European Journal of Innovation in Nonformal Education (EJINE)
Volume 6 | Issue 3 | Mar - 2026 ISSN: 2795-8612

Modernization in Education and its Impact on Student-Centered Teaching Effectiveness: A Study at School Level

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A B S T R A C T

The present study examines the impact of modernization in education on student-centered teaching effectiveness at the school level. In the context of rapid technological advancement and pedagogical transformation, the study aims to explore how modern educational practices influence classroom teaching and learning processes. A descriptive survey method was employed, and a sample of 80 teachers was selected from schools in Medinipur Sadar Block, Paschim Medinipur, West Bengal, using a random sampling technique. Data were collected through two standardized instruments: the Modernization in Education Scale and the Student-Centered Teaching Effectiveness Scale. Statistical techniques such as mean, standard deviation, correlation, t-test, and ANOVA were used for analysis.

The findings reveal that both modernization in education (Mean = 74.6) and student-centered teaching effectiveness (Mean = 71.2) are at relatively high levels among teachers. A strong positive and statistically significant relationship ($r = 0.68$, $p < 0.01$) was found between modernization and teaching effectiveness, indicating that increased use of modern tools and innovative pedagogies enhances student-centered practices. The t-test results showed no significant gender differences in teaching effectiveness, while ANOVA results confirmed that modernization has a significant impact on teaching effectiveness ($F = 9.84$, $p < 0.05$).

The study concludes that modernization—through the integration of ICT, digital resources, and innovative teaching strategies—plays a crucial role in improving teaching effectiveness by fostering active learning, student engagement, and critical thinking. The findings highlight the need for strengthening digital infrastructure and providing continuous professional development to teachers for effective implementation of modern educational practices.

A R T I C L E I N F O

Article history:
Received 15 Jan 2026
Received in revised form
15 Feb 2026
Accepted 23 Mar 2026

Keywords: Modernization in Education, Student-Centered Teaching, Teaching Effectiveness, ICT, School Education.

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Education has undergone a paradigm shift in the 21st century due to modernization, technological advancements, and globalization. Traditional teacher-centered approaches are gradually being replaced by student-centered pedagogies that emphasize active learning, collaboration, and critical thinking.

Modernization in education includes the integration of Information and Communication Technology (ICT), smart classrooms, digital content, and innovative teaching strategies. These changes have not only altered the teaching-learning process but also improved the effectiveness of teaching by making it more interactive and learner-oriented.

Student-centered teaching effectiveness focuses on how well teachers engage students, encourage participation, and facilitate meaningful learning experiences. Therefore, understanding the relationship between modernization and teaching effectiveness is essential for improving educational outcomes.

Review of Literature

Recent studies on modernization in education and student-centered teaching effectiveness strongly support the findings of the present study, highlighting the transformative role of technology and innovative pedagogies in enhancing the teaching-learning process.

A systematic review conducted by Norliana Che Mat and Jamaludin (2024) found that student-centered teaching significantly improves students' academic achievement, motivation, and critical thinking skills. The study emphasized that active learning, collaboration, and inquiry-based approaches are essential components of effective modern pedagogy (Norliana Che Mat & Jamaludin, 2024). Similarly, another review confirmed that student-centered approaches foster greater engagement, learner autonomy, and deeper understanding, making them indispensable in contemporary classrooms (HRMARS, 2024). These findings are consistent with the present study, which identified a high level of student-centered teaching effectiveness among teachers.

Research on innovative pedagogical approaches further reinforces the positive impact of modernization. A study published in *Scientific Reports* (2024) revealed that instructional methods such as problem-based learning, flipped classrooms, and interactive teaching strategies significantly enhance students' critical thinking and academic performance (*Scientific Reports*, 2024). This supports the notion that modernization, through innovative teaching strategies, contributes substantially to teaching effectiveness.

Moreover, a meta-analysis on educational technology and pedagogy indicated that the integration of technology with student-centered approaches leads to improved learning outcomes and academic achievement (Cuper Journal, 2024). The study highlighted that technology alone does not guarantee effectiveness; rather, its impact depends on how well it is utilized to promote learner-centered environments. This finding directly aligns with the present study's result, which demonstrated a strong positive relationship between modernization and teaching effectiveness.

Objectives of the Study

1. To assess the level of modernization in education at the school level.
2. To evaluate student-centered teaching effectiveness among teachers.
3. To examine the relationship between modernization and teaching effectiveness.
4. To compare teaching effectiveness based on demographic variables (gender).

Hypotheses of the Study

H_{01}: There is no significant relationship between modernization in education and student-centered teaching effectiveness.

H_{02}: There is no significant difference in teaching effectiveness between male and female teachers.

H_{03}: There is no significant impact of modernization in education on teaching effectiveness.

Methodology

Research Design: The present study adopts a **descriptive survey method** to investigate the impact of modernization in education on student-centered teaching effectiveness. This design is appropriate as it enables the researcher to systematically collect, analyze, and interpret data related to existing educational practices without manipulating any variables.

Sample: The study is based on a sample of **80 teachers** drawn from different schools of Medinipur Sadar Block, Paschim Medinipur, West Bengal. A **random sampling technique** was employed to ensure that each member of the population had an equal chance of being selected.

Tools Used: To collect relevant and reliable data, two standardized tools were utilized. The **Modernization in Education Scale** was used to measure the extent to which modern practices, including

the use of technology, innovative teaching strategies, and digital resources, are implemented in schools. Additionally, the **Student-Centered Teaching Effectiveness Scale** was administered to assess the degree to which teachers adopt learner-centered approaches, promote active participation, and facilitate meaningful learning experiences. Both tools were selected for their validity and suitability in achieving the objectives of the study.

Statistical Techniques: The collected data were analyzed using appropriate statistical techniques to ensure accurate interpretation. **Mean** and **Standard Deviation** were used to describe the central tendency and variability of the data. **Correlation analysis** was employed to examine the relationship between modernization in education and teaching effectiveness. Furthermore, the **t-test** was applied to compare differences between groups, particularly in relation to demographic variables such as gender.

Data Analysis and Interpretation

Table 1: Descriptive Statistics of Modernization in Education

Measure	Value
Mean	74.6
Median	75
Mode	78
Standard Deviation	8.5
Minimum	52
Maximum	95
Range	43
Skewness	-0.22
Kurtosis	0.35

The descriptive statistics presented in Table 1 provide a comprehensive understanding of the level and distribution of modernization in education among the sampled teachers. The mean score of 74.6 indicates that the overall level of modernization in schools is relatively high, suggesting that most teachers are actively incorporating modern educational practices such as digital tools, innovative teaching methods, and technological resources into their classrooms. The median value of 75 and mode of 78 further support this observation, indicating that a large number of respondents scored above the average, reflecting a generally favorable inclination toward modernization.

The standard deviation of 8.5 reveals a moderate level of variability in the responses, implying that while most teachers report a high level of modernization, there are still some differences in the extent to which these practices are implemented. The minimum score of 52 and maximum score of 95, with a range of 43, indicate a considerable spread in the data, suggesting that some schools or teachers may still lag behind in adopting modern educational practices.

The skewness value of -0.22 indicates a slight negative skewness, meaning that the distribution is somewhat tilted toward higher scores. This suggests that a majority of teachers fall on the higher end of modernization. The kurtosis value of 0.35 indicates a distribution that is slightly more peaked than normal, reflecting a moderate concentration of scores around the mean. Overall, the data suggest that modernization in education is fairly well established among the sampled teachers, though some variability still exists.

Table 2: Descriptive Statistics of Student-Centered Teaching Effectiveness

Measure	Value
Mean	71.2
Median	72
Mode	74
Standard Deviation	9.1
Minimum	48
Maximum	92
Range	44

Skewness	-0.15
Kurtosis	0.28

Table 2 presents the descriptive statistics of student-centered teaching effectiveness among the teachers. The mean score of 71.2 indicates that the overall level of teaching effectiveness, particularly in terms of student-centered approaches, is relatively high. This suggests that teachers are increasingly adopting practices that promote active learning, student engagement, and participatory classroom environments. The median (72) and mode (74) values closely align with the mean, reinforcing the consistency of the data and indicating that most teachers demonstrate effective student-centered teaching practices.

The standard deviation of 9.1 suggests a moderate degree of variation in teaching effectiveness among the respondents. While many teachers exhibit high effectiveness, there are still differences in how effectively student-centered methods are implemented. The minimum score of 48 and maximum score of 92, along with a range of 44, highlight that some teachers may face challenges in adopting such approaches, possibly due to limited resources, training, or experience.

The skewness value of -0.15 indicates a slight negative skewness, suggesting that the majority of scores are concentrated toward the higher end, with fewer teachers scoring lower. The kurtosis value of 0.28 implies a distribution that is slightly peaked, indicating a moderate clustering of scores around the mean. Overall, the findings reveal that student-centered teaching effectiveness is generally strong among the sampled teachers, though there remains scope for improvement and uniformity across all participants.

Table 3: Correlation between Modernization and Teaching Effectiveness

Variables	Modernization in Education	Teaching Effectiveness
Modernization in Education	1	0.68**
Teaching Effectiveness	0.68**	1
Sig. (2-tailed)	—	0

Table 3 presents the correlation matrix showing the relationship between modernization in education and teaching effectiveness. The correlation coefficient (r = 0.68) indicates a **strong positive relationship** between the two variables. This suggests that as the level of modernization in education increases, the effectiveness of teaching, particularly in a student-centered context, also tends to improve significantly.

The significance value (Sig. = 0.000) indicates that the obtained correlation is statistically significant at the 0.01 level (2-tailed). This means that the probability of obtaining such a strong relationship by chance is extremely low. Therefore, the null hypothesis stating that there is no significant relationship between modernization in education and teaching effectiveness is rejected.

The findings imply that modern educational practices—such as the use of digital tools, interactive teaching methods, and innovative pedagogies—play a crucial role in enhancing teaching effectiveness. Teachers who are more engaged with modernized teaching approaches are better able to facilitate active learning, promote student participation, and create a more dynamic classroom environment. Overall, the table clearly demonstrates that modernization is a key determinant of effective teaching.

Table 4: Gender-wise Comparison of Teaching Effectiveness

Gender	N	Mean	SD	t-value
Male	40	70.1	9.5	
Female	40	72.3	8.7	1.12

Table 4 shows the comparison of teaching effectiveness between male and female teachers. The mean score for male teachers is 70.1, while the mean score for female teachers is slightly higher at 72.3. This indicates that female teachers, on average, demonstrate marginally higher teaching effectiveness compared to their male counterparts. However, the difference between the two groups is relatively small.

The standard deviation values (Male = 9.5; Female = 8.7) indicate that there is a moderate level of variability in teaching effectiveness scores within both groups. Male teachers show slightly greater variation compared to female teachers, suggesting that their teaching effectiveness scores are somewhat more dispersed.

The calculated t-value of 1.12 is not statistically significant at the 0.05 level. This indicates that the observed difference in mean scores between male and female teachers is not significant enough to draw any firm conclusion about gender-based differences in teaching effectiveness. Therefore, the null hypothesis stating that there is no significant difference in teaching effectiveness between male and female teachers is accepted.

In conclusion, the findings suggest that gender does not play a significant role in determining teaching effectiveness. Both male and female teachers are equally capable of delivering effective, student-centered instruction when provided with appropriate resources and support.

Table 5: ANNOVA for impact of Modernization on Teaching Effectiveness

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F-value
Between Groups	1452.3	2	726.15	9.84
Within Groups	5678.4	77	73.74	
Total	7130.7	79		

Table 5 presents the results of the Analysis of Variance (ANOVA) conducted to examine the impact of modernization in education on teaching effectiveness. The table shows that the sum of squares between groups is 1452.3 with 2 degrees of freedom, while the sum of squares within groups is 5678.4 with 77 degrees of freedom. The total sum of squares is 7130.7, indicating the overall variation in teaching effectiveness scores.

The mean square value for the between-groups variation is 726.15, which is considerably higher than the within-groups mean square value of 73.74. This substantial difference suggests that the variation in teaching effectiveness due to different levels of modernization is much greater than the variation occurring within the groups themselves.

The calculated F-value is 9.84, which is statistically significant at the 0.05 level of significance (as it exceeds the critical F-value for df = 2 and 77). This indicates that there is a significant difference in teaching effectiveness across different levels of modernization. Therefore, the null hypothesis stating that there is no significant impact of modernization on teaching effectiveness is rejected.

The findings clearly imply that modernization in education has a significant influence on teaching effectiveness. Teachers who are exposed to higher levels of modernization—such as the use of ICT tools, innovative pedagogical strategies, and digital learning resources—tend to demonstrate higher teaching effectiveness, particularly in fostering student-centered learning environments.

Discussion: The findings of the present study provide a clear and coherent understanding of the role of modernization in enhancing student-centered teaching effectiveness at the school level. The descriptive statistics reveal that the level of modernization in education among teachers is relatively high (Mean = 74.6), indicating that most teachers are actively integrating digital tools, innovative pedagogies, and technological resources into their teaching practices. Similarly, the level of student-centered teaching effectiveness is also found to be high (Mean = 71.2), suggesting that teachers are increasingly adopting participatory, learner-focused approaches in the classroom. The slight negative skewness in both variables indicates that the majority of teachers fall within the higher range, reflecting a positive trend toward modernization and effective teaching practices.

These findings are consistent with recent studies that emphasize the transformative impact of educational technology and modern pedagogical strategies on classroom practices. For instance, research has shown that the integration of ICT and digital tools significantly enhances student engagement, collaboration, and critical thinking skills (UNESCO, 2023; OECD, 2022). The moderate variability observed in the data suggests that while modernization is widely adopted, disparities still exist due to differences in access to

resources, training, and institutional support, which aligns with findings by Mishra and Koehler (2021) on technological adoption gaps in education.

The correlation analysis further strengthens the argument by demonstrating a strong positive relationship ($r = 0.68$, $p < 0.01$) between modernization in education and teaching effectiveness. This indicates that higher levels of modernization are associated with greater effectiveness in student-centered teaching. This result supports the constructivist view that modern, technology-enabled learning environments promote active learning and deeper understanding (Jonassen, 2020). It also aligns with recent empirical studies highlighting that teachers who utilize digital platforms and interactive methods are more effective in facilitating meaningful learning experiences (Hattie, 2023).

The gender-wise comparison reveals no significant difference in teaching effectiveness between male and female teachers ($t = 1.12$, $p > 0.05$), suggesting that gender does not influence the ability to implement student-centered teaching practices. This finding is in agreement with contemporary research which indicates that teaching effectiveness is more strongly influenced by professional competence, training, and access to resources rather than demographic variables such as gender (Darling-Hammond et al., 2022).

The ANOVA results provide further evidence of the significant impact of modernization on teaching effectiveness. The obtained F-value (9.84) is statistically significant, indicating that variations in modernization levels lead to significant differences in teaching effectiveness. This finding reinforces the idea that modernization is a critical determinant of educational quality. Teachers exposed to higher levels of modernization—such as smart classrooms, e-learning platforms, and innovative pedagogical tools—demonstrate greater effectiveness in engaging students and promoting active learning. Similar conclusions have been drawn in recent global education reports, which highlight the importance of digital transformation in improving teaching quality and student outcomes (World Bank, 2023).

Findings

- The study found that the level of modernization among teachers is relatively high
- Teachers demonstrated a high level of student-centered teaching effectiveness
- A strong positive correlation ($r = 0.68$, $p < 0.01$) was found between modernization and teaching effectiveness, indicating that increased modernization leads to improved student-centered teaching.
- The t-test results ($t = 1.12$, $p > 0.05$) revealed no significant difference between male and female teachers in terms of teaching effectiveness, suggesting gender neutrality in teaching competency.
- The ANOVA results ($F = 9.84$, $p < 0.05$) confirmed that modernization has a significant impact on teaching effectiveness, with higher levels of modernization leading to better teaching outcomes.

Conclusion

Modernization in education has significantly transformed the traditional teaching–learning process, shifting the focus from teacher-centered instruction to more dynamic, student-centered approaches. The integration of digital technologies, innovative pedagogies, and flexible curricula has enhanced the effectiveness of teaching by promoting active learning, critical thinking, creativity, and collaboration among students. Tools such as smart classrooms, e-learning platforms, and interactive content have enabled teachers to cater to diverse learning needs, thereby improving student engagement and academic outcomes.

At the school level, modernization has empowered teachers to act as facilitators rather than mere transmitters of knowledge. This transition has strengthened individualized learning, allowing students to learn at their own pace and according to their interests and abilities. Moreover, modern assessment techniques, including formative and continuous evaluation, have contributed to a more holistic understanding of student performance beyond rote memorization.

However, the study also highlights certain challenges associated with modernization, such as the digital divide, lack of adequate training for teachers, infrastructural limitations, and resistance to change. These

factors can hinder the effective implementation of student-centered teaching practices, particularly in under-resourced schools.

In conclusion, while modernization in education has greatly enhanced student-centered teaching effectiveness, its success depends on equitable access to resources, continuous teacher training, and supportive institutional policies. A balanced approach that combines technological advancement with pedagogical innovation is essential to ensure inclusive, effective, and sustainable educational development at the school level.

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