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A comparative study of e-learning constraints among UG and PG students at SKNAU, Jobner

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Abstract

The rapid advancement of Information and Communication Technologies (ICTs) has significantly enhanced the adoption of e-learning platforms in higher education. Despite these advancements, students continue to face several constraints that limit the effective use of digital learning systems. The present study was conducted during the academic session 2024–25 at Sri Karan Narendra College of Agriculture, Jobner, Rajasthan, to assess and compare the constraints perceived by Undergraduate (UG) and Postgraduate (PG) students in e-learning. A total of 120 students, comprising 60 UG and 60 PG, were selected through simple random sampling. The study focused on three major dimensions of constraints: knowledge, physical, and technical. Data were collected using a structured interview schedule and analyzed using Mean Percent Score (MPS), Spearman's rank correlation, Z-test, and t-test. The findings revealed that the majority of students experienced a medium level of constraints, with 80.00% of UG and 61.67% of PG students falling in this category. A strong positive and statistically significant correlation was observed between UG and PG students in ranking the constraints, indicating similar perception patterns. However, UG students reported higher levels of constraints compared to PG students across most variables. Key knowledge constraints included lack of basic digital skills and limited awareness of e-learning tools. Physical constraints were mainly related to inadequate infrastructure, shortage of technical personnel, and unreliable electricity supply. Technical constraints included difficulties in conducting practical sessions, monitoring student participation, and accessing online platforms due to connectivity issues. The study concludes that although both UG and PG students face similar types of constraints, the severity is greater among UG students. Strengthening digital infrastructure, enhancing technical support, and providing training programs are essential to improve the effectiveness of e-learning in agricultural higher education.

Keywords: E-learning, constraints, UG and PG students, ICT, higher education, digital learning

Introduction

The integration of Information and Communication Technologies (ICTs) into higher education has significantly transformed teaching–learning processes across India. E-learning, defined as technology-enabled learning delivered through electronic media, has emerged as a vital mode of instruction in universities and professional institutions. It provides flexibility, accessibility, cost-effectiveness and opportunities for self-paced learning (Kumar, 2019; Eze *et al.*, 2018) ^[13, 6]. In the Indian higher education system, the adoption of digital learning has gained momentum particularly after the expansion of broadband connectivity and smartphone penetration, enabling students to access academic content beyond classroom boundaries (MHRD, 2020; UGC, 2021).

The Government of India has actively promoted digital education through several national initiatives. The University Grants Commission has issued guidelines for online and blended learning to enhance quality standards in higher education. Platforms such as SWAYAM, developed

by the Ministry of Education, provide Massive Open Online Courses (MOOCs) to ensure equitable access to quality education. Digital repositories like e-PG Pathshala and National Digital Library of India further strengthen academic resource availability. In agricultural education, the Indian Council of Agricultural Research has also emphasized ICT-mediated knowledge dissemination and virtual learning mechanisms to modernize agricultural instruction (ICAR, 2020).

Despite these progressive initiatives, the implementation of e-learning in India is not free from constraints. Studies conducted in Indian universities have highlighted challenges such as limited digital literacy, inadequate training, lack of institutional preparedness, poor internet connectivity and insufficient technical infrastructure (Kashyap *et al.*, 2021; Gaur *et al.*, 2020) ^[11, 7]. Particularly in rural and semi-urban regions, unstable electricity supply and low bandwidth availability create significant barriers to effective online learning (Dhawan, 2020) ^[5]. Furthermore, economic constraints, including high costs of devices and internet

services, limit students' sustained participation in digital education (Jena, 2020) ^[10].

Research also indicates that students' attitudes and perceptions significantly influence the success of e-learning adoption (Singh and Thurman, 2019) ^[18]. Undergraduate (UG) and Postgraduate (PG) students may differ in their adaptability and exposure to digital tools. PG students, being more research-oriented, may demonstrate better familiarity with online databases and virtual platforms, whereas UG students may face greater difficulties due to limited prior exposure and lower self-regulation skills (Kumar and Sharma, 2021) ^[12]. Social constraints such as lack of interaction, reduced peer collaboration and feelings of isolation further affect students' engagement in online environments (Mishra *et al.*, 2020) ^[17].

In agricultural higher education, where practical demonstrations and field-based learning form an essential component of the curriculum, technical and physical constraints of e-learning become even more critical. Limited availability of smart classrooms, inadequate facilities for recording lectures and difficulties in conducting virtual practical sessions pose additional challenges (ICAR, 2020; Kashyap *et al.*, 2021) ^[11]. Therefore, understanding the multidimensional constraints faced by students is essential for strengthening digital education strategies in agricultural universities.

Although several Indian studies have examined online education challenges during recent years, limited empirical evidence exists comparing the constraints perceived by UG and PG students in agricultural colleges of Rajasthan. A systematic assessment of knowledge, physical, technical, social, economical and miscellaneous constraints will provide insights for policy formulation and institutional planning. Hence, the present study was undertaken to assess and compare the constraints perceived by UG and PG students regarding e-learning platforms at Sri Karan Narendra College of Agriculture, Jobner. The findings are expected to support the development of targeted capacity-building programmes, improved infrastructural support and inclusive e-learning practices in agricultural higher education institutions.

Materials and Methods

The study was conducted during the academic session 2024–25 at Sri Karan Narendra College of Agriculture, a constituent college of Sri Karan Narendra Agriculture University. The college was selected purposively due to the active use of e-learning platforms in teaching.

An ex-post facto research design was employed. The population consisted of all Undergraduate (UG) and Postgraduate (PG) students enrolled during the study period. A total of 120 respondents (60 UG and 60 PG) were selected using simple random sampling from the official list obtained from the Dean's office.

The study focused on constraints perceived by students regarding e-learning platforms, categorized into major dimensions, of which three were considered for analysis. Data were collected through a structured and pre-tested interview schedule, using a four-point scale: Most Important, Important, Least Important, and Not Important.

The Mean Percent Score (MPS) was used to assess the intensity of constraints, and respondents were grouped into low, medium, and high levels based on mean and standard deviation.

Data were analyzed using frequency, percentage, mean, and standard deviation. Spearman's rank correlation coefficient (r_s) was used to examine ranking similarity between UG and PG students, tested with the t-test, while the Z-test was applied to compare mean differences. Significance was tested at 5% and 1% levels.

Results and Discussion

1. Constraints perceived by UG and PG students in e-learning platform

Constraints can be defined as a fact or decision that limit what you can do, hence it was important to identify the different kinds of constraints related to e-learning faced by students. Under this study, the researcher included different types of constraints like knowledge constraints, physical constraints and technical constraints. The observations were measured in categories *i.e.* most important, important, least important and not important inferences were drawn accordingly.

Table 1: Distribution of UG and PG students of SKNCOA according to their Constraints level n = 120

S. No.	Constraints level	UG (n ₁ =60)		Constraints level	PG (n ₂ =60)	
		f	%		f	%
1	Low (Less than 42.82 score)	4	6.67	Low (Less than 30.05 score)	14	23.33
2	Medium (From 42.82 to 59.54 score)	48	80.00	Medium (From 30.05 to 49.19 score)	37	61.67
3	High (More than 59.54 score)	8	13.33	High (More than 49.19 score)	9	15.00
	Total	60	100	Total	60	100

Mean= 51.18 SD= 8.36 Mean= 39.62 SD= 9.57

Table 1 indicated that the majority 48 (80.00%) UG students faced medium constraints followed by high 8 (13.33%) and 4 (6.67%) faced low constraints about knowledge, physical and technical constraints related to e-learning platform.

Similarly, table 1 indicated that the majority 37 (61.67%) PG students faced medium constraints followed by low 14 (23.33%) and 9 (15.00%) faced high constraints about knowledge, physical and technical constraints related to e-learning platform.

The findings are in conformity with the findings of Badhala (2008) ^[1], Badhala and Bareth (2013) ^[3].

2. Knowledge constraints faced by UG and PG students regarding the e-learning platform

Table 2. indicates that UG students had high constraints of Lack of basic knowledge in e-learning such as PPT preparation etc with 33.89 MPS, followed by Lack of knowledge to access the e-learning resources, Unawareness about preparation regarding e-learning, Lack of awareness about relevant application and their appropriate usage for e-learning, Lack of skills to use the e-learning tools, Lack of training on handling problems during e-learning and Lack of trained learners for e-learning 31.11, 30.00, 29.44, 27.78, 26.11 and 25.56 MPS respectively.

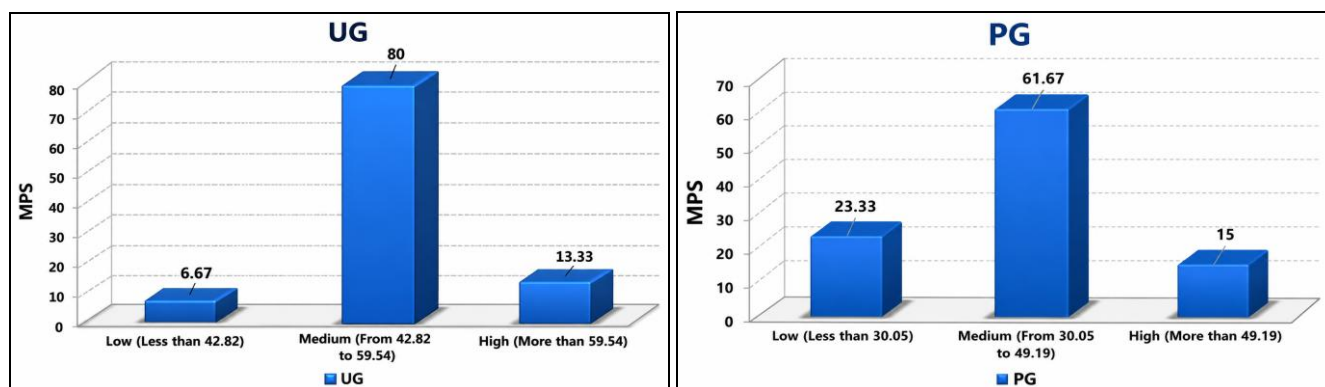


Fig 1: Distribution of UG and PG students of SKNCOA according to their constraints level

Table 2: Knowledge constraints faced by UG and PG students regarding the e-learning platform n = 120

S. No.	Constraints	UG (n ₁ =60)		PG (n ₂ =60)	
		MPS	Rank	MPS	Rank
Knowledge constraints					
1	Lack of awareness about relevant application and their appropriate usage for e-learning	29.44	4	13.89	5.5
2	Lack of skills to use the e-learning tools	27.78	5	15.00	4
3	Lack of training on handling problems during e-learning	26.11	6	12.78	7
4	Lack of basic knowledge in e-learning such as PPT preparation etc	33.89	1	20.00	2
5	Lack of trained learners for e-learning	25.56	7	13.89	5.5
6	Lack of knowledge to access the e-learning resources	31.11	2	21.11	1
7	Unawareness about preparation regarding e-learning	30.00	3	18.33	3
	Overall	29.13		16.43	

r_s = Rank correlation $r_s = 0.83^*$

*Significant at 5% level of significance

$t = 3.78$

Table 2 shows that PG students reported the highest knowledge constraint in “Lack of knowledge to access e-learning resources” (21.11 MPS), followed by “Lack of basic knowledge in e-learning (PPT preparation etc.)” (20.00 MPS) and “Unawareness about preparation regarding e-learning” (18.33 MPS). The remaining constraints were reported with comparatively lower MPS values.

The Spearman’s rank correlation ($r_s = 0.83$) indicated a strong positive relationship between UG and PG students in ranking knowledge constraints. The calculated ‘t’ value (3.78) was significant at 5% level, showing a statistically significant association despite differences in magnitude. These findings are consistent with Hermansyah and Aridah (2021) [8].

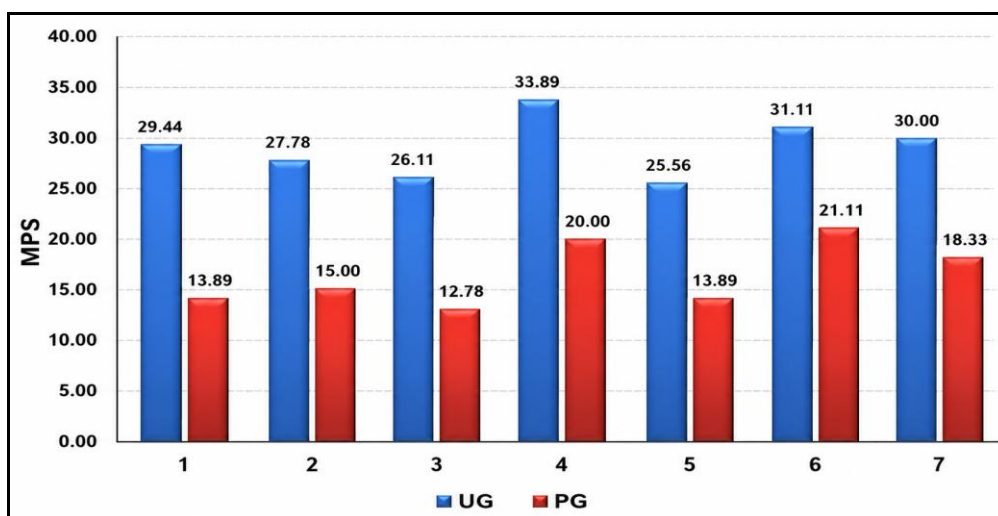


Fig 2: Knowledge constraints faced by UG and PG students regarding the e-learning platform

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e-learning” (18.33 MPS). The remaining constraints were reported with comparatively lower MPS values. The Spearman’s rank correlation ($r_s = 0.83$) indicated a strong positive relationship between UG and PG students in ranking knowledge constraints. The calculated ‘t’ value

(3.78) was significant at 5% level, showing a statistically significant association despite differences in magnitude. These findings are consistent with Badhala (2012) [2], Hermansyah and Aridah (2021) [8].

3. Comparison of knowledge constraints faced by UG and PG students regarding the e-learning platforms

The data table3. shows that calculated 'Z' value was higher than the tabulated value at 1% level of significance in all the

statements of "Lack of awareness about relevant application and their appropriate usage for e-learning", "Lack of skills to use the e-learning tools", "Lack of training on handling problems during e-learning", "Lack of basic knowledge in e-learning such as PPT preparation etc", "Lack of trained learners for e-learning", "Lack of knowledge to access the e-learning resources" and "Unawareness about preparation regarding e-learning".

Table 3: Comparison of knowledge constraints faced by UG and PG students regarding the e-learning platforms n = 120

S. No.	Constraints	UG (n ₁ =60)		PG (n ₂ =60)		Z Value
		Mean	SD	Mean	SD	
Knowledge constraints						
1	Lack of awareness about relevant application and their appropriate usage for e-learning	0.88	0.69	0.42	0.50	4.25**
2	Lack of skills to use the e-learning tools	0.83	0.62	0.45	0.50	3.74**
3	Lack of training on handling problems during e-learning	0.78	0.64	0.38	0.49	3.84**
4	Lack of basic knowledge in e-learning such as PPT preparation etc	1.02	0.87	0.60	0.49	3.22**
5	Lack of trained learners for e-learning	0.77	0.59	0.42	0.50	3.50**
6	Lack of knowledge to access the e-learning resources	0.93	0.76	0.63	0.49	2.59**
7	Unawareness about preparation regarding e-learning	0.90	0.54	0.55	0.57	3.46**

** Significant at 1% level of significance

From the findings of table 1, 2 and 3 it could be concluded that

1. A majority of students fell into the medium constraints level group, with 37 (61.67%) PG students and 48 (80.00%) UG students classified under this category, followed by students in the low and high constraints level groups, respectively.
2. PG students have high level of constraints on statement "Lack of knowledge to access the e-learning resources", low level of constraints on statement "Lack of training on handling problems during e-learning" and UG students have high level of constraints on statement "Lack of basic knowledge in e-learning such as PPT preparation etc" and low level of constraints on statement "Lack of trained learners for e-learning".
3. A positive rank order correlation was observed between the knowledge constraints level of UG and PG students regarding the various statements of e-learning platform, indicating a similar trend in relative constraints across statements.
4. Statistically significant differences were found between UG and PG students, both statement wise and in terms

of overall constraints. UG students consistently showed higher levels of constraints as compared to PG students.

The higher constraints level of e-learning platform among the UG students as compared to PG students because UG students face significantly more knowledge constraints in e-learning due to Lower digital literacy, less exposure to independent learning, Limited experience with academic technologies compared to PG students.

4. Physical constraints faced by UG and PG students regarding the e-learning platform

Table 4. further indicates that UG students had high constraints of Shortage of computer professionals to support and maintain e-learning with 48.89 MPS, followed by Lack of maintenance of ICT tools, Lack of backup facilities for regular supply of electricity, Problem of availability of uninterrupted internet facility, Lack of suitable infrastructure like SMART class rooms, Inadequate availability of tools related to e-learning and Shortage of proper computer facilities in the campus 46.67, 45.00, 43.89, 42.78, 40.56 and 39.44 MPS respectively.

Table 4: Physical constraints faced by UG and PG students regarding the e-learning platform n = 120

S. No.	Constraints	UG (n ₁ =60)		PG (n ₂ =60)	
		MPS	Rank	MPS	Rank
Physical constraints					
1	Inadequate availability of tools related to e-learning	40.56	6	30.56	7
2	Problem of availability of uninterrupted internet facility	43.89	4	38.89	3
3	Lack of maintenance of ICT tools	46.67	2	38.33	4
4	Shortage of proper computer facilities in the campus	39.44	7	35.56	6
5	Shortage of computer professionals to support and maintain e-learning	48.89	1	43.33	1
6	Lack of backup facilities for regular supply of electricity	45.00	3	42.78	2
7	Lack of suitable infrastructure like SMART class rooms	42.78	5	36.11	5
	Overall	40.91		37.94	

r_s = Rank correlation r_s = 0.85*

* Significant at 5% level of significance

t = 3.72

Table 4. further indicates that PG students had high constraints of Shortage of computer professionals to support and maintain e-learning with 43.33 MPS, followed by Lack of backup facilities for regular supply of electricity, Problem of availability of uninterrupted internet facility, Lack of

maintenance of ICT tools, Lack of suitable infrastructure like SMART class rooms, Shortage of proper computer facilities in the campus and Inadequate availability of tools related to e-learning with 42.78, 38.89, 38.33, 36.11, 35.56 and 30.56 MPS respectively.

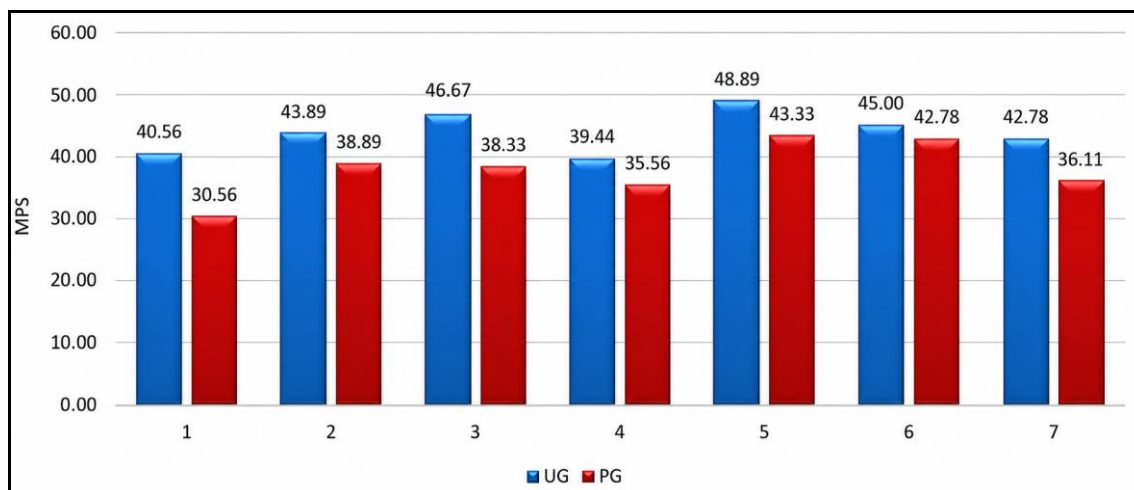


Fig 3: Physical constraints faced by UG and PG students regarding the e-learning platform

An effort was also made to assess the relationship in the physical constraints between UG and PG students regarding e-learning. The calculated value of rank order correlation (r_s) was 0.85, indicating a strong positive correlation. Furthermore, the calculated 't' value (3.72) exceeded the table value at the 5% level of significance, leading to the conclusion that there is a statistically significant association between the ranks assigned by UG and PG students regarding physical constraints, despite differences in the magnitude of their MPS.

These findings are consistent with the results reported by Larbi-Apauet *et al.* (2020) [14].

5. Comparison of physical constraints faced by UG and PG students regarding the e-learning platforms

The data table 5 shows that calculated 'Z' value was higher than the tabulated value at 5% level of significance in the statements of "Inadequate availability of tools related to e-learning", "Lack of maintenance of ICT tools", "Shortage of proper computer facilities in the campus", "Shortage of computer professionals to support and maintain e-learning", "Lack of suitable infrastructure like SMART class rooms" and non-significance in the statements of "Problem of availability of uninterrupted internet facility", "Lack of backup facilities for regular supply of electricity".

Table 5: Comparison of physical constraints faced by UG and PG students regarding the e-learning platforms n = 120

S. No.	Constraints	UG (n ₁ =60)		PG (n ₂ =60)		Z Value
		Mean	SD	Mean	SD	
Physical constraints						
1	Inadequate availability of tools related to e-learning	1.22	1.08	0.92	0.72	1.98*
2	Problem of availability of uninterrupted internet facility	1.32	0.97	1.17	0.59	1.03 ^{NS}
3	Lack of maintenance of ICT tools	1.40	1.03	1.15	0.66	2.01*
4	Shortage of proper computer facilities in the campus	1.18	0.72	1.07	0.61	1.99*
5	Shortage of computer professionals to support and maintain e-learning	1.47	0.77	1.30	0.67	2.22*
6	Lack of backup facilities for regular supply of electricity	1.35	1.07	1.28	0.49	0.44 ^{NS}
7	Lack of suitable infrastructure like SMART class rooms	1.28	0.64	1.08	0.53	2.07*

* Significant at 5% level of significance, NS= non-significant

** Significant at 1% level of significance

From the findings of table 4 and 5 it could be concluded that

1. PG students have high level of constraints on statement "Shortage of computer professionals to support and maintain e-learning", low level of constraints on statement "Inadequate availability of tools related to e-learning" and UG students have high level of constraints on statement "Shortage of computer professionals to support and maintain e-learning" and low level of constraints on statement "Shortage of

proper computer facilities in the campus".

2. A positive rank order correlation was observed between the physical constraints level of UG and PG students regarding the various statements of e-learning platform, indicating a similar trend in relative constraints across statements.
3. Statistically significant differences were found between UG and PG students, both statement wise and in terms of overall constraints. UG students consistently showed higher levels of constraints as compared to PG students.

The higher constraints level of e-learning platform among the PG students as compared to UG students because UG students face more physical barriers to accessing and benefiting from e-learning than PG students due to most critical gaps of tools availability and maintenance, technical support staff, On-campus infrastructure.

6. Technical constraints faced by UG and PG students regarding the e-learning platform

Table 6 further indicates that UG students had high constraints of Lack of facilities for conducting practical demonstrations with 60.56 MPS, followed by difficulty to monitor the student's participation and discipline, Problem in access for the students due to their location at remote areas, Rapidly changes in software versions or modifications, Lack of resources for recording full-length lectures, Challenges to keep tracking of progress of students, Lack of facilities for the systematic distribution of subject wise study materials, Lack of facilities for the recording of complete lectures, Inadequate bandwidth for e-learning, Lack of availability of updated software for learning tools and Inability to access the internet due to electricity problems 58.89, 57.78, 55.00, 52.78, 50.56, 49.44, 48.33, 47.22, 46.11 and 43.33 MPS respectively. Similarly, table 6 further indicates that PG students had high constraints of Problem in access for the students due to their

location at remote areas with 56.11 MPS, followed by Lack of facilities for conducting practical demonstrations, Lack of resources for recording full-length lectures, Lack of facilities for the recording of complete lectures, Rapidly changes in software versions or modifications, Challenges to keep tracking of progress of students, Lack of facilities for the systematic distribution of subject wise study materials, Difficulty to monitor the student's participation and discipline, Lack of availability of updated software for learning tools, Inability to access the internet due to electricity problem and Inadequate bandwidth for e-learning with 52.78, 46.67, 43.33, 43.33, 41.67, 38.89, 37.78, 31.1, 30.56 and 28.33 MPS respectively.

An effort was also made to assess the relationship in the technical constraints between UG and PG students regarding e-learning. The calculated value of rank order correlation (r_s) was 0.69, indicating a strong positive correlation. Furthermore, the calculated 't' value (2.93) exceeded the table value at the 5% level of significance, leading to the conclusion that there is a statistically significant association between the ranks assigned by UG and PG students regarding technical constraints, despite differences in the magnitude of their MPS.

These findings are consistent with the results reported by Meena *et al.* (2011)^[15] and Bahar *et al.* (2020)^[4].

Table 6: Technical constraints faced by UG and PG students regarding the e-learning platform n = 120

S. No.	Constraints	UG (n ₁ =60)		PG (n ₂ =60)	
		MPS	Rank	MPS	Rank
Technical constraints					
1	Problem in access for the students due to their location at remote areas	57.78	3	56.11	1
2	Inadequate bandwidth for e-learning	47.22	9	28.33	11
3	Lack of availability of updated software for learning tools	46.11	10	31.11	9
4	Inability to access the internet due to electricity problems	43.33	11	30.56	10
5	Rapidly changes in software versions or modifications	55.00	4	43.33	4.5
6	Challenges to keep tracking of progress of students	50.56	6	41.67	6
7	Lack of facilities for the systematic distribution of subject wise study materials	49.44	7	38.89	7
8	Difficulty to monitor the student's participation and discipline	58.89	2	37.78	8
9	Lack of resources for recording full-length lectures	52.78	5	46.67	3
10	Lack of facilities for the recording of complete lectures	48.33	8	43.33	4.5
11	Lack of facilities for conducting practical demonstrations	60.56	1	52.78	2
	Overall	51.82		40.96	

r_s = Rank correlation $r_s = 0.69^*$

* Significant at 5% level of significance

t = 2.93

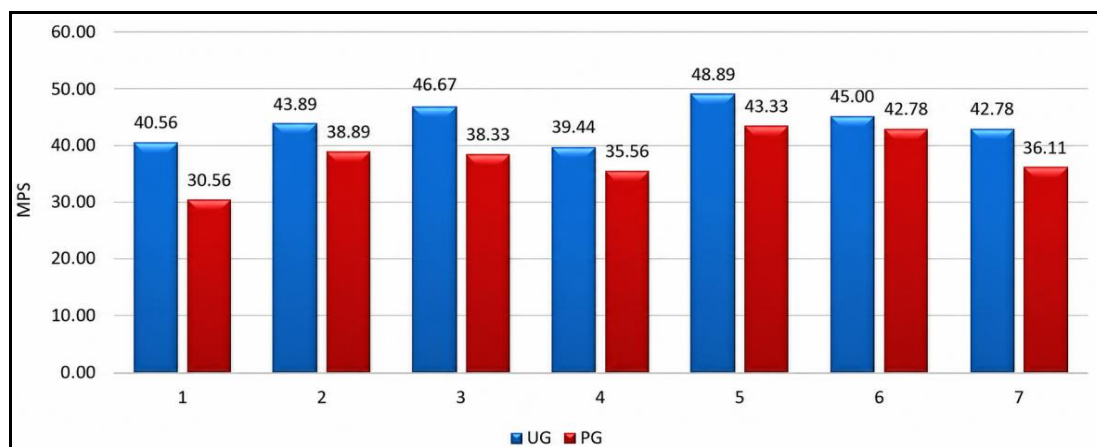


Fig 4: Technical constraints faced by UG and PG students regarding the e-learning platform

7. Comparison of technical constraints faced by UG and PG students regarding the e-learning platforms

The data table 7 shows that calculated 'Z' value was higher than the tabulated value at 1% level of significance in all the statements of "Inadequate bandwidth for e-learning", "Lack of availability of updated software for learning tools", "Difficulty to monitor the student's participation and discipline" and calculated 'Z' value was higher than the tabulated value at 5% level of significance in the statements

of "Inability to access the internet due to electricity problems", "Rapidly changes in software versions or modifications", "Lack of facilities for the systematic distribution of subject wise study materials" and "Lack of resources for recording full-length lectures", "Lack of facilities for the recording of complete lectures" and non-significance in the statement of "Problem in access for the students due to their location at remote areas", "Challenges to keep tracking of progress of students".

Table 7: Comparison of technical constraints faced by UG and PG students regarding the e-learning platforms n = 120

S. No.	Constraints	UG (n ₁ =60)		PG (n ₂ =60)		Z Value
		Mean	SD	Mean	SD	
Technical constraints						
1	Problem in access for the students due to their location at remote areas	1.73	1.09	1.68	1.08	0.25 ^{NS}
2	Inadequate bandwidth for e-learning	1.42	0.79	0.85	0.55	4.58**
3	Lack of availability of updated software for learning tools	1.38	1.01	0.93	0.63	2.92**
4	Inability to access the internet due to electricity problems	1.30	0.98	0.92	0.65	2.53*
5	Rapidly changes in software versions or modifications	1.65	1.20	1.30	0.65	1.98*
6	Challenges to keep tracking of progress of students	1.52	1.11	1.25	0.79	1.51 ^{NS}
7	Lack of facilities for the systematic distribution of subject wise study materials	1.48	1.11	1.17	0.76	2.08*
8	Difficulty to monitor the student's participation and discipline	1.77	1.06	1.13	0.62	3.98**
9	Lack of resources for recording full-length lectures	1.58	0.91	1.40	0.85	2.22*
10	Lack of facilities for the recording of complete lectures	1.45	1.10	1.30	0.89	2.25*
11	Lack of facilities for conducting practical demonstrations	1.82	1.17	1.58	0.72	1.98*

* Significant at 5% level of significance, NS= non-significant

** Significant at 1% level of significance

From the findings of table 6 and 7 it could be concluded that:

1. PG students have high level of constraints on statement "Problem in access for the students due to their location at remote areas", low level of constraints on statement "Inadequate bandwidth for e-learning" and UG students have high level of constraints on statement "Lack of facilities for conducting practical demonstrations" and low level of constraints on statement "Inability to access the internet due to electricity problems".
2. A positive rank order correlation was observed between the technical constraints level of UG and PG students regarding the various statements of e-learning platform, indicating a similar trend in relative constraints across statements.
3. Statistically significant differences were found between UG and PG students, both statement wise and in terms of overall constraints. UG students consistently showed higher levels of constraints as compared to PG students.

The higher technical constraints level of e-learning platform among the PG students as compared to UG students because UG students are more severely impacted by technical challenges in e-learning than PG students, this may be due to less experience with digital tools, poorer infrastructure support, limited adaptability to technical changes. This indicates a higher constraints level with e-learning tools among UG students compared to PG students.

Conclusion

The study concluded that most UG and PG students experienced a medium level of constraints in e-learning. UG students faced higher constraints than PG students, especially in terms of knowledge and technical aspects. Major issues included lack of basic knowledge, inadequate

infrastructure, and technical difficulties. A positive correlation was observed between UG and PG students in ranking constraints. Overall, e-learning effectiveness is limited by these challenges. Therefore, improving digital skills, infrastructure, and support systems is essential.

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Conflict of Interest

The authors declare that they have no conflict of interest. All co-authors have read and approved the contents of the manuscript, and there is no financial interest to report. We certify that this submission is original work and is not under consideration for publication elsewhere.

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