



Effect of ICT on Student's Satisfaction and Academic Performance

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Abstract-- Information and Communication Technology (ICT) has changed the tradition teaching learning process up to larger extent now days. It offers many benefits to the learners. However, there is always a question of student satisfaction with regard to On-line Teaching Learning Process (OTLP) as it will directly affect their academic performance. The study is quantitative in nature, and the information was gathered from 512 respondents who were enrolled in undergraduate and postgraduate programs at universities in Haryana (India) via an online survey. Utilizing structural equation modeling, the suggested theories were examined. For educational management, these factors are essential for online courses. Keeping this in mind the researcher has taken current study with an objective to study the effectiveness of ICT on student satisfaction and their academic performance.

Keywords: *Information and Communication Technology (ICT), Student Satisfaction, Academic Performance.*

1. INTRODUCTION

In past few decades, trend of online classes is becoming popular day by day with increased use and reach of internet. Student's interests are also increasing in online learning with increased number of institutions who offered online classes (Wei *et al.*, 2020). COVID- 19 had created a situation that forced all the educational institutions to go with online courses to continue the classes. Before COVID-19, online classes were not much in trend but at present time, it becomes pertinent for every educational institution to go with online classes for running smoothly learning activities.

In online classes, not only teaching but other activities can also be conducted parallelly such as personal assignment, group projects, evaluation activities, online group discussions/debates etc. (Wei *et al.*, 2020). Along with the benefits, various problems are also faced by teachers and students while coming into online teaching learning process like difficulty in registering, managing the different accounts for multiple courses, protecting the confidentiality etc. (Dinh *et al.*, 2020).

One major problem is to maintain the teacher- student and the student –student interaction in online classes. On the other hand, technological issues are also creating disruptions in learning such as low connectivity, sound interruption and check-in problems. Conducting online classes are not so much easy for teacher as well as students (Linh, 2020). Students find difficult to minimize the technological disruption whereas teachers also face

difficulties in maintaining the effectiveness of their teaching as in face-to-face classroom. As a result, the satisfaction level regarding online learning of students goes down and it ultimately would impact on academic performance of the students.

In the light of above background, current study is designed with the objective, *to investigate the effectiveness of Information and Communication Technology for the students' academic performance and satisfaction.*” To get deep insights, extensive literature review is done.

2 LITERATURE REVIEW

Use of online classes has been increased with the widespread of computers, internet and fast growth in technology (Wei *et al.*, 2020). Online classes reflect the platform where the teacher-student interaction and learning are done through Information and Communication Technology. Online learning is an ICT based learning program that also termed as ‘e-learning’, ‘online learning’ or ‘distance education’ and ‘distance learning’. Mitchell *et al.*, 2005 said that knowledge of computer and information technology can increase the satisfaction level of students.

Online classes are beneficial for students and teachers both in such a way that it breaks the monotonous routine, gets better utilization of time and resources. Students continue their learning and interaction with teacher through online classes. The easy access of material for their learning makes the learning process convenient. With rising the education standards and competition in the educational institutions, student’s satisfaction has become an important concern (Parahoo *et al.*, 2016).

Some studies are concluded that online classes are more satisfying and results are better than face to face classroom interaction (Forgey *et al.*, 2016). On the other hand, some studies are consistent with the results that face-to-face learning is more significant than online learning and the students are more satisfied with face-to-face learning than online learning (Dinh *et al.*, 2020).

Gopal, R., Singh, V. & Aggarwal, A. (2021) have also come up with the statements regarding the influence of online classes on student happiness and academic performance that course design, teacher quality, fast feedback, and meeting the expectations of the students all contribute to improve student satisfaction and academic success. E-learning offers opportunities for efficient time management and encourages students to learn independently, according to a study by Balakamakshi and Savithri (2021) on the impact of e-learning on students' academic performance at the college level.

The justification for e-learning was based on the integration of three theories that show how online communication via social media and collaboration learning boost students' learning activities and allow them to share knowledge, information, and discussion (Alalwan *et al.*, 2019). Saleem and Rasheed (2014) also identified the elements of e-learning that influenced student satisfaction. Rajabalee, Y. B., & Santally, M. I. (2020) came up with the argument that engagement and student satisfaction are strongly and favourably associated. The students' behavioural intent to use social media for cooperative learning and communication via the internet for education improves as a result of their perceptions of social media's enjoyment, usefulness, and simplicity of use, Almaiah, M. A., & Alyoussef, I. Y. (2019).

The development of information technology and changes in the educational system have an impact on the ways in which people learn as described by Ikhsan, R. B., Saraswati, L. A., Muchardie, B. G., & Susilo, A. (2019). A

study conducted by Bolliger, D. U., & Halupa, C. (2018) indicated that students had high degree of transactional distance and reasonably high level of engagement. Researchers found a modest correlation between student engagement and transactional distance that transactional distance can accurately predict student engagement. According to Chandrasekaran *et al.* (2023), the information security course covers the procedures and equipment needed to safeguard sensitive electronic information from disruption, alteration, and destruction in cyberspace. Cerverol *et al.* (2020) suggested that four factors predominately affect the quality of the instructional and educational procedures in virtual campuses: teachers' positive attitudes towards the use of technology for learning, students' possession of the necessary digital skills, and activities that foster discussion and exchange of ideas. Samoylenko *et al.* (2022) investigated the capacities of ICT used in the educational process at all levels of university education in Russia: Bachelor's/Master's Level Programmes and Professional Training. According to the findings, ICT as well as technology for e-learning are widely used at universities to handle educational processes, foster various forms of communication and participation, carry out evaluations and evaluate progress, and plan blended learning team projects.

3 METHODOLOGY

3.1 Participants

Data for this cross-sectional survey were gathered from 512 respondents who were enrolled in the state of Haryana's higher education institutions. Demographic profile of sample revealed that majority of respondents were female (52.3 per cent of the total sample) following by 47.7 per cent male respondents. Majority of the respondents fall in more than 20 years age group followed by major chunk of (483) unmarried respondents. The majority of students 74 per cent found to be studying through offline mode of Teaching Learning Process.

3.2 Materials

There are two sections to this study. The demographic factors covered in the first section include Marital Status, Age, Gender, Area of Work, and Mode of Teaching Learning Process (under-graduate or post-graduate). The three factors that is Information and Communication Technology (ICT), Student's Satisfaction and Student's Academic Performance are measured in the second section. A five-point Likert scale, with from 1 denoting "strongly disagree" to 5 denoting "strongly agree," was used to access these variables. Only the students who are enrolled in higher studies are considered for sample selection. The primary data were collected using a google form from the students of professional courses. The government as well as private educational institutions from The States of Haryana (India) have been considered for the sample selection. The study included sixty-three questions in order to assess the effect of ICT on Student's Satisfaction and Academic Performance.

3.3 Design

A descriptive research design was employed in the study. The factor "Information and Communication Technology" is treated as independent variable. The Student's Satisfaction and Student's Academic Performance are the dependent variables in the current study.

3.4 Utilities/Applications

The current study has been meant for students. Their satisfaction level regarding use of ICT has been examined in present study as in current situation; it is the most challenging task for educational institutions. The students are vital elements for educational institutions and if the students are not satisfied with the services provided by institutions, the students will not turn up and it will become the question of survival for the institutions. The satisfaction related to the services provided by the institutions is witnessed by their academic performance.

3.5 Procedure

The respondents in this cross-sectional study were chosen using judgment sampling. They were briefed on the purpose of the investigation and the methods used to collect data. They received guarantees about the privacy of the data and received no payment for taking part in the study. An online survey was used to collect the data used in this investigation. The survey was created using Google Forms, and it was sent over WhatsApp and emails. Data from the state of Haryana were gathered. With all Indian institutions offering online courses, this was the ideal opportunity to gather information for the present study topic. As a result, students have ample time to comprehend the tool and provide thoughtful answers to the questionnaire. Out of the 1000 questionnaires distributed, 605 were returned by the students. But some of the questionnaires received from the respondent's contained errors and duplicate copies. In conclusion, 512 questionnaires were used in this study. Both male and female students participated in the study, and the sample included students in various age groups and courses, such as undergraduate and postgraduate studies at higher education institutions.

4. OBJECTIVES OF THE STUDY

The main aim of the current study is to examine the effect of ICT on student satisfaction and their academic performance in higher education. Below are the concise objectives of the current study:

1. To study the effect of Information and Communication Technology (ICT) on Student's Satisfaction (SS); and
2. To study effect of Information and Communication Technology (ICT) and Student's Academic Performance (AP).

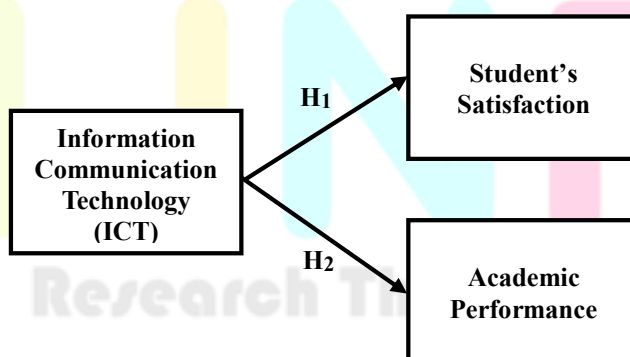


Figure 1: Proposed Research Model

Figure 1 explains the relationships between Information Communication Technology (ICT), student's satisfaction and Student's Academic Performance. The relevant hypotheses to achieve the said objectives are explained as:

H₁: Information Communication Technology (ICT) has positive effect on Student's Satisfaction.

H₂: Information Communication Technology (ICT) has positive effect on Student's Academic Performance.

5 RESULT FINDINGS

The original statistical approaches are applied for the calculation of frequency measurement, descriptive statistics, reliability test, and correlation to draw the inferences. Smart PLS software has been employed for Measurement Model and Structural Equation Modelling to achieve objectives of the current study.

5.1 Hypotheses Testing of H₁

The respective loadings (>0.6 as said by Masrek & Samadi, 2017) for all the items of ICT and Student Satisfaction lie in the feasible criteria of outer loadings. The Cronbach Alpha values (>0.7 as said by Garson, 2016) for ICT (0.91) and Student Satisfaction (0.933) indicate that the data is reliable. All the respective Composite Reliability (CR) values for ICT (0.916, 0.91) and Student Satisfaction (0.934, 0.933) lie in the feasible criteria. It is a sign of perfect data. Average Variance Extracted (AVE) values (> 0.5 as explained by Sabiu et al. 2016) for ICT (0.561) and Student Satisfaction (0.699) lie in acceptable range indicating it is an adequate model.

Table 1: Validity and Reliability Instruments for ICT and SS

Factor Loading			Reliability Analysis and Convergent Validity				Fornell-Larcker Criteria	Heterotrait-Monotrait Ratio
Items	ICT	SS	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted		
ICT 1	0.901		0.91	0.916	0.91	0.561	0.749	
ICT 2	0.614							
ICT 3	0.733							
ICT 4	0.703							
ICT 5	0.719							
ICT 6	0.787							
ICT 7	0.713							
ICT 8	0.79							
SS 1		0.854	0.933	0.934	0.933	0.699	0.836	
SS 2		0.795						
SS 3		0.825						
SS 4		0.787						
SS 5		0.87						
SS 6		0.88						

The diagonal values (0.749 and 0.836) of top numbers in factor column are higher than correlation value (0.543) below it. So, based on the output, Discriminant Validity model is accepted for ICT and Student Satisfaction. HTMT ratio for ICT and Student Satisfaction shows that both variables do not have the problems of Discriminant Validity as the value (0.54) of HTMT is less than 0.90. So, it is a sign of good model.

Table 2: Path Relationship Output for ICT and SS

Hypothesis Path	Path Coefficient	R-Square	F-Square
ICT -> SS	0.503	0.253	0.338

Source: PLS-SEM Output

Path coefficient for ICT on Student Satisfaction is 0.503. The value of R-square (0.253) indicates that the weak level of variance is explained by the said relationship as the threshold value for R-square is <0.25 for weak effect; <0.50 for moderate; and <0.75 for strong effect. After glancing through the value of f-square (0.338), it is concluded that the effect of ICT on Student satisfaction is moderate to strong as the value 0.338 is closer to 0.35 (threshold criteria).

Table 3: Model-Fit Indices for ICT and SS

Analysis	Saturated model	Estimated model
SRMR	0.044	0.044
d_ULS	0.206	0.206
d_G	0.173	0.173
Chi-square	472.715	472.715
NFI	0.904	0.904

Source: PLS-SEM Output

All the values of model-fit lie in the threshold value. Hence, it can be said that the model is a good fit.

Thus, the hypothesis H_1 : Information and Communication Technology (ICT) has positive impact on Student Satisfaction is accepted as better use of ICT leads to improve satisfaction level of students.

5.2 Hypotheses Testing of H_2

All values of Cronbach's Alpha are found placed within the range. So, reliability measure defines a good sign that the data is perfect for further calculations. All the respective CR values for ICT (0.914 0.928) and AP (0.952, 0.959) lie in the feasible criteria. The values of AVE for ICT (0.617) and AP (0.771) are in placed in acceptable range i.e. > 0.5 as explained by Sabiu et al. (2016) and Bido & Silva (2019).

The diagonal values (0.878 and 0.786) of top numbers in factor column are higher than correlation value (0.558) below it. So, based on the output, Discriminant Validity model is accepted for ICT and AP. HTMT ratio for ICT and AP shows that both variables do not have the problems of Discriminant Validity as the value (0.596) of HTMT is less than 0.90. So, it is a sign of good model.

Table 4: Validity and Reliability Instruments for ICT and AP

Factor Loading			Reliability Analysis and Convergent Validity				Fornell-Larcker Criteria	Heterotrait-Monotrait Ratio
Items	ICT	SS	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted		
AP 1	0.86		0.951	0.952	0.959	0.771	0.878	
AP 2	0.9							
AP 3	0.87							
AP 4	0.882							
AP 5	0.879							
AP 6	0.865							
AP 7	0.892							
ICT 1		0.811	0.911	0.914	0.928	0.617	0.786	
ICT 2		0.695						
ICT 3		0.787						
ICT 4		0.827						

ICT 5		0.802						
ICT 6		0.817						
ICT 7		0.708						
ICT 8		0.825						

All the criteria, Outer Loadings, CR, AVE, Alpha values and Discriminant Validity of Measurement Model have met the results. So, study moves forward to calculate the results of path relationship and model-fit.

Table 5: Path Relationship Output for ICT and AP

Analysis	Path Coefficient	R-square	F-Square	T-statistics (O/STDEV)	P Value
ICT -> AP	0.558	0.311	0.452	14.292	0.00

Source: PLS-SEM Output

The value of path coefficient is 0.558 for ICT and AP. Further, the values of R-square (0.311) presents that moderate level of variance is explained by the effect of ICT on AP (Threshold values for R-square represent: <0.25 for weak, <0.50 for moderate and <0.75 for strong). Based on f^2 value (0.452), it is estimated that the effect of ICT on AP is found strong (as per threshold criteria: weak, if it is less than 0.02; moderate, if it is less than 0.15 and; strong, greater than 0.35).

Table 6: Model-Fit Indices for ICT and AP

Analysis	Saturated model	Estimated model
SRMR	0.045	0.045
d_ ULS	0.239	0.239
d_ G	0.136	0.136
Chi-square	403.124	403.124
NFI	0.932	0.932

Source: PLS-SEM Output

The estimated values of the model should be equal to or larger than the saturated model values for d_ ULS and d_ G. The threshold value contains all of the model-fit values. So, the model is said to be well-fitted.

Hence, the hypothesis H₂: Information and Communication Technology has positive impact on Student's Academic Performance as is evident from literature review that effective use of ICT improves the academic performance of the students undoubtedly.

6 CONCLUSION

The information and communication technology (ICT) is directly linked to student's academic performance and satisfaction with online classes was assessed by the authors of the current study. The findings of this study will assist educators in raising student satisfaction and performance in online classes. In order to improve satisfaction level of students, the instructor should use new teaching pedagogies like ICT programming, assignments and some ICT related projects may be assigned to the students. Instructor should use ICT in easy way so that students would be encouraged more towards ICT and their perceived use of ease would be high. Despite existing literature across the globe, India is still in need of such issues as very few studies have been conducted so far. It is always observed that student's interest in use of computers, internet and new technologies is important for increasing the

enrolment of students in online classes and advancement in online courses. It plays an important role in influencing the student's academic outcome.

Though, utmost care has been taken while conducting the study, even then, it is being realised with due course of time that the data collected for current study is from the students of professional courses and that too from the educational institutions of the state of Haryana. Further, this sample selection may be drawn from other states also and educators and management may become part of sample.

7 REFERENCES

- [1] Almaiah, M. A., & Alyoussef, I. Y. (2019). Analysis of the effect of course design, course content support, course assessment and instructor characteristics on the actual use of E-learning system. *IEEE Access*, 7, 171907–171922.
- [2] Al-rahmi, W. M., Othman, M. S., & Mi Yusuf, L. (2015). The Effectiveness of Using E-Learning in Malaysian Higher Education: A Case Study Universiti Teknologi Malaysia. *Mediterranean Journal of Social Sciences*, 6(5), 625-637.
Retrieved from <https://www.richtmann.org/journal/index.php/mjss/article/view/7686>
- [3] Balakamakshi T Y, R Savithri. (2021). Effect of e– learning on student's academic performance at college level. *PalArch's Journal of Archaeology of Egypt / Egyptology*, 18(1), 4690-4694.
Retrieved from <https://archives.palarch.nl/index.php/jae/article/view/7418>
- [4] Baber, H. (2020). Determinants of Students' perceived outcome and satisfaction in online learning during the pandemic of COVID-19. *Journal of Education and e-Learning Research*, 7(3), 285–292.
- [5] Bolliger, D. U., & Halupa, C. (2018). Online student perceptions of engagement, transactional distance, and outcomes. *Distance Education*, 39(3), 299–316.
Retrieved from <https://doi.org/10.1080/01587919.2018.1476845>
- [6] Dinh, L. P., & Nguyen, T. T. (2020). Pandemic, social distancing, and social work education: Students' satisfaction with online education in Vietnam. *Social Work Education*, 39(8), 1074-1083.
- [7] El-Sayad, G., Md Saad, N. H., & Thurasamy R. (2021). How higher education students in Egypt perceived online learning engagement and satisfaction during the COVID-19 pandemic. *J. Comput. Educ.* 8(4), 527-550.
Retrieved from <https://doi.org/10.1007/s40692-021-00191-y>
- [8] Gopal, R., Singh, V. & Aggarwal, A. (2021). Impact of online classes on the satisfaction and performance of students during the pandemic period of COVID 19. *Education and Information Technologies*, 1-25, 6923–6947.
Retrieved from <https://doi.org/10.1007/s10639-021-10523-1>
- [9] Garson, G.D. (2016) *Partial Least Squares: Regression and Structural Equation Models*. Statistical Associates Blue Book Series.
Retrieved from https://www.smartpls.com/resources/ebook_on_pls-sem.pdf

- [10] Gray, J. A., & DiLoreto, M. (2016). The effects of student engagement, student satisfaction, and perceived learning in online learning environments. *International Journal of Educational Leadership Preparation*, 11(1), 1–20.
- [11] Ikhsan, R. B., Saraswati, L. A., Muchardie, B. G., & Susilo, A. (2019). The determinants of students' perceived learning outcomes and satisfaction in BINUS online learning. Paper presented at the 2019 5th International Conference on New Media Studies (CONMEDIA). IEEE, 68-73.
- [12] Kauffman, H. (2015). A review of predictive factors of student success in and satisfaction with online learning. *Research in Learning Technology*, 23, 1-23.
- [13] Maqableh, M., & Jaradat, M. (2021). Exploring the determinants of students' academic performance at university level: The mediating role of internet usage continuance intention. *Education and Information Technologies*.
Retrieved from <https://doi.org/10.1007/s10639-021-10453-y>
- [14] Martin, A. M. (2020). Instructor qualities and student success in higher education online courses. *Journal of Digital Learning in Teacher Education*, 37(1), 65–80.
Retrieved from <https://doi.org/10.1080/21532974.2020.1815106>
- [15] Martin, F., Wang, C., & Sadaf, A. (2018). Student perception of helpfulness of facilitation strategies that enhance instructor presence, connectedness, engagement, and learning in online courses. *The Internet and Higher Education*, 37, 52–65.
- [16] Masrek, M.N., Samadi, I., (2017). User Engagement In Academic Web Digital Library. *International Journal of Civil Engineering and Technology*, Vol. 8, Issue 9, pp. 789-799.
Retrieved from https://iaeme.com/MasterAdmin/Journal_uploads/IJCIET/VOLUME_8_ISSUE_9/IJCIET_08_09_088.pdf
- [17] N. Alalwan, W. M. Al-Rahmi, O. Alfarradj, A. Alzahrani, N. Yahaya and A. M. Al-Rahmi (2019), "Integrated Three Theories to Develop a Model of Factors Affecting Students' Academic Performance in Higher Education," in *IEEE Access*, 7, 98725-98742.
Retrieved from doi: <https://doi.org/10.1109/ACCESS.2019.2928142>
Retrieved from <https://doi.org/10.1080/08841241.2015.1083511>
- [18] Rajabalee, Y. B., & Santally, M. I. (2020). Learner satisfaction, engagement and performances in an online module: Implications for institutional e-learning policy. *Education and Information Technologies*.
Retrieved from <https://doi.org/10.1007/s10639-020-10375-1>
- [19] T. J. F. Mitchell, S. Y. Chen and R. D. Macredie (2005), The Relationship between Web Enjoyment and Student Perceptions and Learning Using a Web-Based Tutorial. *Learning, Media and Technology*, 30(1), 27-40.
Retrieved from doi: <https://doi.org/10.1080/13581650500075546>
- [20] Wang, C., Hsu, H. C. K., Bonem, E. M., Moss, J. D., Yu, S., Nelson, D. B., & Levesque-Bristol, C. (2019), Need satisfaction and need dissatisfaction: A comparative study of online and face-to-face learning contexts. *Computers in Human Behavior*, 95, 114-125.

[21] Wei, H. C., & Chou, C. (2020). Online learning performance and satisfaction: do perceptions and readiness matter? *Distance Education*, 41(1), 48-69.

Retrieved from <https://doi.org/10.1080/01587919.2020.1724768>

