER and large scale dropouts. All the female respondents were classified with three groups namely: all the female respondents, female respondents willing to pursue higher studies and female students unwilling to pursue higher education. To each group, it was questioned to know what the reasons, prioritised by them are.

Ultimately from the dendrograms (Figure 5, Figure 6 and Figure 7), four reasons were identified which they prioritised most. The identified reasons are (i) expensive higher education, due to economically weak students cannot grab it, (ii) few number of seats in higher education institutes and less opportunities foe mediocre students in West Bengal, (iii) unavailability of proper guidance and awareness made them channelised to early marriage and (iv) involvement of politics in higher education institutes in West Bengal.

**4.6. Projected e-Learning Model Establishment for Female Students of West Bengal**

100% female students expressed their willingness to enroll in higher studies through e-Learning as through e-Learning most of the obstructions become resolved. The proposed model for e-learning based model will have two facades: one is learner centric and other one will be context centric. The learner centric user interface should be pivotal to the overall design of e-Learning system so that it is well accepted to both the learners and instructors. The context centric components will be dedicated for delivery of e-Learning content and curriculum, analysis of learning procedures and needs of users.

There will be three user groups with appropriate level of permission to get entry to the e-Learning applications. These groups are teachers or instructors, students or learners and administrators. From the female students' viewpoint their activities will be like: collect plan of learning, download the learning content and materials, self-study, performing assignments online and submit, face the examination etc. The basic activities of teachers will include: prepare teaching plan & upload, preparation of content and upload, preparation of assignments and upload, assessment and analyse involvement of students,

service and knowledge support to students online and giving feedback to the administrator *etc*.

The basic activities of administrators will be: assigning learning and teaching support in e-Learning environment, test and results publication, publishing notices and announcements, managing records of resources, managing enrollment and users, addressing feedbacks given by learners and teachers and other administrative involvements.

The proposed architecture of web portal is represented in Figure 8.
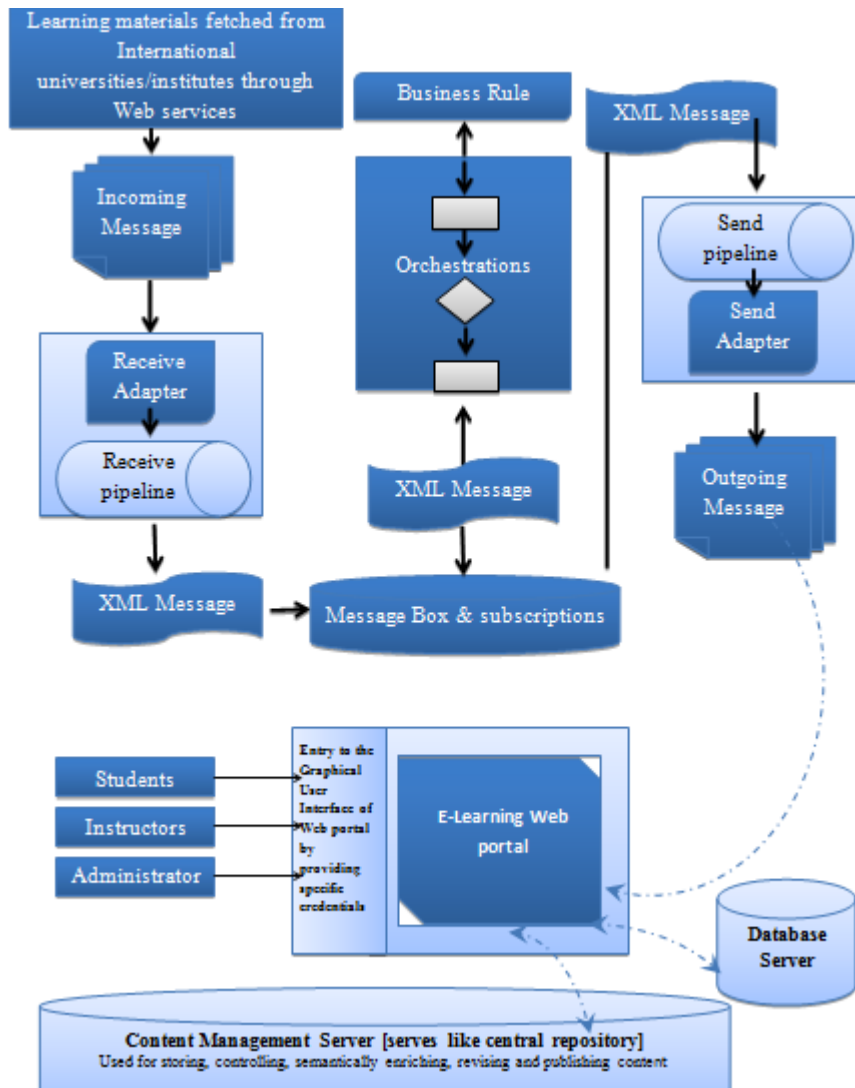
Figure 8. Proposed Model of E-Learning Web Portal Architecture (Establishment)

Here three servers are necessitated: BizTalk Server, Content Management Server (CMS) and Database Server. This set up is to be established in the e-Learning control room, from where each node (each computer present in e-Learning centers) of e-Learning centers can be managed. Here the web services are used to fetch learning resources from well known knowledge network *e.g.*, NKN (National Knowledge Network), Briahaspati and other universities of repute across the globe like MIT OPEN COURSEWARE (Massachusetts Institute of Technology Courseware). In accordance with the definition of W3C (World Wide Web Consortium), web service is a software system which is designed to support machine to machine communication maintaining interoperability throughout

the network. Generally web services use XML (Extensible Markup Language) messages which follow SOAP (Simple Object Access Protocol) standard.

From the knowledge network the projected web portal will be able to fetch learning materials through web services. The data will come in the portal's end like XML messages. Now through parsing the XML messages, it is possible to get the materials in the required form and format which can be delivered to the user-end of the web portal.

In the portal architecture setup the XML messages are channelised through BizTalk server. BizTalk server is an enterprise application integration solution developed by Microsoft Corporation. This application integration solution is made through the presence of out of box *i.e.*, build in XML and SOAP support. Through the integration with Visual Studio Dot Net (preferably upper versions like Microsoft Visual Studio 2008 and 2010), it can provide speed, flexibility and reliability in standard application integration. BizTalk server also provides the support of built-in EDI (Electronic Data Interchange) functionality which may help learners as well as instructors to communicate with each other online. Moreover through this technology, online broadcast of interactive classes and lectures can be made available to the students from any geographical location, like lectures of an eminent scientist in respective fields or online classes of renowned universities *etc.* [19]

In the Figure 14 we have the XML messages from web services. The files get entry through 'Receive Adapter' and through 'Receive pipeline', the XML messages are passed to the 'Message Box and Subscriptions '. Messages come to the BizTalk server through HTTP, SOAP, files *etc*. Adapters are additional transport support to the messages. Message Box is the central storage of BizTalk server which ensures the reliability of messages regarding delivery to exact destination.

The XML messages are fetched in 'BizTalk Orchestrations' to process through some custom rules. BizTalk orchestration facilitates a range of tools to simplify the design and implementation of complex services. Business Rules Engine is present to install current rules or protocols from Orchestration and these may be changed from time to time. Then the XML messages are sent out to 'Send Adapter' through 'Send pipeline'. The XML messages are sent to the destination *i.e.*, in the web portal. Then the XML messages are parsed through different parsing techniques to obtain the data that were already sent from another geographic location. As a consequence, the developers will able to fetch the desired data and place the same in the desired place in the web portal [20].

The Content Management Server (CMS) is set up with the web portal to effectively manage the workflow among the students, instructors and administrators in the proposed e-Learning web portal. The key advantage of CMS is that data can be defined such as documents, images, videos, mathematical and scientific formulas and in many other types and forms. These various types of data storage are essential to present the learning contents or lectures with animations, nuggets, diagrams etc. Moreover, CMS can be used as a central repository and it handles duplicate or newly updated data through versions. These version control feature will be effective in uploading the revised contents in the web portal.

The database server manages the database services following the client server model.

The functional model of the e-Learning enabled web portal (in Figure 14) defines that in e-Learning control room the web application will reside along with the three servers. From district e-Learning headquarters of West Bengal or from e-Learning centers of any district the students and instructors will able to login and access the portal. Only administrators and instructors have the permission to access the web portal from e-Learning control room which will be present in West Bengal State headquarters. From state headquarters *i.e.*, from e-Learning control room the web based teaching learning activities will be maintained and monitored on a day to day basis.

5. Conclusion

From the study the obstacles of the female students in enrolling higher studies were identified. Of the several reasons, some reasons were extracted through hierarchical clustering techniques. If those most significant reasons can be removed the enrollments of the female students will rise up. As a way out, e-Learning and its advantages were presented. As per the views of the female students, they are ready to accept e-Learning based education. Suggestions to improve the GER through e-Learning are also a good insight from the survey. The impact of e-Learning may better enrich the female students' enrollments in higher education in West Bengal. To increase the GER of female students an e-Learning model is set up following recent technologies of IT industry trends.

Acknowledgment

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