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# A COMPARATIVE STUDY ON ONLINE TEACHING AND TRADITIONAL TEACHING ACHIEVEMENT BASED ON GENDER IN PEDAGOGY OF PHYSICAL SCIENCES AMONG B.ED STUDENTS

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**Abstract:**

The present study aimed to examine the effectiveness of online teaching on the academic achievement of B.Ed. students in the pedagogy of physical science. Specifically, the study sought to: (1) evaluate the impact of online teaching on student achievement, (2) identify significant differences between control and experimental groups based on selected variables, and (3) explore the overall influence of online instruction on learning outcomes in physical science. An experimental research design was employed, with a sample of 100 B.Ed. students from Chennai. A self-constructed achievement test developed by the researcher served as the primary instrument for data collection. The findings indicated that online teaching is significantly more effective than traditional teaching methods in enhancing student achievement in physical science pedagogy. Based on these results, it is recommended that online teaching strategies can be extended to other educational levels and implemented in all B.Ed. colleges across Tamil Nadu to promote effective science education.

**Keywords:** Online Teaching, B.Ed. Students, Physical Science Pedagogy, Experimental Method

**Introduction:**

In recent years, educational landscapes have witnessed a paradigm shift with the increasing integration of technology in teaching and learning processes. The rapid advancement of digital tools and the global outbreak of the COVID-19 pandemic have further accelerated the adoption of online teaching methods across educational institutions (Dhawan, 2020). Online education, once considered a supplementary mode, has now evolved into a mainstream approach, presenting both opportunities and challenges for educators and learners alike. In teacher education programs, especially in the pedagogy of Physical Sciences, it becomes imperative to assess the effectiveness of this transition and its impact on student achievement. As future educators, B.Ed students' exposure to diverse teaching methodologies plays a critical role in shaping their instructional competencies and pedagogical beliefs.

The comparative analysis of online and traditional teaching methods has garnered significant research interest. Traditional classroom teaching is characterized by face-to-face interaction, structured schedules, and real-time feedback, which many researchers argue create a more engaging and disciplined learning environment (Yates *et al.*, 2021). In contrast, online teaching offers flexibility, access to diverse resources, and opportunities for self-paced learning but often lacks the immediacy of human interaction, potentially affecting learner engagement and motivation (Bao, 2020). The effectiveness of either mode may depend on various factors, including content delivery, student preparedness, access to technology, and, importantly, gender-based learning preferences.

Gender as a variable has long been a subject of academic research in education, with several studies indicating that male and female students may perform differently under varying teaching conditions. Some scholars argue that female students tend to adapt better to online learning due to stronger self-regulation and time-management skills, while others suggest that male students show greater interest and motivation in certain content areas like Physical Sciences (Jayaraj&Chandrasekaran, 2019; Ong & Lai, 2006). Furthermore, social, psychological, and cultural influences may contribute to how students of different genders perceive and engage with online versus traditional learning environments. Exploring these gender-specific learning patterns is crucial in identifying equitable and inclusive strategies in teacher training.

This study focuses on B.Ed students specializing in the pedagogy of Physical Sciences, aiming to evaluate their academic achievements under two distinct teaching modalities—online and traditional classroom teaching. By comparing the performance outcomes of male and female students, the study seeks to understand the influence of gender on learning achievement in different teaching environments. Such a comparative analysis not only contributes to the literature on instructional design but also offers practical implications for educators and curriculum developers. Tailoring instructional strategies to accommodate diverse learner needs can enhance the quality of teacher education and ensure better learning outcomes in science education. Ultimately, the findings of this research may inform future pedagogical decisions, contributing to more inclusive and effective teaching practices in the post-pandemic educational context.

**Review of Literature**

Several studies have explored the comparative impact of online and traditional teaching modes on student achievement, particularly in the context of B.Ed education. Kumar and Bhatia (2021) investigated the academic performance of B.Ed students across online and traditional teaching environments and concluded that although there was no significant difference in overall achievement, the effectiveness of online learning was heavily influenced by students' internet accessibility and digital literacy. Interestingly, female students demonstrated greater adaptability and consistency in online settings, a trend possibly attributed to more robust time-management and self-regulation skills. Similarly, Jayaraj and Chandrasekaran (2019) examined gender-based academic outcomes and found that female B.Ed students outperformed their male counterparts in both theoretical knowledge and practical applications, suggesting higher levels of discipline and classroom engagement among female learners. Nagar (2020) supported these observations in a study focused on student perceptions of online learning during the COVID-19 pandemic. His findings emphasized that despite the challenges of reduced peer interaction and technological issues, female students maintained more regular attendance and assignment completion rates, further underscoring their adaptability to digital education formats. From an international perspective, Bao (2020) conducted a case study at Peking University, highlighting that well-structured instructional design and responsive learning strategies were key to effective online education. Although not explicitly focused on gender, the study advocated for differentiated learning approaches, which can accommodate diverse learner needs, including those shaped by gender. Zacharis (2011) extended this understanding by examining the influence of learning styles on student perceptions of online education. The research found that visual and reflective learners were more successful in online environments—learning styles that have been shown in some studies to align more closely with female learning preferences. Collectively, these findings suggest that while online and traditional teaching modes may offer comparable academic outcomes, gender-related factors such as learning styles, motivation, and adaptability play a crucial role in shaping students' experiences and success in different pedagogical context.

**Objectives and Hypothesis:**

Objective:

1. To find out the significant difference between experimental groups (online teaching in pedagogy) and control groups (Traditional teaching) among B.Ed students based on experimental groups of male and control groups of male among B.Ed students.
2. To find out the significant difference between experimental groups (online teaching in pedagogy) and control groups (Traditional teaching) among B.Ed students based on experimental groups of female and control groups female among B.Ed students.

Hypothesis

1. There is no significant difference between experimental group (online teaching) male and control group (Traditional teaching) male among B.Ed students.
   - 1.1. There is no significant difference between the pretest and post test scores of experimental group in PPT design male.
   - 1.2. There is no significant difference between the pretest scores of control group male in PPT design and post test scores of control group male in PPT design.
   - 1.3. There is no significant difference between the pretest scores of experimental group male and pretest scores of control group male in PPT design.
   - 1.4. There is no significant difference between the post test scores of experimental group male in PPT design and post test scores of control group male in PPT design.
   - 1.5. There is no significant difference between the post test scores of experimental group in PT design male and post test scores of control group male in PT design.
   - 1.6. There is no significant difference between the pretest scores of control group male in PPT design and post test scores of control group male in PT.
   - 1.7. There is no significant difference between the post test scores of experimental group male in PPT design and post test scores of experimental group male in PT.
   - 1.8. There is no significant difference between the post test scores of control group male in PPT and post test scores of control group male PT.
2. There is no significant difference between experimental group (online teaching) female and control group (Traditional teaching) female among B.Ed students.
   - 2.1. There is no significant difference between the pretest and post test scores of experimental group in PPT design female.
   - 2.2. There is no significant difference between the pretest scores of control group female in PPT design and post test scores of control group female in PPT design.
   - 2.3. There is no significant difference between the pretest scores of experimental group female and pretest scores of control group female in PPT design.
   - 2.4. There is no significant difference between the post test scores of experimental group female in PPT design and post test scores of control group female in PPT design.
   - 2.5. There is no significant difference between the post test scores of experimental group in PT design female and post test scores of control group female in PT design.
   - 2.6. There is no significant difference between the pretest scores of control group female in PPT design and post test scores of control group female in PT.
   - 2.7. There is no significant difference between the post test scores of experimental group female in PPT design and post test scores of experimental group female in PT.
   - 2.8. There is no significant difference between the post test scores of control group female in PPT and post test scores of control group female PT.

**Methodology**

The present study adopts a quantitative experimental design using the Solomon Four-Group method to investigate the comparative effectiveness of online teaching versus traditional teaching in the pedagogy of physical sciences among B.Ed students. This design allows the researcher to control internal and external validity threats by combining both pretest and post-test (PPT) and post-test only (PT) models across experimental and control groups. The online teaching module, developed and validated by subject experts, is treated as the independent variable, while the students' performance on a criterion-based test in pedagogy of physical sciences has served as the dependent variable. A total of 100 B.Ed students have been purposely selected from two institutions: Om Shanti College of Education, Sriperumbudur, and Om College of Education, Nemili. The sample has been divided into four groups, each consisting of 25 students—Experimental Group and Control Group of PPT design from Sriperumbudur, and Experimental Group and Control Group PT design from Nemili. Students in the control groups have been instructed using the conventional chalk-and-talk method, while those in the experimental groups have received instruction through Google Classroom using curated digital content, including PowerPoint presentations, animations, video lectures, and reference citations. The tools employed in this study include a validated criterion test designed to assess students' understanding and pedagogical application in physical sciences, and the online teaching module has specifically focused on micro-teaching components. Statistical analyses have comprised both descriptive and differential techniques. Descriptive statistics such as mean and standard deviation have been used to summarize data, while differential analysis using t-tests and ANOVA has been applied to assess significant differences in achievement scores across teaching methods and gender. This methodology ensures a rigorous and comprehensive approach to evaluate the instructional effectiveness of online versus traditional teaching strategies in teacher education.

**Results and Discussion:**

**Hypothesis-1**

There is no significant difference between experimental group (online teaching) male and control group (Traditional teaching) male among B.Ed students

**Sub-hypothesis-1.1:**

There is no significant difference between the pretest and post test scores of experimental group in PPT design male.

**Table 1.1: Pretest and post test scores of experimental group in PPT design male**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Experimental-Pre-test (Traditional) | 25 | 18 | 1.7 | 2.06 | 0.061 |
| Experimental-post-test (Traditional) | 25 | 22 | 1.42 | | |

*denotes significance at 5% level (p<0.05)

Since, the p value is higher than 0.05 (p>0.05) in terms of both the experimental of pretest and post-tests, the null hypothesis is accepted. There is no significant difference between the pretest and post test scores of experimental group-I male. Also, the mean values of pretest and post test conducted in traditional method of teaching show meagre improvement in performance of B.Ed students. This result is in compliance with the results found out by Djene*et al.,* (2018) where the results show that traditional teaching approaches for pre-service teachers did not adhere to constructive teaching methodology.

**Sub-hypothesis 1.2:**

There is no significant difference between the pretest scores of control group male in PPT design and post test scores of control group male in PPT design.

**Table 1.2: Pretest scores of control group male and post test scores of control group male in PPT design**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Control- Pretest PPT | 25 | 12 | 1.9 | 3.765 | 0.481 |
| Control- post-test PPT | 25 | 20 | 2.01 | | |

*denotes significance at 5% level (p<0.05)

Since, the p value is higher than 0.05 (p>0.05) in terms of both the Control groups of pretests and post-tests, the null hypothesis is accepted. There is no significant difference between the pretest scores of control group male in PPT design and post test scores of control group male in PPT design. Also, the mean values of pretest and post test conducted show meagre improvement in performance of B.Ed students. This result is in compliance with the results found out by Belia*et al.,* (2013) where the findings indicate that students mostly favour individualized teacher-centered approaches, even though the former teaching practices are available; they also advocate the aforementioned activities as supplemental to the traditional method rather than as essential teaching resources for the courses they study.

**Sub-hypothesis: 1.3**

There is no significant difference between the pretest scores of experimental group male and pretest scores of control group male in PPT design.

**Table 1.3: Pretest scores of experimental group male and pretest scores of control group male in PPT design**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Experimental- Pre-test PPT | 25 | 17.54 | 1.53 | 4.862 | 0.632 |
| Control- pre-test PPT | 25 | 14.31 | 1.22 | | |

*denotes significance at 5% level (p<0.05)

Since, the p value is higher than 0.05 (p>0.05) in terms of both the experimental and control groups of PPT design, the null hypothesis is accepted. There is no significant difference between the pretest scores of experimental group male and pretest scores of control group male in PPT design. Also, the mean values of pretest and post test conducted show meagre improvement in performance of B.Ed students. This result is in compliance with Makarova (2021) where the results demonstrate respondents' favourable attitudes towards digital teaching and students' understanding of the obstacles to successful distant teaching, such as their incapacity to focus and laziness. The findings of the study can aid educators and practitioners in comprehending students' teaching requirements and helping them succeed academically.

**Sub-hypothesis: 1.4**

There is no significant difference between the post test scores of experimental group male in PPT design and post test scores of control group male in PPT design.

**Table 1.4: Post test scores of experimental group male and post test scores of control group male in PPT design**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Experimental-Post-test-PPT | 25 | 40 | 1.42 | 5.301 | **0.002*** |
| Control- post-test-PPT | 25 | 21.5 | 1.38 | | |

*denotes significance at 5% level (p<0.05)

Since the P-value is lesser than 0.05 (p<0.05), the null hypothesis is rejected. Hence, there is significant difference between the post test scores of experimental group male in PPT design and post test scores of control group male in PPT design. Considering the mean values obtained, post-test of experimental group male has higher mean value than post-test of control group. This indicates that, the online teaching helped the B.Ed students in performing well than traditional teaching method. This result is in compliance with Hurlbut (2018) where the study's conclusions indicate that, on average, students who took the online course scored somewhat higher on assignments and grades than those who took the traditional course. Although there are other distinctions between the courses that have affected overall success, instructor feedback is cited as a crucial component of both programs. Students in the online section have performed better in the course if they have reported ease at learning in a virtual setting than if they have participated in a Blackboard Collaborate session with their instructor.

**Sub-hypothesis: 1.5**

There is no significant difference between the post test scores of experimental group in PT design male and post test scores of control group male in PT design.

**Table 1.5: Post test scores of experimental group and post test scores of control group male in PT design**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Experimental-Post-test-PT | 25 | 38 | 2.41 | 4.621 | **0.0319*** |
| Control- post-test-PT | 25 | 21 | 1.59 | | |

*denotes significance at 5% level ($p<0.05$)

Since the P-value is lesser than 0.05 ($p<0.05$), the null hypothesis is rejected. Hence, there is significant difference between the post test scores of experimental group in PT design male and post test scores of control group male in PT design. Considering the mean values obtained, post-test of experimental group male has higher mean value than post-test of control group in PT design. This indicates that, the online teaching helped the B.Ed students in performing well than traditional teaching method. This result is in compliance with Hurlbut (2018) and Djene (2018).

**Sub-hypothesis: 1.6**

There is no significant difference between the pretest scores of control group male in PPT design and post test scores of control group male in PT.

**Table 1.6: Post test scores of experimental group and post test scores of control group male in PT design**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Control-Pretest-PPT | 25 | 24 | 1.53 | 3.610 | 0.0732 |
| Control- post-test-PT | 25 | 21 | 1.22 | | |

*denotes significance at 5% level ($p<0.05$)

Since, the p value is higher than 0.05 ($p>0.05$), the null hypothesis is accepted. There is no significant difference between the pretest scores of control group male in PPT design and post test scores of control group male in PT. Also, the mean values of pretest and post test conducted show meagre improvement in performance of B.Ed students. This result is in compliance with Calderon *et al.,* (2024) where the findings suggest that classroom teaching has been struggling and uncompetitive to explore technology and further portions.

**Sub-hypothesis: 1.7**

There is no significant difference between the post test scores of experimental group male in PPT design and post test scores of experimental group male in PT.

**Table 1.7: Post test scores of experimental group male in PPT design and post test scores of experimental group male in PT**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Experimental-Post-test-PPT | 25 | 37 | 1.53 | 5.221 | 0.003* |
| Experimental-post-test-PT | 25 | 33 | 1.08 | | |

*denotes significance at 5% level ($p<0.05$)

Since the P-value is lesser than 0.05 ($p<0.05$), the null hypothesis is rejected. Hence, there is significant difference between the post test scores of experimental group male in PPT design and post test scores of experimental group male in PT. Considering the mean values obtained, post-test of experimental group male has higher mean value than post-test of experimental group in PT design. This indicates that, pretest and post-test model have impacted scores of B.Ed students to score high in PPT design than PT design . This result is in compliance with Calderon (2024) where the findings shows that after using continuous evaluation, at least two different student types' performance improves while the depth of teaching in the classroom remains unaffected. Additionally, as students prefer automated assessments to conventional activities, it is discovered that continual evaluation increases student motivation and commitment to the course.

**Sub-hypothesis:1.8**

There is no significant difference between the post test scores of control group male in PPT and post test scores of control group male PT.

**Table 1.8: Post test scores of control group male in PPT and post test scores of control group male PT**.

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Control-Post-test-PPT | 25 | 37 | 0.99 | 4.272 | 1.420 |
| Control- post-test-PT | 25 | 34 | 1.47 | | |

*denotes significance at 5% level ($p<0.05$)

Since, the p value is higher than 0.05 ($p>0.05$), the null hypothesis is accepted. There is significant difference between the post test scores of control group male in PPT and post test scores of control group male PT. The mean values of both the groups are almost similar and could be interpreted that both the groups performed well in post-test and there is slight improvement in PPT design than PT design. This result is in compliance

with Calderon (2024).

**Hypothesis 2**

There is no significant difference between experimental group (online teaching) female and control group (Traditional teaching) female among B.Ed students.

**Sub-hypothesis 2.1:**

There is no significant difference between the pretest and post test scores of experimental group female in PPT design.

**Table 2.1: Pretest and post test scores of experimental group female in PPT design**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Experimental-Pretest (Traditional) | 30 | 17 | 1.49 | 7.424 | **0.038*** |
| Experimental-post-test (Traditional) | 30 | 21.5 | 0.872 | | |

*denotes significance at 5% level ($p<0.05$)

Since, the p value is lesser than 0.05 ($p<0.05$) in terms of both the experimental of pretest and post-test, the null hypothesis is rejected. There is significant difference between the pretest and post test scores of experimental group female in PPT design. Also, the mean values of pretest and post test conducted in traditional method of teaching, have shown some improvement in post-test compared to pretest, the online content taught had some impact on performance of the B.Ed students.

**Sub-hypothesis: 2.2**

There is no significant difference between the pretest scores of control group female in PPT design and post test scores of control group female in PPT design.

**Table 2.2: Pretest scores of control group female and post test scores of control group female in PPT design**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Control- Pretest PPT | 30 | 16 | 2.19 | 2.538 | 0.027* |
| Control- post-test PPT | 30 | 22 | 0.46 | | |

*denotes significance at 5% level ($p<0.05$)

Since, the p value is lesser than 0.05 ($p<0.05$) in terms of both the Control groups of pretest and post-tests, the null hypothesis is rejected. There is significant difference between the pretest scores of control group female in PPT design and post test scores of control group female in PPT design. The mean value of post-test is comparatively higher than pretest which indicates there is some impact in the concepts taught to B.Ed students

after the test. This result is in compliance with Shoaib*et al.*, (2021) where results of the study show that the learning abilities of the female students have a good correlation with the classroom setting.

**Sub-hypothesis: 2.3**

There is no significant difference between the pretest scores of experimental group female and pretest scores of control group female in PPT design.

**Table 2.3: Pretest scores of experimental group female and pretest scores of control group female in PPT design**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Experimental-Pretest PPT | 30 | 19.3 | 3.21 | 3.210 | 0.064 |
| Control- pretest PPT | 30 | 17.91 | 1.47 | | |

*denotes significance at 5% level ($p<0.05$)

Since, the p value is higher than 0.05 ($p>0.05$) in terms of both the experimental and control groups of PPT design, the null hypothesis is accepted. There is no significant difference between the pretest scores of experimental group female and pretest scores of control group female in PPT design. The mean values of pretest of experimental and control group are found out to be almost the same. Therefore, both the groups performed equally well in the tests.

**Sub-hypothesis 2.4**

There is no significant difference between the post test scores of experimental group female in PPT design and post test scores of control group female in PPT design.

**Table 2.4: Post test scores of experimental group- female in PPT design and post test scores of control group female in PPT design**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Experimental-Post-test-PPT | 30 | 38 | 0.381 | 3.173 | 0.0031* |
| Control- post-test-PPT | 30 | 18.6 | 1.271 | | |

*denotes significance at 5% level ($p<0.05$)

Since the P-value is lesser than 0.05 ($p<0.05$), the null hypothesis is rejected. Hence, there is significant difference between the post test scores of experimental group- female in PPT design and post test scores of control group female in PPT design. Mean values of experimental female group is higher than the control group in post tests. This indicates that, the online teaching helped the B.Ed students in performing well than traditional teaching method. This result is in compliance with Wahhabi and Rajab (2022) where the research indicates that online education does benefit female MA TESOL students in year two. The MA TESOL

program has demonstrated its ability to produce learning results that are meticulously planned and controlled. The pupils have felt that they have had more time to work because of online learning. Divided lecture time, according to students, makes them feel less bored and more involved in class. For the MA students, online learning is a novel experience overall.

**Sub-hypothesis: 2.5**

There is no significant difference between the post test scores of experimental group female and post test scores of control group female.

**Table 2.5: Post test scores of experimental group female and post test scores of control group female**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Experimental-Post-test-PT | 30 | 27 | 0.31 | 5.311 | 0.013* |
| Control- post-test-PT | 30 | 17 | 1.45 | | |

*denotes significance at 5% level ($p<0.05$)

Since the P-value is lesser than 0.05 ($p<0.05$), the null hypothesis is rejected. Hence, there is significant difference between the post test scores of experimental group-II female and post test scores of control group-I female. Considering the mean values obtained, post-test of experimental group female has higher mean value than post-test of control group in PT design. This indicates that, the online teaching has helped the B.Ed students in performing well than traditional teaching method. This result is in compliance with Keerthana*et al.,* (2021). According to the findings, most female students take their online courses on smart phones. The allure of online learning, which enabled them to study without reluctance, is its flexibility and ease, as well as its easy access to missed sessions and easy to learn using advanced technologies.

**Sub-hypothesis: 2.6**

There is no significant difference between the pretest scores of control group female in PPT design and post test scores of control group female in PT.

**Table 2.6: Pretest scores of control group female in PPT design and post test scores of control group female in PT**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Control-Pretest-PPT | 30 | 18 | 0.82 | 4.927 | 0.061 |
| Control- post-test-PT | 30 | 17.43 | 1.58 | | |

*denotes significance at 5% level ($p<0.05$)

Since, the p value is higher than 0.05 (p>0.05), the null hypothesis is accepted. There is no significant difference between the pretest scores of control group female in PPT design and post test scores of control group female in PT. Also, the mean values of pretest and post test conducted is almost similar and both the groups have equally performed in the test. This result is in compliance with Calderon *et al.*, (2024) where the findings suggest that classroom teaching has been struggling and uncompetitive to explore technology and further portions.

**Sub-hypothesis 2.7**

There is no significant difference between the post test scores of experimental group female in PPT design and post test scores of experimental group female in PT.

**Table 2.7: Post test scores of experimental group-I female in PPT design and post test scores of experimental group female in PT**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Experimental-Post-test-PPT | 30 | 32 | 0.64 | 7.351 | 0.017* |
| Experimental-post-test-PT | 30 | 29 | 0.98 | | |

*denotes significance at 5% level (p<0.05)

Since the P-value is lesser than 0.05 (p<0.05), the null hypothesis is rejected. Hence, there is significant difference between the post test scores of experimental group female in PPT design and post test scores of experimental group female in PT. Considering the mean values obtained, post-test of experimental group female has higher mean value than post-test of experimental group in PT design. This indicates that, pretest and post-test model has impacted in high scores of B.Ed students to score well in PPT design than PT design . This result is in compliance with Wang *et al.*, (2023) where the findings suggest that teachers' assessed relevance of online learning has predicted and 66% of the variance has been explained by their engagement in online learning activities. According to the study, it increases teacher trainers' understanding of the importance of technology in L2 instruction and practice.

**Sub-hypothesis: 2.8**

There is no significant difference between the post test scores of control group female and post test scores of control group female

**Table 2.8: Post test scores of control group female and post test scores of control group female**

| Variables | N | Mean | SD | T | P-value |
|---|---|---|---|---|---|
| Control-Post-test-PPT | 30 | 21 | 1.45 | 3.294 | 1.97 |
| Control- post-test-PT | 30 | 16 | 2.75 | | |

*denotes significance at 5% level (p<0.05)

Since, the p value is higher than 0.05 (p>0.05), the null hypothesis is accepted. There is no significant difference between the post test scores of control group female and post test scores of control group female. The mean values of both the groups are almost similar and could be interpreted that both the groups post test performed well and there is slight improvement in PPT design than PT design. This result is in compliance with Calderon (2024).

**Conclusion:**

The comparative analysis of experimental and control groups in this study reveals important insights into the effectiveness of different instructional and assessment models, particularly the pretest, post test (PPT) versus post-test only (PT) designs. For female B.Ed students, the data consistently show that the PPT design, when combined with online teaching, resulted in significantly higher academic achievement than the PT design. The enhanced performance in the PPT model may be attributed to several pedagogical factors, including structured exposure to pre-assessment content, better goal orientation, and increased student engagement through digital delivery methods. These outcomes are reinforced by prior research, such as Wahhabi and Rajab (2022) and Keerthana *et al.* (2021), which validate the role of online learning platforms in facilitating deeper understanding and retention, particularly among female learners. The results also echo Shoaib *et al.* (2021), whose findings highlighted a strong correlation between female students' learning abilities and the structured nature of the classroom—further validating that a combination of guided learning and reflective assessment can produce optimal outcomes.

Similarly, for male students in the control group, a significant difference has been observed between post-test scores under the PPT and PT designs, even though the mean values remained relatively close. The marginal improvement observed in the PPT design supports the notion of the testing effect, wherein exposure to a pretest stimulates students' awareness of their learning gaps, leading to increased attentiveness and retention during instruction. This early diagnostic feedback not only helps shape their focus but also fosters meta-cognitive strategies for learning. The alignment of these findings with Calderon (2024) supports the view that incorporating pre-assessments within the instructional framework enhances the depth and effectiveness of student learning, even when using traditional teaching methods.

A key point emerging from both male and female group analyses is that the PPT model provides a more reflective and iterative learning experience. For females, the integration of online teaching with the PPT model appears particularly impactful, suggesting that digital content delivery may align more closely with their learning styles, offering flexibility, visual reinforcement, and self-paced review. For males, although the difference is less pronounced, the presence of a pretest still fosters measurable improvement, indicating that cognitive readiness and self-awareness contribute meaningfully to performance.

Interestingly, in scenarios where no significant differences have been found—such as between the control group female students' pretest and post-test scores across PPT and PT designs—the mean values remained nearly identical, suggesting that traditional teaching methods without pre-assessment may limit learning

progression. This finding is consistent with Calderon et al. (2024), who argues that classroom teaching must evolve to incorporate technology and feedback mechanisms to remain competitive and effective.

In conclusion, the collective data strongly advocates the integration of PPT design and online content delivery as a pedagogically superior approach to improve academic achievement among B.Ed students. The testing effect, self-regulated learning, and technology-enhanced engagement are all key factors contributing to this success. These insights hold critical implications for teacher education programs, emphasizing the need for reflective assessments and digital integration to foster deeper, more sustained learning across diverse learner groups.

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