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Information and Communication Technology and Learning in Higher Education

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A B S T R A C T

In recent past the development of information and communication technology has permeated the many aspects of life in myriad ways. There is hardly any field which is untouched by it, and also known for its ability to dissolve the boundaries, and inclusiveness. These defining characteristics has made the information and communication technology (ICT) essential in education where gap between teacher and pupil and restrictions in the flow of ideas are well removed by it. In recent years the Government of Haryana, one of the state of India also having the highest per capita expenditure on education, has heavy invested in the ICT based education system. The present study is an attempt to investigate how the students perceive this new technology based learning. A sample of 250 students is taken and the principal component analysis techniques is utilized to meet the objectives of the study. It is found that the students are quite comfortable in using computer and browsing the information on internet. They think computer based classes encourages them to search for more facts than the traditional methods. The students are also find the computer based classes more interactive as these classes encourages to search for more facts. The results also indicate that in modern teaching environment teacher still occupied important role.

Keywords: information and communication technology, learning, students

I. Introduction

The students are the life blood of any education institutes and they are also the main stakeholders. The higher education is basically oriented to develop the skills of the students so that they may earn more in their life. The recognition that today's economies need to be knowledge based, which in turn require a workforce and consumer body that are characterized by flexibility, independence in learning and information and communications technologies competence. The information and communication technology (ICT) enabled fact based decision making virtually across all functional area of a system. The analytics which is well grounded in information technology and statistics is now new buzz word in job market. These factors may be an even more compelling reason for governments to be as proactive in introducing the ICT based learning in educational institutes. In Haryana in the recent past the government had invested heavily on ICT based learning in colleges. The universities of the state has also introduced numbers of course related to ICT to meet the growing demand of ICT based workforce and other opportunities coming up in this sector of the economy.

Statement of the problem

The ICT has set new learning environment where learning goes beyond textbooks, classroom and now they have access to unlimited resources to learn. ICT based education offers new opportunities for both the educator and the learner to enrich their teaching and learning experiences through virtual environments that support not just the delivery, but also the exploration and application of information. The question is to know how the students perceive this new blend of education. The present study is an attempt to examine the perceptions of the students regarding the ICT based education in Govt. Colleges of Haryana.

The present study intends to investigate the effects of information and communication technology on students and their perceptions about ICT.

II. Method

To investigate the problem and achieve the objective of the study the following methodology is employed:

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Research design

The present study is based on the exploratory design intended to explore the possibilities of obtaining as many relationships as possible between different variables without knowing their end point applications.

Data collection

A structured questionnaire is prepared to collect data which is relevant to the objectives of the present study. The questionnaire is developed after discussing different experts and information retrieved from the internet. The questions used in the questionnaire are made easy as possible. Options for multiple responses having rated scale are followed by each question. Respondents have to select one option out of given choices. A typical question out of prepared questionnaire of the study is given as under:

I enjoy using personal computers

(a) Strongly Agree, b) Agree, c) Neutral, d) Disagree, e) Strongly Disagree

To quantify the responses for statistical analysis Liker Scale is used. Under this scale responses are quantified as: Strongly Agree-5, Agree-4, Neutral-3, Disagree-2, and Strongly Disagree-1.

Reliability: It means would the same procedures, experiments or actions carried out again produce the same result? It is a measure of the extent to which an item, scale, or instrument will yield the same score when administered in different times, locations, or populations, when the two administrations do not differ in relevant variables. In the present study the Cronbach's Alfa has been used as a measure of the reliability of the data.

Research Population: The research population of the study is defined as:

- Students of Govt. Colleges in Haryana

Sampling

Random sampling is adopted to observe the data. A sample of 250 students is taken randomly from the colleges belonging to Haryna.

Data analysis

To analysis the observed data I have used the descriptive tools of the statistics for presenting and revealing the vital characteristics of the data. The principal component analysis which is one of the techniques for data reduction of multivariate data is used.

Structure of the collected data

To know how well this ICT based learning is perceived by the students I have recorded the observations of 250 students through well structured questionnaire from the field which are exposed to ITC from different colleges under the direct control of the Haryana government. The Table-1 gives the glimpse of the collected observations. In the given data of 250 observations 110 belong to male category and 140 are female. On the basis of stream of the course 140 students belong to commerce and 110 are from science stream.

Table 1: Frequency of Observations (Student wise)

Colleges	Obs	Boys	Girls	Commerce	Science
Hisar	30	16	14	15	15
Sirsa	30	12	18	15	15
Jind	30	16	14	15	15
Fatehabad	20	00	20	20	00
Karnal	20	15	5	10	10
Ambala	20	9	11	10	10
Gurgaon	20	10	10	10	10
Punchkula	30	12	18	15	15
Rohtak	20	00	20	15	5
Bhiwani	30	20	10	15	15
Total	250	110	140	140	110

Descriptive of the perceptions of the students

The descriptive in the form mean score of the responses regarding the perceptions of the students is presented in the Table-2 in appendix. The mean score is classified on gender basis to get better understanding of the perceptions of the students. The results in the table indicate that most of the statements related to computer and e learning has average score greater than three which fall under the territory of agree. Similar type of the observations we can made out of mean score based on gender wise category (Figure-1). In case of information embodied in the statements it may be observed that the students are very

Table 2 Mean Score of the Perception of the Students

Sr.	Variable	Mean	Male	Female
1	I enjoy using personal computers	4.10	4.21	4.01
2	I use the personal computers for work and play	4.12	4.01	4.21
3	I was comfortable with using the PC and software applications before I took up the e-learning based courses	3.52	3.56	3.48
4	The e-classes encourages me to search for more facts than the traditional methods	3.24	3.11	3.34
5	The e-class encourages me to participate more actively in the discussion than the traditional methods	3.30	3.11	3.45
6	The teacher is enthusiastic about teaching the class	4.00	3.98	4.01
7	The teacher's style of presentation holds me interest	3.80	3.67	3.90
8	The teacher is friendly towards individual students	3.99	4.01	3.98
9	The teacher has a genuine interest in students	3.98	3.67	4.23
10	Students felt welcome in seeking advice/help	3.18	3.01	3.31
11	The teacher encourages student interaction	2.58	2.34	2.76
12	The teacher handles the e-learning units efficiently	3.85	3.78	3.90
13	The teacher explains how to use the e-learning components	3.22	3.09	3.32
14	We were invited to ask questions/receive answers	3.92	3.81	4.01

15	We were encouraged to participate in class	4.16	4.34	4.01
16	The teacher encourages and motivates me to use e-learning	4.38	4.21	4.51
17	My previous experience in using the PC and software applications helped me in the e-learning based courses	3.54	3.97	3.21
18	I do read as well as participate in the discussion group	3.99	4.12	3.89
19	The instructor initiated most of the discussion	4.34	4.23	4.43
20	The students initiated most of the discussion	2.85	2.79	2.89
21	The instructor participated actively in the discussion	4.12	4.01	4.21
22	I found the course contents of EduSat classes related to the subject	3.90	3.89	3.90
23	It was easy to understand the structure of the e-learning components	4.12	4.01	4.21
24	The e-learning components was available all the time on web	4.11	4.23	4.01
25	I perceive the design of the EduSat classes components to be good	4.04	3.97	4.10
26	Accessibility to the Internet	4.08	4.21	3.98
27	Did not experience problems while browsing	3.99	4.01	3.98
28	Overall, the internet is easy to use	4.10	4.21	4.01
29	I could interact with classmates through the web	2.56	3.01	2.21
30	I can use any PC at the college computer lab using the same account and password	4.14	4.01	4.25
31	I can use the computer labs for practicing	4.19	4.12	4.25
32	Overall, the information technology infrastructure is satisfactory	3.85	3.92	3.80
33	I can get technical support from technicians	4.33	4.34	4.32
34	I think that the EDUSAT system is good	4.22	4.21	4.23
35	There are enough computers to use and practice	3.41	3.23	3.56
36	I can print my assignments and materials easily	3.11	3.23	3.01

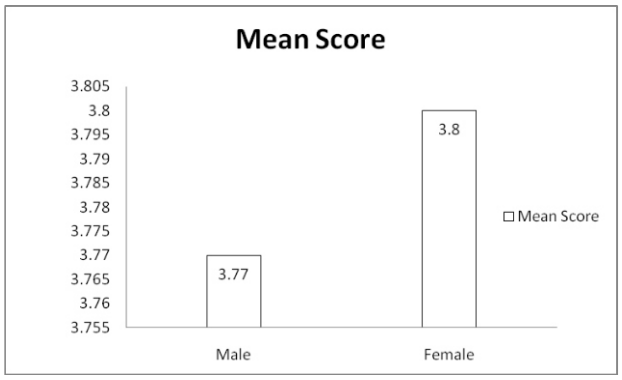

Figure 1: Mean Score of the perceptions of the Students (Gender wise)

Figure 2: Mean Score of the perceptions of the Students (Stream wise)

enthusiastic about the ICT based education. The students think that they are quite comfortable in using computer and browsing the information on internet. They are also aware of the e_resources on web. They think computer based classes encourages them to search for more facts than the traditional methods. The students are also satisfied with the teacher the way he/she handling the class. The students are also find the computer based classes more interactive as these classes encourages to search for more facts. It means the teachers in government colleges who are handling computer and related courses are quite trained to discuss the multidimensional aspect the contents of the topics of the class. Across the stream of the courses, in which concerned with commerce and science stream, it is found that the students belonging to science stream has more score on different parameters observed in the forms of statements (Figure-2). It seems the students belonging to science stream are more tuned to ICT based learning environment.

Perceptions of the students college wise

The descriptive of the perceptions of the students for different colleges is exhibited in Fig.-3. It suggests that students of Haryana are agree with ICT enabled learning environment. The students of Gurgaon, Hisar, Karnal ,Ambla and Punchkula are quite aware of e learning and its importance.

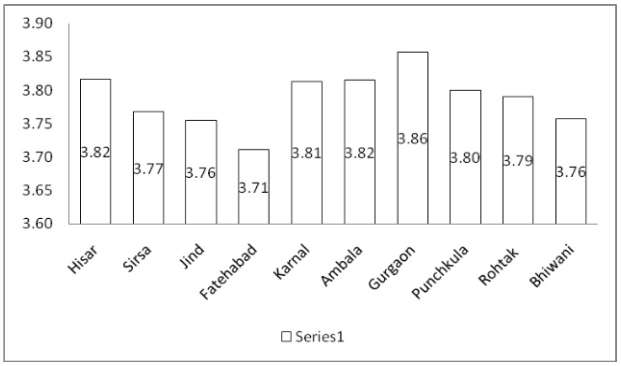

Figure 3: Mean Score of the perceptions of the Students (College wise)

Factor analysis of perceptions of the students

To get the better insight of the information hidden in the data, I have applied the factor analysis on the observed data. Factor analysis is a multivariate statistical technique used for data reduction. As the observed data has multidimensional aspects, in my case it has thirty-six statements. It demands the reduction of data in few dimensions to arrive at better interpretation and have worthful information. Factor analysis is generic name of data reduction techniques which include number of methods. In the present analysis the Principal Component Analysis (PCA) has been selected to extract the major components or factors from the observed data. Before apply the PCA, the data has been tested and judged for suitability of applying this technique. For the purpose the data is first tested for its reliability to know the extent the set of variables is consistent in what it is intended to measure. In this case it is measured by using the Cronbach,s alpha. The reported value of the statistic is .763 which is well above the minimum accepted value of reliability of five point scale. The factor analysis is based on the correlation matrix of the variables. Any departure from normality, homoscedasiticty, and linearity can diminish correlations between the variables. For the purpose, the overall significance of the correlation matrix has assessed with the Bartlett test and the factorability of the overall set of variables and individual variables using the measure of sampling adequacy. The values of these test are reported in Table-3, and these values indicate the observed data is fit case for applying the factor analysis technique.

Table 3: Test for factor analysis

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.897
Bartlett's Test of Sphericity	Approx. Chi-Square	495.60
	df	595
	Sig.	0
Reliability Test		
Cronbach's Alpha	.763	

By using the principal component analysis three major components factors has emerged from the observed data. For identifying the principal components I relied on the rule of eigen value. As per this rule the components which have eigen value greater than one are considered for further analysis and they may treated as proxy for all the variables of the study. It is found the first factor accounts for 42.56% of total behaviour followed by 23.45% by second, and 10.67% by the third component. In aggregate all these three factors account for 76.68% behaviour of the observed data set of the study. The values of these factors is presented in the Table-3.A, and also displayed in Figure-4.

Table 3.A: Factor Extracted

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
F1	15.32	42.56	42.56	15.32	42.56	42.56	13.88	38.56	38.56
F2	8.44	23.45	66.01	8.44	23.45	66.01	9.45	26.25	64.82
F3	3.84	10.67	76.68	3.84	10.67	76.68	4.26	11.85	76.68

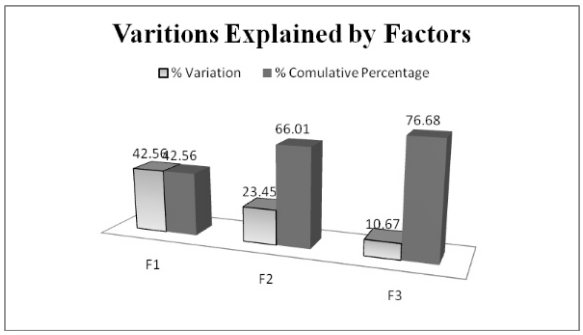

Figure 4: Proportion of total Variations Explained by Factors

Before further examining the factor responsible for explaining the total behaviour, the behaviour of all the thirty six variables is investigated for individual variable's total behavior explained by the common extracted components. First variable concern with enjoyed using personal computers has communality equal to 0.956 means 95.6% behaviour of this variable is account for common factors and the rest of its behaviour is unique to this variable. As per the criterion of selecting the statements/variables for factor analysis the communality of variables must be greater than 0.50 which means only those variables must be retained for analysis. In the present study all the statements have communalities greater than 0.50 so all the variables qualified for explaining the extracted factors/ components.

In the factor analysis, the extracted components are simply the latent variable or construct which is the combination of similar type of the variables. To know what type of the information a factor represent the variables having factor loadings above 0.40 are identified and clubbed together to know its characteristics. After examining the grouped variables a hypothetical name is given to the factors. Sometime a particular statement may be having significant loading with more than one factor which may create confusion in making statement about the factors. To overcome this type of the situation factor analysis provided us the tools in the form of factor rotation. In this techniques factor are rotated orthogonally in space generated by the variables without affecting the overall variability of the factors. It simply redistributes the variations among given factors while keeping overall variations constant. The purpose of this technique is simply facilitating the researcher to interpret ate the factors easily. In the present study most commonly used varimax rotation method has applied to interpret the factors. The statements including 6 to16, 19&21 having highest loading with factor one. All these statements are concerned with student's perception regarding the class teacher like how the teacher handles the class and make it more attractive etc. These statements in combined form can be named as Characteristics of the Teacher. The teacher capability and his/her behaviour in the class account for more than 42.56% of the perception of students regarding ICT enabled learning. It implies

that in modern teaching environment teacher still occupied important role. It further implies that the facilitators and motivators quality of the teacher has significant role in learning proc-ess. The statements which are the part of the first factor Characteristics of the Teacher along with factor loadings are given in Table-4

Table 4: List of Factor Extracted and Factor Loadings

Factor	Q. No.	Variable	Loading
	6	The teacher is enthusiastic about teaching the class	0.764
	7	The teacher's style of presentation holds me interest	0.913
	8	The teacher is friendly towards individual students	0.854
	9	The teacher has a genuine interest in students	0.651
	10	Students felt welcome in seeking advice/help	0.791
	11	The teacher encourages student interaction	0.929
	12	The teacher handles the e-learning units efficiently	0.586
Teacher Characteristics	13	The teacher explains how to use the e-learning components	0.763
	14	We were invited to ask questions/receive answers	0.831
	15	We were encouraged to participate in class	0.782
	16	The teacher encourages and motivates me to use e-learning	0.879
	19	The teacher initiated most of the discussion	0.932
	21	The teacher participate actively in the discussion	0.867
	22	I found the course contents of EduSat classes related to the subject	0.932
	23	It was easy to understand the structure of the e-learning components	0.654
	24	The e-learning components was available all the time on web	0.665
	25	I perceive the design of the EduSat classes components to be good	0.553
	26	Accessibility to the Internet	0.872
	27	Did not experience problems while browsing	0.543
	28	Overall, the internet is easy to use	0.785
Technical Support	29	I could interact with classmates through the web	0.834
	30	I can use any PC at the college computer lab using the same account and password	0.789
	31	I can use the computer labs for practicing	0.621
	32	Overall, the information technology infrastructure is satisfactory	0.786
	33	I can get technical support from technicians	0.576
	34	I think that the EDUSAT system is good	0.883
	35	There are enough computers to use and practice	0.665
	36	I can print my assignments and materials easily	0.543
	1	I enjoy using personal computers	0.934
	2	I use the personal computers for work and play	0.875
	3	I was comfortable with using the PC and software applications before I took up the e-learning based courses	0.761
Students characteristics	4	The e-classes encourages me to search for more facts than the traditional methods	0.691
	5	The e-class encourages me to participate more actively in the discussion than the traditional methods	0.743
	17	My previous experience in using the PC and software applications helped me in the e-learning based courses	0.923
	18	I do read as well as participate in the discussion group	0.739
	20	The students initiated most of the discussion	0.785

The second factor which account for 23.46% behaviour comprising of the statements 22 to 36. These statements in combined form reflect the medium and instrument which facilitate the e based learning, and in this way second factor can be named as Technical support. It means the soft infrastructure and physical infrastructure are very important for e learning and moulding the perceptions of students about modern teaching methods. The statements which are the part of the second factor technical support along with factor loadings are given in Table-4.

The third factor which account for 10.67% behaviour is mainly the outcome of the statement related to the characteristics of the students. These statements include 2 to 5, 17 to 18 and 20. So this factor may be named characteristics of the students .These statements reflect how comfortable are the students to handle the computer system and their ability to participate in the class interaction and group discussion.

In aggregate it is explored that capability of the teacher and the students along with technical support are essential to fully exploit the potential of ICT based learning.

Summary

To know how the students perceive the ICT based learning, the perceptions of 250 students from different colleges across different discipline are recorded through a structured questionnaire. The questionnaire consists of 36 statements are categorized into different groups by using principal component analysis. From the descriptive of the perceptions of the students it is found that most of the statements related to computer and e learning have average score greater than three which fall under the territory of agree. Similar type of the observations we can made out of mean score based on gender wise category. The results imply that the students are very enthusiastic about the ICT based education. The students think that they are quite comfortable in using computer and browsing the information on internet. They are also aware of the e resources on web. They think computer based classes encourages them to search for more facts than the traditional methods. The students are also satisfied with the teacher the way he/she handling the class. The students are also found the computer based classes more interactive as these classes encourages to search for more facts.

By using the principal component analysis three major components factors has emerged from the observed data accounting for 76.68% behaviour of the observed data set of the study. The first factor is named as Characteristics of the Teacher. The teacher capability and his/her behaviour in the class account for more than 42.56% of the perception of students regarding ICT enabled learning. It implies that in modern teaching environment teacher still occupied important role. It further implies that the facilitators and motivators quality of the teacher has significant role in learning process. The second factor which account for 23.46% behaviour comprising of the statements 22 to 36. These statements in combined form reflect the medium and instrument which facilitate the e based learning, and in this way second factor can be named as Technical support. It means the soft infrastructure and physical infrastructure are very important for e learning and moulding the perceptions of students about modern teaching methods. The third factor which account for 10.67% behaviour is mainly the outcome of the statement related to the characteristics of the students. These statements include 2 to 5, 17 to 18 and 20. So this factor may be named characteristics of the students .These statements reflect how comfortable are the students to handle the computer system and their ability to participate in the class interaction and group discussion.

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