

## RESEARCH NOTE

**Effectiveness of Teaching Methods on Students in Formal Education During COVID-19 in India: An Experimental Research****Khushboo Yadav<sup>1</sup>, Punam Kumari<sup>2</sup> and Sudhanand Prasad Lal<sup>3</sup>**

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**ABSTRACT**

*The present study aimed to examine the impact of online education on student performance and effectiveness compared to traditional classroom education. The research was conducted at Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, with a purposive sampling procedure used to select 50 second-year Postgraduate students from various departments of the College of Agriculture. The students were divided randomly into two groups: the Experiment Group (Online Group) and the Control Group (Offline Group). Standardized teaching material was developed, and a knowledge test comprising twenty standardized statements was administered to assess the students' understanding. The reliability values of the test were determined to be 0.79. Prior to the intervention, a pre-test was conducted and scores were recorded. Then, the teaching material was provided to both the control and experimental groups, followed by a post-test to measure the impact of the instruction. The data analysis employed a paired t-test, and the results revealed that classroom instruction had a significant effect on students' knowledge compared to online education. The 'Z' values of Wilcoxon Signed Ranks Test for the pre-test and post-test of the Control group (Classroom Instruction) were -4.389 and -4.392, respectively. Both the Control and Experimental groups demonstrated a significant knowledge gain at the one percent level. These findings suggest that the traditional classroom environment had a more significant influence on students' knowledge compared to online education.*

**Key words:** Effectiveness; Experimental study; Paired 't' test; Teaching methods; Wilcoxon Signed Rank test.

Classroom instruction is a traditional kind of education, where the teacher and pupils must be physically present inside the classroom to establish a learning environment. Establishing a bond between teacher and student is encouraged through classroom instruction. This is particularly helpful for fostering its growth into a mentor-mentee relationship that is more gratifying. In a more advanced way, classroom instruction also encourages networking among the students or participants. The interaction between the teacher and the student in a classroom is direct. In online learning, interactions between students and teachers happen via electronic devices like computers, mobile phones, laptops, etc. with internet connection for connectivity. A conventional kind of education, classroom instruction creates a learning environment within the actual classroom

walls because both the teacher and the students must be physically present there. Establishing a bond between teacher and student is encouraged through classroom instruction. This is particularly helpful for fostering its growth into a mentor-mentee relationship that is more gratifying.

Traditional teaching manner favored by some students who likely to experience the real student-teacher experience in a well-organized classroom setting supporting student-teacher connection, joint learning, and deliberated interaction (Ravai and Jorden, 2004). As online education experience more dropout rate than face-to-face learning practices by 8 per cent and 3 per cent, respectively, as far as learning experience concern 100 per cent students suggested face-to-face learning where online education recorded 87 per cent positive responses (Ni., 2013). The

institutions and academic organization also registered negative acceptability for online courses and campus-based degree programs (*Columbaro and Monaghan, 2008*). Due to the onset of COVID-19 pandemic in India the urge to switch the formal education on online mode led to investigate the issue. The present manuscript investigated relative effectiveness of the traditional and online education informal classroom setting.

## METHODOLOGY

The study was conducted in 2021 at Dr. Rajendra Prasad Central Agricultural University in Pusa, Samastipur. The study involved 50 second-year Post Graduate (PG) students from the College of Agriculture, specializing in soil science, plant breeding and genetics, agronomy, plant pathology, and entomology. The students were divided into two groups: the Control group, which received classroom education, and the Experimental group, which received online education. Each group consisted of 25 respondents, resulting in a total of 50 participants.

The study utilized an experimental research design to assess the relative effectiveness of the teaching methods which makes the research distinctive as usually in social science ex-post facto research design is used (*Singh et al., 2022; Pooja et al., 2023; Bandhavaya et al., 2022*). The content for the study was derived from standard resources and books related to Training Development and Organization. Specifically, the study focused on the role of organizations in training and development. The content was standardized by experts in the field of Training and Development, incorporating suggestions and additions to ensure accuracy.

To measure the students' knowledge, a list of thirty statements based on the content related to the "Role of Organizations in Training and Development" was drafted. An appropriateness scale, based on *Madhu (2016)* framework, was adopted to assess the statements. Each statement was rated on a scale of 0 to 2, indicating "not at all appropriate," "appropriate," and "very appropriate," respectively. The twenty statements with the highest mean scores out of the thirty were selected to create the final knowledge test. Test-retest reliability was assessed for these twenty statements, and a coefficient of correlation was calculated to establish reliability ( $r = 0.79$ , ensuring its accuracy in measuring the students' knowledge.

Both the Control and Experimental groups underwent pre-test and post-test using different modes. The Control group completed the pre-test and post-test offline, while the Experimental group used Google Forms for the online administration of these tests. After the pre-test, both groups received lectures according to their respective modes (online or classroom), and a post-test was conducted. The scores obtained from the pre-test and post-test were recorded for analysis. The study focused on the primary data as it is experimental research whereas, *Workneh and Ponnusamy (2016)* used both primary as well as secondary data for their study in India.

Treatments	Control group	Experimental group
Treatment 1.0	Pre-Test	Pre-Test
Treatment 2.0	Lecture	Online education
Treatment 3.0	Post-Test	Post-Test

In hypothesis experiments involving correlated samples, the paired sample t-test was employed to compare the means of the two populations (*Buruah et al., 2023*) and z-test is used when sample size is  $>30$  (*Kumari et al., 2022*). The degree of significance was also determined using the Wilcoxon Signed Rank test. A non-parametric or distribution-free test is an example of the Wilcoxon signed rank sum test. In terms of the sign test, the Wilcoxon signed rank sum test is employed to examine the possibility that a distribution's median equals a particular number. When a numerical scale is inappropriate but it is still possible to rank the observations, it can be used in place of a one sample t-test, a paired t-test, or for ordered categorical data (*Sinha et al., 2018*).

## RESULTS AND DISCUSSION

*Relative effectiveness of pre-test and post-test average means scores of Classroom Education* : Table 1 depicts a mean score value of 4.28 for pre-test of Classroom Instruction group where as it was 15.96 for the pre-test of Control group. The mean difference

**Table 1. t-test of significance of difference between pre-test and post-test average mean scores of classroom education (Control group) (N=25)**

Test	Mean	Difference	95% confidence interval of the difference	
			Lower	Upper
Pre-test	4.28			
Post-test	15.96	-11.68	-12.52	-10.84
't' value		-28.690**	(p value =.001)	

\*\* *p-value* is significant at one percent level of probability.

between of the pre-test and post-test is 11.68 and it is negative because difference was calculated from pre-test with post-test i.e., difference is negative.

The t-value of the group was 28.690\*\* (p value = .001) and that was significant at one per cent level. The upper and lower bound denotes margin error in the confidence interval, it is significant at 95 per cent confidence interval. Thus, we can say that the Offline Education or Classroom Instruction is highly significant in bringing change in the learning change in the learning outcome of pupils. The reason may be that the direct contact method is a highly effective method of instruction to the pupils. This has been proved through *Edger Dale's "Cone of experience"* says that direct purposeful experience i.e., direct method of instruction is most effective method for bringing changes in the knowledge of the learner i.e., in their learning outcomes.

*Relative effectiveness of pre-tests average means scores of classroom instruction and online education* : Table 2 depicts the relative effectiveness of significance of difference between the pre-tests average mean scores of Classroom Instruction and Online Education. The table reveals that the mean pre-test score of the groups' i.e., Online Teaching group was found to be 4.76 and for pre-test of Classroom Instruction it was 4.28 only, the difference being 0.48 and the difference is negative because difference was calculated from pre-test with post-test (Table-2).

The t-test value for the group was 1.030 which is non-significant (p value= .313). The lower and upper bound denotes margin error in the confidence interval it is significant at 95 per cent confidence interval. It implies that the null hypothesis was accepted which means there is no significant difference between the performance of students in pre-tests of both the groups i.e., Classroom Instruction and Online Education.

**Table 2. t-test of significance of difference between pre-test average mean scores of control group (classroom instruction) and experimental group (online education) (N=50)**

Test	Mean	Difference	95% confidence interval of the difference	
			Lower	Upper
Control Pre-test	4.28			
Experimental Pre-test	4.76	-0.48	-1.44	-0.48
't' value		-1.030 (p value =.313)		
Non-significant				

**Table 3. t-test of significance of difference between the effect of control group (classroom instruction) and experimental group (online teaching) on learning outcomes of the pupils (N=50)**

Test	Mean	Difference	95% confidence interval of the difference	
			Lower	Upper
Control group	15.96			
Experimental group	10.24	5.72	4.92	6.51
't' value		14.848** (p value =.001)		

\*\*p value was significant at one percent level of probability

*Relative effectiveness of both post-test averages means scores of classroom education and online education*: Table 3 depicts a t-value of 14.848\*\* (p value=.001) revealing that the Classroom Instruction is significant at one per cent level of probability. Lower and upper bound denotes margin error in the confidence interval it is significant at 95 per cent confidence interval. Thus we can say that Classroom Instruction is highly effective than Online Teaching in bringing about desired changes into the learning outcomes of the pupils.

The traditional classroom students performed better than online classroom students in terms of average mean scores (*Arias et al, 2018*). A similar study was conducted (*Darkwa and Antwi, 2021*) to assess the academic performance of the students divided into before COVID-19 period and during COVID-19, which concluded that the students' average mean scores was higher (M=68.286) before COVID-19 than during COVID-19 (M=68.145). *Narsingoju (2021)* in their study conducted survey on 500 students and observed that most of the students after one year of online teaching still preferred offline mode of education as it will have a huge positive effect on their overall development. A study conducted by *Amin et al., (2022)* among higher education students with a sample size of 550 respondents and found out that 46.5 per cent student strongly believed that offline education facilitates more focused study behavior among them rather than offline education. Furthermore, they also concluded that 38.9 per cent and 45.1 per cent students agreed that offline education makes them to learn more and less disruptive compared to online education.

In the study, students under online education

**Table 4. Wilcoxon Signed Paired Rank Test statistics showing Z-value and significance level**

	Classroom instruction pre-test and post -test	Classroom instruction post-test and online education post-test
Z	-4.389(a)	-4.392(b)
Asymptotic Sig. (2-tailed)	0.00	0.00

a. Based on negative ranks; b. Based on positive ranks.

found not to perform up to mark with respect to offline education, whereas *Meinam, 2022* found out that after taking online classes, students felt that their knowledge and proficiency with using various electronic educational tools had risen. Furthermore, *Madhuri et al., 2022* due to the advantages of online learning and how it allowed students to continue their academic pursuits in the face of unnatural circumstances like the COVID-19 pandemic, students now indirectly have a more favorable perception of online education.

In Table 4 Wilcoxon Signed Ranks Test was employed, which yielded an asymptotic significance value of 0.00 ( $p < 0.01$ ) for both the comparison between pre-test and post-test of classroom instruction and the comparison between the post-test of classroom instruction and the post-test of online education. This indicates a highly significant difference in the test scores before and after classroom instruction, as well as between classroom instruction and online education. The corresponding Z-values further support these findings, with a value of -4.389 for the classroom instruction comparison and -4.392 for the comparison between classroom instruction and online education. These results suggest that classroom instruction leads to substantial improvements in learning outcomes compared to both pre-instruction levels and online education. The study's findings align with previous research highlighting the effectiveness of face-to-face instruction over online education in promoting student achievement (*Tezer et al., 2019*).

## CONCLUSION

This study aimed to compare the effectiveness of classroom instruction and online education by assessing the performance of students before and after receiving instruction. A subject material was developed using available resources and expert input, ensuring standardization. A knowledge test consisting

of 20 statements was used for pre-test and post-test evaluations, and its reliability was calculated to be 0.79. Students were randomly assigned to either the control group (classroom education) or the experimental group (online education). The analysis of the data revealed significant differences between the two groups. The t-test value for the control group indicated a significant impact of classroom education on student performance. The pre-test results showed no significant difference in the initial knowledge levels of both groups. However, the post-test results indicated a significant difference in the performance of students who received classroom instruction compared to those who received online education. The study findings suggest that classroom instruction was more effective, highlighting the need to prioritize and support traditional classroom learning. However, hybrid models that combine the strengths of both methods should be considered. Further research is required to optimize instructional methods and address the drawbacks of online education while supporting technological development and online educators.

## CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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