Comparison of B.Ed. Students' Perception about the Effectiveness of Online and Face-to-face Learning with respect to Cognitive, Affective and Psychomotor Domains of Learning

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Abstract: *During COVID Pandemic, online learning emerged as an alternative to face-to-face learning. Though the transition to online mode was unplanned, progressively, schools and colleges across the world have realized its significance and adopted it as an integral part of teaching-learning. Several studies are being conducted to explore its possibilities in mainstream education for various programmes and degree courses. This paper investigates how B.Ed. students who are the prospective teachers at upper primary and secondary levels of education perceive the effectiveness of online learning as compared to face-to-face learning with respect to development in their cognitive, affective and psychomotor domains of behaviour. The study was conducted on 200 B.Ed. students of different state and central universities of the state of Bihar. Data was collected through incidental sampling technique on a seven-point scale prepared for the purpose. The findings show that there is a significant difference in perception of B.Ed. students about the effectiveness of online and face-to-face learning in the three domains, i.e., cognitive, affective and psychomotor. They also differ significantly in perception about the effectiveness of the two modes on the basis of locality i.e., the rural and the urban students. However, no significant difference in perception was found on the basis of age, gender and teaching subject.*

Keywords: *Cognitive, Affective, Psychomotor, Bloom's Taxonomy.*

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Introduction:

World is confronting an exceptionally testing situation during the spread of pandemic because of covid-19 virus. To counteract the effect of Corona Virus, many countries declared lockdown in recent past. Education sector was badly affected due to this. Schools across the world were shutdown. Students were compelled to be out of the brick and mortar classrooms. This changed the interface of education and teaching and learning became digital. During this time the scholarly world moved from traditional face-to-face mode to the online mode. This shift has given rise to e-learning, whereby teaching is undertaken remotely and

on online digital platforms. Developing and disseminating lessons by teachers are integral to any teaching process. Though the shift away from the physical classrooms was not a planned move, it has brought online learning to the forefront of education as a cutting edge digital technology. However, in the advancement of online learning, the intersectionality of access, quality and process need to be given serious thought to decide the future of online learning in post pandemic era and to visualize how such a shift would impact the education sector.

In view of the physical barriers, financial constraints, lack of a sound government policy regarding its implementation and pedagogical considerations, it is important to delve deep into how going online has changed the ways of teaching-learning and has it actually been successful in reaching-out to students as effectively and efficiently, if not more, as face-to- face learning. Teachers must ensure that online mode of learning encompasses all the three domains of learning, viz., cognitive (thinking, reasoning, problem solving and so on), affective (feeling or emotions) and psychomotor (physical or kinaesthetic) to develop a complete human. It is important to understand that there are different categories of learners who have varied needs and requirements and so accordingly different techniques and procedures must be adopted in the planning and delivery of the lessons to ensure that such needs are addressed. The world of education has gradually accepted the 'Every child matters' structure which requires that all learners with different needs are counted. If online learning has to stay, the education planners have to ascertain that its best potentials are adequately harnessed to touch the brain, heart and psyche of every child who undergoes it.

Online learning has its own challenges; the primary requirement being internet access. Students without access to internet cannot participate in online learning. In his book, Harari (2018) outlines how schools still focus on traditional academic skills and rote memorization. For the little span of time that online learning replaced face-to-face learning in the pandemic, it has just replicated the latter in video conferencing mode. To become an integral component of education process, it has to move between structured and unstructured learning environments depending upon the age and experience of students and requirements of education. It must make use of its collaborative tools and engaging methods to personalize learning experiences and include every student in the process of intellectual development, attitude formation and skill enhancement. In the present scenario, while some educationists worry that the hasty transition of learning to online mode may hinder this goal, others consider this switching over as a catalyst for creating a new and effective method of education and call online learning as the 'new normal'.

Teachers have a significant role to play in online learning, so they need to be pedagogically well equipped and attitudinally and strategically well prepared. They play vital role in curricular transaction; hence, their perception about the effect of online learning on the different domains of learning must be examined. Furthermore, it is also required to understand the perception of the teachers in the making who are the future torch bearers and who will plan for the future strategies of effective online learning. If their perception about online learning and its prospects is low, it will adversely affect their behaviour intention to use it in future.

B.Ed. students are the prospective teachers of upper primary and secondary levels of education. During pandemic time, they have experienced both face-to-face and online teaching-learning. Their perception about the effectiveness of online learning vis-à-vis face- to-face learning becomes all the more significant as they are the teachers of the 'new normal' education system. However, review of literature did not bring to light any study conducted on the perception of B.Ed. students about the same in relation to the different domains of learning. It is to fill in this research gap that we have undertaken the study under the formal title 'Comparison of B.Ed. Students' Perception about the Effectiveness of Online and Face- to-Face Learning with respect to Cognitive, Affective and Psychomotor Domains of Learning'.

Review of Related Literature: While reviewing the available literature related to the study, we found some studies which showed no significant difference between face-to-face mode and online mode learning, some

favoured online learning while some others favoured face-to-face learning.

Ledman (2008) examined student learning in online and classroom formats of the same course. The results revealed that test scores for students in online classes were not significantly different from those of the students in the traditional in-class course sections. The online students overall had slightly lower final course grades. Gulacar, Damkaci & Bowman (2013) conducted a comparative study of an online and a face-to face chemistry course and found that there were no significant differences between online and face to face courses when comparing the various chemistry topics covered in the exam.

Connolly, Macarthur, Stansfield & McLellan (2007), in a three year comparison study of online versus face-to-face delivery for three graduate level computing classes, reported that online students consistently outperform face-to-face students. In a similar empirical investigation of learner differences in online and classroom delivery, Iverson, Colky & Cyboran (2008) found that online learners have significantly more positive reaction levels of enjoyment and utility and significantly stronger intent to transfer their learning. A meta- analysis by Pei & Lou (2019) showed that the online learning has advantages to enhance undergraduates' knowledge and skills. Further, the study by Agarwal & Kaushik (2020) revealed that online learning has positive impact on the morals of students by creating a diversion from the ongoing pandemic situation.

Bertus, Gropper & Hinkelman (2006), examined student performance in traditional versus online learning classes for graduate finance majors and found a significant difference in the performance of these two groups of students with traditional mode performing better. Study by Fendler, Ruff & Shrikhande (2011) suggested that the online students perform similar to in-class students at the lower level of learning, however, their performance was not as good as in-class students at the uppermost level of learning as given by Bloom's Taxonomy. In another study, Crain & Ragan (2017) explored factors affecting effectiveness of online instruction and found that online classes were less effective than face-to-face classes. Another

investigation by Faildly (2018) on learning outcomes in online and face-to-face, accounting courses' also indicated that the students performed significantly better in the face to face than in online sections. The study by Ragi (2020) on comparative analysis of online and face to face classroom instruction revealed that postgraduate students were favourable for the face- to-face interactions. It was further substantiated by Darkwa & Antwi (2021) who compared the effectiveness and student academic performance of classroom learning and online learning. The results show that classroom learning was more effective than online learning.

During review of literature,we did not come across any study that compared the effectiveness of the two modalities with respect to cognitive, affective and psychomotor domains of learning taken together.

Operational Definitions of Important Terms of the Study

The operational definitions of important terms used in the study are given below:

1. **Perception:** Perception of students was measured as the composite score obtained by each B.Ed. student on a 7-point scale ranging from Strongly disagree to Strongly agree and consisting 30 items about effectiveness of online learning versus face-to- face learning.

2. **B.Ed. students:** Second year B.Ed. students enrolled in teacher education institutions of Patna University, Aryabhatt Knowledge University, Central University of Bihar, Central University of Jharkhand and Regional Institute of Education, Bhubaneshwar, Odisha who have learned both through online and face-to-face mode in their present programme were considered as B.Ed. students in the study.

3. **Cognitive domain of learning:** 12 statements in questionnaire based on Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation levels of learning as given by B.S. Bloom in 1956 constituted the cognitive domain of learning.

4. **Affective domain of learning:** 11 statements in questionnaire based on Receiving, Responding,

Valuing, Organising and Characterizing as given by Krathwohl's in 1964 constituted the affective domain of learning.

5. **Psychomotor domain of learning:** 7 statements in questionnaire based on Imitation, Manipulation, Precision, Articulation and Naturalisation as given by Dr. R.H. Dave 1969 constituted the Psychomotor domain of learning.

Delimitations : The study was conducted only on B.Ed. students studying in selected teacher education institutions. The teacher trainees of lower levels of education were not taken in the study due to paucity of time and resources.

Need : The concept of traditional education has changed drastically since the outbreak of Corona Virus. Being physically present in an institution is not the only learning option anymore. Keeping with this, it is important to state the need of the present study as well. The need have been enumerated as follows:

1. There is a need to analyse the perception of B.Ed. students about the effectiveness of online and face-to-face learning in this current pandemic situation.

2. The difference in cognitive, affective and psychomotor achievements in learning of B.Ed. students needs to be studied as they are the prospective teachers who would participate in devising strategies of effective teaching-learning in the 'new normal situation'.

Objectives :

The present study was conducted to achieve the following objectives:

1. To analyze the perception of B.Ed. students about the effectiveness of online learning and face-to-face learning with respect to age, gender, locality and main teaching subject.

2. To compare the perception of B.Ed. students about the effectiveness of online and face-to-face learning in cognitive, affective and psychomotor domains of learning

3. To find out the perception of B.Ed. students about the effectiveness of online and face- to-face learning in cognitive domain of learning with respect to age, gender, locality and main teaching subject

4. To find out the perception of B.Ed. students about the effectiveness of online and face- to-face learning in affective domain of learning with respect to age, gender, locality and main teaching subject

5. To find out the perception of B.Ed. students about the effectiveness of online and face- to-face learning in psychomotor domain of learning with respect to age, gender, locality and main teaching subject.

Hypotheses : For analysis, the following hypotheses were framed:

H_1: B.Ed. students differ significantly in their perception about the effectiveness of online learning and face-to-face learning.

H_2: B.Ed. students differ significantly in their perception about the effectiveness of online learning and face-to-face learning in cognitive, affective and psychomotor domains of learning.

H_3: B.Ed. students differ significantly in their perception about the effectiveness of online learning and face-to-face learning in cognitive domain of learning.

H_4: B.Ed. students differ significantly in their perception about the effectiveness of online learning and face-to-face learning in affective domain of learning.

H_5: B.Ed. students differ significantly in their perception about the effectiveness of online learning and face-to-face learning in psychomotor domain of learning.

Each of the hypotheses H_1, H_3, H_4 and H_5 was further analyses with respect to age, gender, locality and main teaching subject. Corresponding to each hypothesis, a null hypothesis was framed for statistical testing.

Research Method:

Setting of the Study: This study was carried out on the B.Ed. students of various state and central universities of Bihar.

Design of the Study: Survey research design was employed to study and compare the variables under study.

Population and Sample of the Study: Students studying in B.Ed. colleges of various state and central universities of Bihar constituted the population frame of the study from which a sample of two hundred and twenty students was selected using incidental sampling technique.

Sample Selection: The sample was selected by incidental sampling technique because the colleges and participants were selected on the basis of their ease of availability. Data was collected only from those students who voluntarily chose to be the participants of the study.

Sample Size: A sample of 220 students was selected by incidental sampling technique. These students were selected from various state and central universities of Bihar. Later 20 respondents were dropped due to incomplete data and analysis was done on responses given by 200 students whose details are as given in sub-section.

Tools Used in the Study: For the study, a Google form was prepared which had two sections:

Section 1: The first section was prepared for getting the demographic profile and educational qualifications of the respondents under the heads: age, gender, locality, educational qualification and main teaching subject.

Section 2: The second section of the Google form consisted of 30 statements on a 7-point scale. The statements were distributed in cognitive, affective and psychomotor domains of learning in which 12 statements were of cognitive domain, 11 statements were of affective domain and 7 statements were of psychomotor domain sequentially. Statements 1 to 12 of the scale were of cognitive domain, 13 to 23 were of affective domain and 24 to 30 were of psychomotor domain. The levels of each domain were considered and the statements were formed accordingly i.e., in cognitive

domain, 6 levels were considered. They were knowledge, comprehension, application, analysis, synthesis and evaluation. In affective domain, 5 levels were considered which were receiving, responding, valuing, organisation and characterisation. In psychomotor domain, 5 levels, viz., imitation, manipulation, precision, articulation and naturalisation were taken into account.

One the scale was ready, it was sent to the supervisor of the study and two other experts for review of the content, form and language of the prepared scale. Based on their feedback, the statements in the scale were either modified or dropped in developing the final form of the scale. Thus content validity of the scale was established.

Scoring: The statements were scored on 7 point Likert scale from Strongly Disagree, Disagree, Somewhat Disagree, to Neither Agree nor Disagree, Somewhat Agree, Agree to Strongly Agree. The favourable perception towards online learning was taken as base for scoring and accordingly positive statements were scored from 1 to 7 i.e., from Strongly Disagree to Strongly Agree and negative from 7 to 1.

Statistical Techniques

The various statistical techniques used for analysis were measures of Central Tendency and Variation, F-test for One Way Analysis of Variance (ANOVA) and t-test. At places data was reported in form of percentages. Statistical Package SPSS Version 20.0 and Microsoft Excel were used to analyze data.

Analysis and Interpretation

Analysis and Interpretation of results as per the objective of the study have been presented in this section. In the beginning, descriptive statistics associated with perception scores of the respondents have been presented.

Table 1. Descriptive Statistics Associated with Perception Scores of Respondents

	N Statistic	Mean Statistic	Std. Deviation Statistic	Skewness		Kurtosis	
				Statistic	Std. Error	Statistic	Std. Error
Total Score	200	132.45	25.691	0.204	0.172	0.681	0.342

Though incidental sampling technique was used to draw the needed sample, data was seen to follow the assumption of normality as brought to light by descriptive statistics given in Table 1. However, the values of skewness (skew<|2.0|) and kurtosis (kur<|9.0|) (Schmider, Ziegler, Danay, Beyer & Buhner, 2010) show that the perception scores of respondents were normally distributed. Hence parametric statistics like t-test and one way ANOVA were used for analysis of data.

1. **To analyse the perception of B.Ed. students about the effectiveness of online learning and face-to-face learning**

    The researchers obtained data of B.Ed. students studying in various teacher education institutions of Bihar having different teaching subjects. Students belonged to different age groups and both females and males were included in the sample. Most of them resided in urban and some in rural areas.

The research hypothesis framed was:

H_1: B.Ed. students differ significantly in their perception about the effectiveness of online learning and face-to-face learning.

    In keeping with the diverse nature of the sample (and the population), B.Ed. students' perception about effectiveness of online and face-to-face learning was analyzed with respect to their age, gender, main teaching subject and locality.

    For statistical testing, four null hypotheses were derived from the research hypothesis (H_1). They were:

$H_{01.1}$ B.Ed. students do not differ significantly in their perception about the effectiveness of online and face-to-face learning with respect to their age.

$H_{01.2}$ B.Ed. students do not differ significantly in their perception about the effectiveness of online and face-to-face learning with respect to their gender.

$H_{01.3}$ B.Ed. students do not differ significantly in their perception about the effectiveness of online and face-to-face learning with respect to their locality.

$H_{01.4}$ B.Ed. students do not differ significantly in their perception about the effectiveness of online and face-to-face learning with respect to their main teaching subject.

    The analyses pertaining to these null hypotheses have been presented in the following sub- sections.

1.1 **Perception of B.Ed. students about the effectiveness of online and face-to-face learning with respect to age:**

The null hypothesis framed here was:

$H_{01.1}$ B.Ed. students do not differ significantly in their perception about the effectiveness of online and face-to-face learning with respect to their age.

    For analysis, one way ANOVA was carried out for three different age groups: 21-25 years, 26-30 years and 31-35 years to study the difference in perception between these groups.

Table 1.1. One way ANOVA to compare age-wise difference in perception about effectiveness of online and face-to-face learning

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	164.319	2	82.159	0.123	0.884
Within Groups	131185.181	197	665.915		
Total	131349.500	199			

Age groups: 21 years-25 years, 26 years-30 years, 31 years-35 years

Table 1.1 depicts that the test statistics is not significant (F=0.123, p=0.884). Therefore the null hypothesis is retained and the research hypothesis is rejected. Hence, it can be interpreted that the B.Ed. students of different age groups do not differ significantly in their perception about the effectiveness of online and face-to-face learning.

1.2 Perception of B.Ed. students about the effectiveness of online and face-to-face learning with respect to gender

The null hypothesis framed here was:

$H_{01.2}$ B.Ed. students do not differ significantly in their perception about the effectiveness of online and face-to-face learning with respect to their gender.

Table 1.2. Independent samples t-test to compare gender-wise difference in perception about effectiveness of online and face-to-face learning

Levene's test for Equality of Variances			t-value		
	F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**
Equal variances assumed	1.098	0.296	-1.461	198	0.146

Mean of females=130.20, SD= 23.78; Mean of males= 135.56, SD=27.97

In table 1.2, Levene's test (F=1.098, p=0.296) shows a homogeneity of variance in the two samples (male and female). Furthermore, the analysis reveals a non significant t value, $t_{(198)}$ = -1.461, p=0.146. Thus, the null hypothesis was retained and it was rejected that there is a significant difference in the perception of female and male B.Ed. students about the effectiveness of online and face-to-face learning.

1.3 Perception of B.Ed. students about the effectiveness of online and face-to-face learning with respect to locality

The null hypothesis framed for testing was:

$H_{01.3}$ B.Ed. students do not differ significantly in their perception about the effectiveness of online and face-to-face learning with respect to their locality.

1.3. Independent samples t-test to compare locality-wise difference in perception about effectiveness of online and face-to-face learning

Levene's test for Equality of Variances			t-value		
	F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**
Equal variances assumed	0.524	0.470	-2.681	198	0.008

Mean of urban respondents=128.93, SD= 24.34; Mean of rural respondents= 138.99, SD=27.00

In Table 1.3, Levene's test (F=0.524, p=0.470) was not significant which shows the homogeneity of variance in the two groups.. It can be seen that t-value is highly significant, $t_{(198)}$ = -2.681, p=0.008. Thus, the null hypothesis is rejected and the research hypothesis is accepted that B.Ed. students residing in urban and rural localities perceive differently the effectiveness of online and face-to-face learning. Furthermore, it is seen that rural students (Mean=138.99, SD=27) consider online learning more effective than the urban students

(Mean=128.93, SD=24.34). This points towards further research to study the factors affecting the students differently.

1.4 Perception of B.Ed. students about the effectiveness of online and face-to-face learning with respect to main teaching subject

Here the respondents were divided in four disciplines based on their main teaching subject, viz., Science, Humanities, Commerce and Social Science. The null hypothesis framed here was:

$H_{01.4}$ B.Ed. students do not differ significantly in their perception about the effectiveness of online and face-to-face learning with respect to their main teaching subject.

Table 1.4. One way ANOVA to compare teaching subject-wise difference in perception about effectiveness of online and face-to-face learning

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2131.210	3	710.403	1.078	0.360
Within Groups	129218.290	196	659.277		
Total	131349.500	199			

Main teaching subjects: Science, Humanities, Commerce and Social Science

According to table 1.4, the test statistics is not significant (F=1.078, p=0.360). Thus, the null hypothesis is retained, the research hypothesis is rejected and it is interpreted that there is no significant difference in perception of B.Ed. students about the effectiveness of online and face-to-face learning with respect to their main teaching subject.

2.   To compare the perception of B.Ed. students about the effectiveness of online and face-to-face learning in all three domains i.e cognitive, affective, psychomotor:

This section of analysis covers three objectives of the study to find out the difference in perception of B.Ed. students with respect to cognitive domain, with respect to affective domain and with respect to psychomotor domain. The corresponding research hypothesis was:

H_2:   B.Ed. students differ significantly in their perception about the effectiveness of online learning and face-to-face learning in cognitive, affective and psychomotor domains of learning.

2.1   Paired comparisons of effectiveness of online and face-to-face learning in cognitive, affective and psychomotor domains

Paired t-test was used to compare the perception of students in the three domains. The three paired comparisons were between cognitive and affective domain, cognitive and psychomotor and affective and psychomotor domains.

Three null hypotheses, as given below, were formulated on the basis of the research hypothesis H_2 for statistical analysis:

$H_{02.1}$: B.Ed. students do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in cognitive and affective domains of learning.

$H_{02.2}$: B.Ed. students do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in cognitive and psychomotor domains of learning.

$H_{02.3}$: B.Ed. students do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in affective and psychomotor domains of learning.

Table 2.1. Descriptive statistics for cognitive, affective and psychomotor domains of learning

	Mean	N	Std.Deviation	Std.Error Mean
CognitiveLevel	50.74	200	12.052	0.852
Affective Level	50.72	200	9.347	0.661
PsychomotoᴸLevel	30.98	200	7.276	0.514

Table 2.2. Paired samples t-test to study domain-wise difference in perception about effectiveness of online and face-to-face learning

		Paired Differences				
		Mean	Std.Deviation	t	df	Sig. (2-tailed)
Pair 1	Cognitive Domain-Affective Domain	0.020	8.788	0.032	199	0.974
Pair 2	Cognitive Domain-Psychomotor Domain	19.765	8.704	**32.114**	199	**0.000**
Pair 3	Affective Domain-Psychomotor Domain	19.745	6.604	**42.285**	199	**0.000**

According to table 2.2, t-value for the cognitive domain - affective domain pair is not significant ($t_{(199)}$ = 0.032 p=0.974). Hence null hypothesis $H_{02.1}$ is retained and it can be interpreted that B.Ed. students perceive online and face-to-face learning to be similarly effective for both cognitive and affective domains of learning.

However, t-values for cognitive domain - psychomotor domain pair ($t_{(199)}$=32.144, p=0.000) and affective domain - psychomotor domain pair ($t_{(199)}$=42.285, p= 0.000) are highly significant. Thus, null hypotheses $H_{02.2}$ and $H_{02.3}$ are rejected. It can be inferred from this analysis that B.Ed. students do not consider online learning and face-to-face learning to be similarly effective for psychomotor domain as compared to cognitive and affective domains of learning. Low mean perception score for psychomotor domain (M=30.98, SD=7.276) than that for cognitive domain (M=50.74, SD=12.052) and affective domain (M=50.72, SD=9.347) suggests that they consider face-to-face learning to be less effective for psychomotor domains of learning.

3.   To find out the perception in different domains of learning with respect to age, gender, locality and main teaching subject:

In this section, each domain of learning was separately analyzed with respect to demographic variables like age, gender and locality and educational variable which was the main teaching subject of the B.Ed. students. The corresponding research hypotheses framed were:

H_3:   B.Ed. students differ significantly in their perception about the effectiveness of online learning and face-to-face learning in cognitive domain of learning.

H_4:   B.Ed. students differ significantly in their perception about the effectiveness of online learning and face-to-face learning in affective domain of learning.

H_5:   B.Ed. students differ significantly in their perception about the effectiveness of online learning and face-to-face learning in psychomotor domain of learning.

The null hypotheses framed here were:

For cognitive domain of learning:

$H_{03.1}$: B.Ed. students of different age groups do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in cognitive domain.

$H_{03.2}$: Female and male B.Ed. students do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in cognitive domain.

$H_{03.3}$: B.Ed. students living in different locality do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in cognitive domain.

$H_{03.4}$: B.Ed. students having different teaching subjects do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in cognitive domain.

For affective domain of learning:

$H_{04.1}$: B.Ed. students of different age groups do not differ significantly in their perception about the

effectiveness of online learning and face-to-face learning in affective domain.

$H_{04.2}$: Female and male B.Ed. students do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in affective domain.

$H_{04.3}$: B.Ed. students living in different locality do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in affective domain.

$H_{04.4}$: B.Ed. students having different teaching subjects do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in affective domain.

For psychomotor domain of learning:

$H_{05.1}$: B.Ed. students of different age groups do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in psychomotor domain.

$H_{05.2}$: Female and male B.Ed. students do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in psychomotor domain.

$H_{05.3}$: B.Ed. students living in different locality do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in psychomotor domain.

$H_{05.4}$: B.Ed. students having different teaching subjects do not differ significantly in their perception about the effectiveness of online learning and face-to-face learning in psychomotor domain.

Table 3.1. One way ANOVA to compare age-wise perception about cognitive, affective and psychomotor domains

For Cognitive Domain					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	171.200	2	85.600	0.587	0.557
Within Groups	28732.795	197	145.852		
Total	28903.995	199			
For Affective Domain					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	23.939	2	11.969	0.136	0.873
Within Groups	17361.936	197	88.132		
Total	28903.995	199			
For Psychomotor Domain					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	1.399	2	0.700	0.013	0.9887
Within Groups	10532.521	197	53.465		
Total	10533.920	199			

Age groups: 21 years-25 years, 26 years-30 years, 31 years-35 years

Table 3.1, shows the comprehensive analysis of age-wise difference in perception of B.Ed. students in cognitive domain, affective domain and psychomotor domain.

According to table 3.1, the test statistics of cognitive domain is not significant (F= 0.587, p=0.557).

The test statistics of affective domain (F= 0.136, p= 0.873) and psychomotor domain (F=0.013, p=0.987) are also not significant. Thus, the null hypotheses $H_{03.1}$, $H_{04.1}$ and $H_{05.1}$ are retained and it is interpreted that B.Ed. students of different age groups do not differ in their perception about effectiveness of online and face-to-face learning in different domains of learning.

Table 3.2. Independent samples t-test to compare gender-wise perception about cognitive, affective and psychomotor domains

For Cognitive Domain					
Levene's test for Equality of Variances			t-value		
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	0.425	0.515	-1.798	198	0.074
For Affective Domain					
Levene's test for Equality of Variances			t-value		
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	0.010	0.922	-0.967	198	0.335
For Psychomotor Domain					
Levene's test for Equality of Variances			t-value		
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	0.007	0.935	-0.939	198	0.349

Mean of females= 49.45, SD= 11.24; Mean of males= 52.54, SD= 12.94 for cognitive domain

Mean of females= 50.18, SD= 9.119; Mean of males= 51.48, SD= 9.657 for affective domain

Mean of females= 30.57, SD= 7.144; Mean of males= 31.55, SD= 7.460 for psychomotor domain

Table 3.2 reveals that the test statistics of cognitive domain is not significant (t(198)= -1.798, p=0.074). The test statistics of affective domain (t(198)= -0.967, p= 0.335) and psychomotor domain (t(198) = -0.939, p= 0.349) are also not significant. Hence null hypotheses H03.2, H04.2 and H05.2 are retained and it is inferred that female and male B.Ed. students similarly perceive the effectiveness of online and face-to-face learning in all the three domains of learning.

Table 3.3. Independent samples t-test to compare locality-wise perception about cognitive, affective and psychomotor domains

For Cognitive Domain					
Levene's test for Equality of Variances			t-value		
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	0.048	0.827	-2.260	198	0.025

For Affective Domain

Levene's test for Equality of Variances			t-value		
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	4.102	0.044	-2.644	198	.009

For Psychomotor Domain

Levene's test for Equality of Variances			t-value		
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	0.031	.861	-2.294	198	0.023

Mean of urban respondents= 49.35, SD= 11.74; Mean of rural respondents= 53.34, SD= 12.27 for cognitive domain

Mean of urban respondents= 49.46, SD= 8.60;   Mean of rural respondents= 53.07, SD= 10.26 for affective domain

Mean of urban respondents= 30.12, SD= 7.18;   Mean of rural respondents= 32.57, SD= 7.23 for psychomotor domain

In table 3.3, it is seen that the t-value is significant for cognitive domain ($t_{(198)}$ = -2.260, p= 0.025), affective domain ($t_{(198)}$ = -2.644, p= 0.009) and psychomotor domain ($t_{(198)}$ = -2.294, p= 0.023). Thus, the null hypotheses $H_{03.3}$, $H_{04.3}$ and $H_{05.3}$ are rejected and it is established that there is a significant difference in the perception of B.Ed. students about the effectiveness of online learning and face-to-face learning in all the three domains on the basis of locality. A significant finding here is that rural students perceive online learning as more effective than face-to-face learning in all the three domains. This may be because rural students were less able to attend online classes than urban students due to connectivity and access issues. Hence, their perception about effectiveness of online classes was affected more by the potentials of online classes than actual hands-on experiences. However, this finding needs to be explored in future research to examine it empirically.

Table 3.4. One way ANOVA to compare teaching subject-wise perception about cognitive, affective and psychomotor domains

For Cognitive Domain					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	518.351	3	172.784	1.193	0.314
Within Groups	28886.934	196	144.825		
Total	28903.995	199			
For Affective Domain					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	148.788	2	49.596	0.564	0.639
Within Groups	17237.087	197	87.944		
Total	17385.875	199			

For Psychomotor Domain

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	198.500	2	66.167	1.255	0.291
Within Groups	10335.420	197	52.732		
Total	10533.920	199			

Main teaching subjects: Science, Humanities Commerce and Social Science

Table 3.4, shows the comprehensive analysis of teaching subject-wise difference in perception of B.Ed. students about the cognitive, affective and psychomotor domains.

According to the table, the test statistics for all the three domains, viz., cognitive domain ((F= 1.193, p= 0.314), affective domain (F=0.564, p=0.639) and psychomotor domain (F=1.255, p=0.291) are not significant. Thus, the null hypotheses $H_{03.4}$, $H_{04.4}$ and $H_{05.4}$ are retained and it is rejected that there is a significant difference in the perception of B.Ed. students about the effectiveness of online learning and face-to-face learning in all the three domains on the basis of the main teaching subject.

Thus the analyses reveal that the B.Ed. students perceive that online learning is less effective than face-to-face learning in psychomotor domain of learning but they do not perceive any difference between the two with respect to their age group, gender and main teaching subject. However, students of rural locality perceive online classes to be more effective than face-to- face learning in all the three domains of learning.

Results and Discussion :

On the basis of the findings of the present study, we find that age, gender and teaching subject or discipline of the prospective teachers do not play significant roles in forming their perception about effectiveness of online versus face-to-face learning in cognitive, affective and psychomotor domains of learning. Studies have revealed that age of learners is significant predictor in determining their success in online learning (Wojciechowski & Palmer, 2005; Kennan, Bigatel, Stockdale, and Hoewe, 2018). But in the present study, age- wise difference was not observed as the respondents were all pursuing the same programme of study and they constituted a group of youngsters who are familiar with technology and use it in their day-to-day life. There is a huge literature on gender-difference in perception of learners about effectiveness of online versus face-to-face learning However, findings regarding gender differences in online and face-to-face learning effectiveness have been inconsistent. While some studies show male preference for online learning (Nistor, 2013), some show female preference (Alghamdi et al, 2020) and still others show no significant difference (Yu, 2021) in line with the findings of the present study. However, locality does play a significant role in determining their perception. Learners residing in rural areas face a lot of problems in online learning. During COVID too, many could not be regular in their online classes due to poor connectivity, lack of proper device or technical knowhow. Still B.Ed. students residing in rural areas perceive online learning to be more effective than face- to-face learning in all the three domains. Furthermore, online learning caters to the requirements of cognitive and affective domains, but for learning in psychomotor domain, face-to-face learning is better than online. Prospective teachers do not favour online learning for their psychomotor growth. Thus, in times to come more in-depth studies are required to explore the possibilities of online learning for development in different domains of learning.

Limitations of the Study:

Some limitations identified in the study that restrict its scope of generalization are:

- Due to paucity of time and resources, tool of the study could not be standardized.

- Data was collected through Google form to maintain social distancing. Hence, it was not possible to check the authenticity of responses.

- Due to anonymity, response rate was low.

Suggestions for Future Research: The present study has tremendous scope for future research. Some suggestions are as given below:

1. The findings of the present study call for another study that explores the factors affecting online learning for students residing in rural areas.

2. Another research can be undertaken to study the impact of online learning on psychomotor development of students.

3. A separate study can be undertaken for each of the cognitive, affective and psychomotor domains of learning comparing online and face-to-face learning.

4. Factors affecting attitude of students towards online learning and their satisfaction with it can be studied.

5. The present study can be replicated for prospective teachers at different levels of education.

Conclusion:

The present study was conducted on B.Ed. students who had to attend online classes due to lockdown in COVID Pandemic. Though the concept of online learning began in India with the rush of internet as a destructive technology in the 1990s, online classes and courses, till recently were used as an adjunct to face-to-face learning in formal education system or as an alternative of non formal education. Amidst this scenario, the sudden switch to online learning for almost 2-year span during the pandemic, has led us to realize that online learning has the potential to bring learners and teachers across the world in a closely knit virtual space for academic pursuits. However, teaching-learning in any mode can be effective only if it brings about comprehensive development of human beings in intellect, attitudes and skills and competencies. The present study is a small step in this direction. We still have a long way to go.

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