



A Statistical Analysis of Teaching Methodologies and Their Impact on Students' Performance

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ABSTRACT

This study investigated the relative success of six different teaching strategies including teacher-centred, student-centred, interactive classroom, flipped classroom, adaptive learning, and online instruction on students' academic performance. The study employed a quantitative design grounded in interpretivism to collect data from students via a structured survey. Statistical tests were used to identify which methods of teaching are most effective on students' performance, despite controlling for demographic variables such as Socioeconomic Status (SES). To determine statistical relationships between academic achievement and teaching strategies, three null hypotheses were developed. The findings suggest that interactive classroom techniques, which involve the combination of collaboration, feedback, and real-time interaction, prove to be the best ones to improve the performance, motivation, and retention rates of the students. The results also indicate that the influence of demographics is not absolute; it is not that the pedagogical effect of teaching style is insignificant. The paper presents evidence-based suggestions that can be adopted by teachers and policy makers to ensure that interactive and technology-based strategies are incorporated in higher learning institutions to enhance learning.

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INTRODUCTION

The scholarly practices in the past two decades effectively developed out of the conventional teacher-centred pedagogies into the emerging generation of an active learning context comprising of group activities and hybrid classrooms along with computer-assisted educational practices (Wasilko, 2020). Although these innovative methods have good outcomes, they require additional empirical research that can identify the best techniques to achieve academic success. The educational environment has become very diverse and, in this case, the universities need teaching methods that particularly cater to the various student traits and their diverse learning styles

Author Biographies

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(Tishkovskaya and Lancaster, 2012). It is necessary to use the statistical tools since these statistical tests allow developing rigorous judgments that compare the performance of teaching methods across many educational institutions.

Past academic research has relied mainly on qualitative case studies and measures instead of quantitative approaches for gaining universal insights. Using regression analysis together with ANOVA and multivariate analysis this investigation presents conclusions supported by data regarding the teaching strategies' effects on student achievement. The examined statistical tools would enable to study after controlling Socioeconomic Status (SES) how age demographic groups as well as gender and financial status impact the effectiveness of different teaching approaches. The analysis includes statistical examination to detect data connections which generates useful results to support educational policy development and classroom instruction methods and produce better student achievements. The increasing importance of educational data analytics improves both teaching method evaluation precision and motivates educational development thus creating a critical research topic for the present time (Marzano, & Toth, 2013).

This study provides a significant base of teaching strategies and their impact on students' performance by using statistical analysis. Succeeding teaching strategies should be identified by the educational systems since their development with various students requires them to enhance the outcomes of students. This article initiates the discussion by highlighting the need to closely examine various teaching approaches for different groups of students (Szabo & Schwartz, 2011). The educational development demands that teachers apply statistical measures to carry out strict evaluation of their teaching approaches. The study inspires the current research since it proves to be economically important in evaluating educational tests that rely on statistics (Tishkovskaya & Lancaster, 2012). The study applies statistical approaches to test the effectiveness of teaching methods and develops evidence-based results to address the formulated issue. The research consists of three major goals that include teaching methodologies and their impact on students' performance, subsequent demographic-focused impact comparison and statistical evaluation of the correlation of academic outcomes. The objectives of this research are to compare the effects of various teaching methodologies and the performance of students in terms of socioeconomic status (Broer et al., 2019).

Objectives

- To evaluate the effectiveness of different teaching methods and their impact on students' performance
- To evaluate the Impact of teaching methodologies after controlling for demographic variable (gender, background and socioeconomic status)
- Analyse the statistical relationship between teaching methods and academic performance

Research Questions

- What are the most effective methods of teaching that help to achieve better academic performance among students?
- Are gender and socioeconomic status (SES) demographic factors that determine the effectiveness of various teaching methods?
- How statistically are various teaching methodologies related to the academic performance of students?

Significance of the Study

The study helps to support the evidence-based reformation of education, since it provides quantitative data to support the interactive and technology-combined pedagogy. The results are supposed to lead teachers, curriculum designers and policymakers to the instructional activities that can match the modern needs of learners and provide the opportunity to make the teaching process equitable and data-driven.

LITERATURE REVIEW

Teaching methodology has a significant effect on student learning, comprehension, and retention. In the last twenty years, there has been a transition from lecture-based teaching to interactive approaches due to a change in learning theory.

Teacher-Centred Approach

In the conventional or lecture approach, the instructor is the main source of knowledge and the students are the passive recipients. Although the strategy is structured and effective in covering a wide curriculum, it tends to restrict critical thinking and participation (Struyven et al., 2010). Research indicates that teacher-centred teaching is more helpful with large groups that need standardisation but leads to lower retention and weaker problem-solving skills (Murphy et al., 2021). In the case of higher education, independent research and creativity is required, and that is why its efficiency is lower.

Student-Centred Approach

A student-centred approach to learning provides students opportunities to develop their own learning through a process of inquiry, discussion and collaboration, while providing the teacher with an opportunity to facilitate learning as opposed to delivering content through lecture. A student-centered approach to learning is positively related to motivation, self-directedness and critical thinking that ultimately contributes to better academic performance (Tang, 2023). The challenge to use this type of student-centred approach to learning will often include using this method in a larger classroom or one where students are at different levels of learning.

Teacher–Student Interactive Method

Interactive classrooms combine aspects of both teacher-centred and student-centred approaches to promote a dialogue between the student and the teacher, as well as provide opportunities for students to engage in questioning and receive feedback from their teachers. The use of interactive classrooms has been shown to have a positive effect on students' ability to retain information, understand concepts at a deeper level, and think critically. Thus, the hypothesis is that an interactive classroom will have a positive effect on the academic performance of students (Tlhoale et al., 2014).

Flipped Classroom / Blended Learning

The flipped classroom model moves the instructional delivery outside of the classroom and allows the students to learn by practising and solving problems during class time. The flipped classroom model encourages students to be more independent and to take responsibility for their own learning by providing them with the opportunity to think critically about what they are learning (Zia et al., 2021). If the students are able to develop a high degree of self-directed learning skills, then it is likely that the students will perform academically at a higher level than if they were not given the opportunity to develop those skills. However, there are many challenges associated with implementing the flipped classroom model, including the need for students to be disciplined, having access to digital resources for their learning, and instructors being prepared to implement this type of instructional design (Capone et al., 2017; Nedeva et al., 2019; Suleiman, 2018; Alqarni, 2018).

Adaptive Teaching

Adaptive instruction is a type of instructional design that uses technology to personalize the content, pace, and feedback that a student receives in the classroom (Kara & Sevim, 2013). Adaptive instruction also provides instructors with data on how well students are doing based on the way they respond to the questions and activities provided. If adaptive instruction is used correctly, it can improve students' comprehension of the material, increase student satisfaction with the course, and ultimately improve their academic performance. There are several challenges associated with using adaptive instruction in the classroom, such as the cost of technology, the amount of professional development required for instructors, and the lack of social interaction among peers (Rodríguez Hernández et al., 2024; Hardy et al., 2019).

Online Learning

Flexible, asynchronous online learning increases accessibility and allows students to control when they complete work based on their own schedules and pace of learning (Westwood, 2018). However, as much as flexible asynchronous online education offers the possibility of students to learn by themselves, there is also the problem of reduced interaction between the student and the instructor and the possibility of reduced accessibility to technology which may translate to reduce student engagement and consequently

reduced student achievement (Rosen et al., 2017).

Hypothesis

H₁: All six teaching methods are equally significant $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$

H₂: The teaching methodologies have no significant effects on the academic performance of students when they are controlled by demographics

H₃: No statistically significant correlation exists between teaching methodologies and academic performance of students

Research Gaps

The research that analyses different teaching methods individually is quite abundant. Nonetheless, very few studies compare several teaching strategies based on the same instructional model and empirically quantify the impact of the teaching strategies on the student achievement. Another problem is that there is no research to connect certain teaching strategies with the outcome data that can be measured. This research gap is covered in this study by means of systematic assessment of six various teaching strategies as a component of research questions and hypotheses (Broekkamp & Hout-Wolters, 2007).

Comparative Insights

It has been indicated that interactive and student-centered approaches tend to be more effective than the traditional approaches. In developing interest and higher-order thinking (Marzano & Toth, 2013). Flipped and adaptive models have better results when technology and formative assessment are used. These insights align combining the quantitative results of the study, the interactive classrooms as the most effective method of teaching should be emphasized. Improving educational results.

Framework

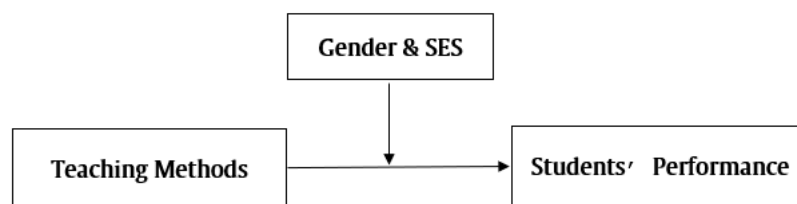


Fig. 1. Framework

METHODOLOGY

This study adhered to a quantitative research design but uses a positivist approach. The research tested the proposed hypothesis based on existing theory and used a deductive approach. What various ways of teaching are, what students perceive and the ways of how these perceptions are manifested in their academic performance were the issues of the research. By carefully analysing the data while considering the context, the study presented a balanced view of both measurable outcomes and the experiences behind them.

Population and Sampling

A total of 1,000 undergraduate and postgraduate students in various institutions of learning were sampled. It was sampled randomly in such a manner that there was an equal representation on gender, age, academic disciplines and socioeconomic backgrounds. The sample size was calculated in such a way that it gave us the t-test, ANOVA, and regression tests, to have the power of statistics.

Data Collection

Data were collected using the structured online questionnaire which was administered using Google Forms. The questionnaire contained Likert-scaled items that assessed student perceptions of six teaching strategies, such as teacher-centred, student-centred, interactive, flipped classroom, adaptive and online learning, and student self-reporting of academic success (grades and performance satisfaction and

engagement). The survey also recorded demographic data like gender, field of study and socioeconomic status (SES) that would make it possible to conduct subgroup analysis.

Variables

- **Dependent Variable:** Academic performance (self-reported grades and perceived learning outcomes).
- **Independent Variables:** Teaching methodologies (including Teacher-Centred Approach, Student-Centred Approach, Teacher–Student Interactive Method, Flipped Classroom / Blended Learning, Adaptive Teaching, and Online Learning)
- **Control Variables:** Demographic factors (gender, SES, academic level).

Statistical Tools and Analysis

The collected data were analysed statistically to see the impact that the teaching methods have on academic outcomes.

- T-Tests: The teaching methodologies have no significant effects on the academic performance of students when they are controlled by demographics.
- ANOVA: The analysis requires multiple group comparison (such as academic performance assessment between students who experienced lecture-based, group learning and flipped classroom methods).
- Regression Analysis: The regression Analysis technique was used to compare teaching methodologies with students’ performance in examination and the class, along with socioeconomic status and their previous academic performance.
- All the null hypotheses and the data have been analysed using MS Excel whereas $\alpha = 0.05$ used as level of significance

RESULTS & FINDINGS

Hypothesis Testing

Table 1
ANOVA

Source of Variation	SS	df	MS	F	P-value	$F_{N_{crit}}$
Rows	333363.2	4	83340.8	662.70	6.061	2.866
Columns	10746.97	5	2149.393	17.091	1.296	2.710
Error	2515.2	20	125.76			
Total	346625.4	29				

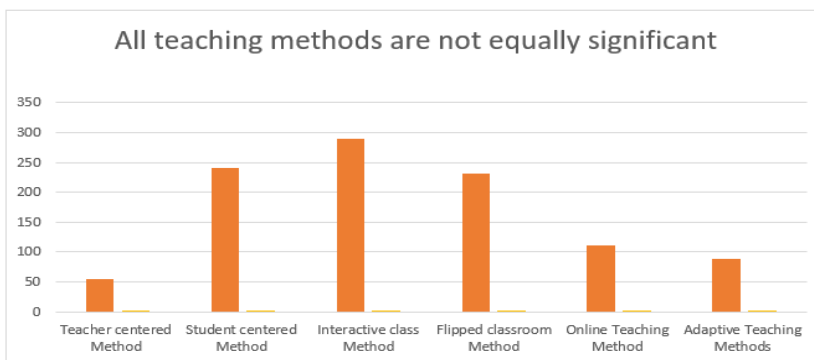


Fig. 2. All Teaching Methodologies and their Significance

Interpretation

The two-factor ANOVA, which did not use replication, indicated statistically significant differences in academic performance not only between the levels of student performance but also between different teaching methodologies. The student performance F-value ($F = 662.70, p < 0.001$) was higher than the critical value ($F_{N_{crit}} n = 2.87$), which means that the levels of performance of students differed significantly in the sample. On the same note, the F-value of teaching methods ($F = 17.09, p < 0.001$) was greater than the critical value ($F_{N_{crit}} n = 2.71$), which corroborates the fact that the instructional method

of teaching had a significant impact on the academic performance of students. These results indicate that teaching methodology is a powerful predictor of what students learn and therefore null hypothesis is rejected.

Comparison of SES and Teaching Methodologies

Table 2

F-Test Two-Sample for Variances

	SES	Pedagogy
Mean	339	176.75
Variance	15007	13482.92
Observations	3	4
df	2	3
F	1.113	
P(F<=f) one-tail	0.434	
F Critical one-tail	9.552	

* $p > 0.05$ variances are equal

Table 3

t-Test: Two-Sample Assuming Equal Variances

	SES	Pedagogy
Mean	339	176.75
Variance	15007	13482.92
Observations	3	4
Pooled Variance	14092.55	
Hypothesized Mean Difference	0	
Df	5	
t Stat	1.789	
P(T<=t) one-tail	0.066	
t Critical one-tail	2.015	
P(T<=t) two-tail	0.133	
t Critical two-tail	2.570	

Interpretation

Since the value of $p > 0.05$, we accept null hypothesis that teaching methodologies have a great impact after controlling socioeconomic status.

Correlation Between Teaching Methodologies and Academic Performance of Students

Table 4

Regression Statistics

	df	SS	MS	F	Significance F	
Regression	3	81640.494	27213.5	2047.896	0	
Residual	1013	13461.265	13.288			
Total	1016	95101.760				
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	34.423	0.582	59.072	0	33.279	35.566
Student .C(X1)	1.852	0.544	3.401	0.005	0.783	2.921
Interactive Class(X2)	20.252	0.608	33.273	1.264	19.057	21.446
Flipped Class Room (X3)	1.294	0.546	2.369	0.017	0.222	2.367

Multiple R = 0.926

R Square = 0.858

Adjusted R Square = 0.858

Standard Error = 3.645

Observations = 1017

Interpretation

As we can see the multiple R= 0.926, it shows the correlation between the actual and predicted performance of students which is closes to 1 its mean students thought by three teaching methods where as adjusted R²=0.858, which is adjusted for number of variable and a high adjusted R² shows that the predicted model is fitted and solid standard error 3.645 is average and predict how much the students' scores are different from the actual performance .F=2047.896 shows the model is best fitted Significance F = 0 is less than 0.05 shows that at least one of the teaching method is best and has a great impact on students' performance Intercept =34.42When the scores of all the teaching methods are zero, the expected student score would be approximately 34.42.

This is the bottom line. Student-Centred =1.85. As student-centred teaching goes up by 1 unit, student performance goes up by 1.85 points (other methods being held constant), interactive class =20.25. This is the most influential method. Performance grows by 20.25 points per every 1-unit rise. Teacher-Centred=1.29, Also positively affects it, but to a lesser extent, it increases performance by 1.29 points per unit. Moreover P-Values shows the statistical significance of the results. P-values of all three methods of teaching are less than 0.05 which implies: They all have a great influence on the performance of the students. Above all, Interactive Class method is highly important P =0.005. The regression model is highly strong and significant. The most effective one is the Interactive Class method as the students demonstrate much better results in case this method is applied. The Student-Centred and flipped classroom approaches are also useful, although not to such an extent.so we reject the null hypothesis.

$$Y=34.42+20.25 \times \text{interactiveClass}(X_2)+1.85 \times \text{student.Centred}(X_1)+1.29488596 \times \text{Flipped classroom}(X_3)$$

Overview of Findings

Data from 1,000 students were analysed to examine how six distinct teaching methodologies like interactive, students centred, teacher-centred, flipped class room, online teaching and adaptive influenced academic performance. Using both descriptive and inferential statistics, the study found notable variations in students' learning outcomes across the instructional strategies. Methods emphasizing interactive and students -centred approaches tended to yield higher achievement levels compared to traditional lecture-based techniques. Interactive classroom approach proved to be the best, then student-centred and flipped classroom approaches. The most common type of instruction, traditional teacher-cantered, demonstrated the least performance results in terms of engagement, motivation, and comprehension.

Table 5
Hypothesis Testing Procedures

No.	Statistical Test	Result	Interpretation
H ₁	ANOVA	Rejected	All teaching methodologies are not equally significant. The interactive teaching method is the best
H ₂	t-test	Accepted	After controlling socioeconomic status teaching methods are statistically significant
H ₃	Regression	Rejected	There is statistically significant correlation exists between teaching methodologies and the academic performance of students.

Table 4 presents the results of the hypothesis testing procedures. The corresponding null hypotheses have been detailed in the earlier part of the study. It was found that the students who learn in an interactive classroom instruction performed the best in the analysis of academic performance of the overall approaches. Flipped classroom models and student-centred models also generated good results, probably due to the active engagement and feedback during the process improving the knowledge and understanding long-term retention. Teacher-centred and purely online approaches were in turn less effective, especially in maintaining student motivation and interest. Furthermore, after controlling socioeconomic status, teaching methods are statistically significant and have a great impact on students' performances. Moreover, there is a statistically significant correlation between teaching methodologies and the academic performance of students.

Discussion

In this study, the findings give a clear picture of how teaching methods influence student performance. For the first question, findings indicate that students were learning more when the teaching was interactive or student-centred. Group work, collective problem solving, and frequent feedback enabled

them to get a deeper grasp of the topics at hand and ensure that they were not bored. The same patterns were observed in the flipped and adaptive classes that echoes previous research that blended learning makes students think more autonomously (Hwang & Chen, 2023). In terms of gender and socioeconomic status the data had virtually no difference. Male and female students had an equal level of benefit, and the socioeconomic background did not diminish the impact of effective teaching practices. This implies that most learners can be approached through an interactive method, irrespective of their background or place of origin (Perna, 2005). Findings indicates that there is statistically significant correlation exists between teaching methodologies and academic performance of students (Briggs, 2019).

CONCLUSION

This study examined six of the most common teaching methodologies, including teacher-centred, student-centred, interactive classroom, flipped classroom, adaptive teaching and online instruction to find out which comparison teaching methodology could better enhance student academic performance. The quantitative evaluations of the answers of 1,000 students showed that there are great dissimilarities among these techniques, as the interactive classroom approach resulted in the greatest mean score of performance and the most robust positive effect on engagement, comprehension, and motivation. The findings indicate that teaching approaches centred on real-time discussion, teamwork, and consistent formative feedback lead to stronger learning outcomes compared to passive, lecture-based instruction. Besides, although after controlling demographic aspects, including gender and socioeconomic status (SES), affect learning contexts, they do not reduce the pedagogical benefit of interaction-based teaching. These findings reinforce the idea that modern education should emphasize interactivity, participation, and reflective learning as core components of curriculum design, supported by t-tests, ANOVA, and regression analyses, refutes most of the null hypotheses and confirms that teaching methodology is a significant predictor of academic achievement. Overall, the findings provide a strong empirical foundation for reconsidering classroom practices and integrating more dynamic and student-centred instructional strategies across different disciplines.

Recommendations

- **Institutional Policy Reform:** It is recommended that educational institutions integrate **interactive and learner-centred approaches** within their curricula to foster deeper engagement and understanding, rather than relying predominantly on lecture-based teaching. The constant professional development programs should equip the instructors with participatory pedagogies, feedback systems, and technology integration.
- **Integration of Technology:** Digital collaboration tools and learning management systems are to be used to supplement face-to-face interactivity. The technology should not substitute the teacher's role in steering the inquiry and participation.
- **Blended and Adaptive Learning Models:** Flipped and adaptive learning techniques ought to be applied selectively to individualise learning and accommodate various learners, especially in tertiary education, where autonomy is important.
- **Continuous Assessment and Feedback:** Formative assessment and feedback regularly must be made a regular institutional practice to maintain student motivation and track progress.
- **Further Research:** The research should be conducted using mixed-method designs in future with classroom observation and longitudinal tracking to prove self-reported data. The study may be extended to early education and new cultural settings to increase the generalisation of the findings.

Limitations

Despite the fact that the study met its goals, its weaknesses are that it used self-reported performance data and did not involve direct classroom observation. There could also be some bias in the usage of online survey due to accessibility to technology. However, the extensive and heterogeneous sample gives an assurance of the extrapolation of findings.

Competing Interests

The authors declared no competing interests.

REFERENCES

- Alqarni, A. (2018). Blended learning and flipped classroom approaches. *American Research Journal of Humanities and Social Sciences*, 4(1), 1-6.
- Briggs, B. (2019). Teaching methods as correlate of student performance in business studies in selected public secondary schools in Port Harcourt. *International Journal of Innovative Social and Science Education Research*, 7(2), 1-12.
- Broekkamp, H., & van Hout-Wolters, B. (2007). The gap between educational research and practice: A literature review, symposium, and questionnaire. *Educational Research and Evaluation*, 13(3), 203-220. <https://doi.org/10.1080/13803610701626127>
- Broer, M., Bai, Y., & Fonseca, F. (2019). A review of the literature on socioeconomic status and educational achievement. *Socioeconomic inequality and educational outcomes: Evidence from twenty years of TIMSS*, 7-17. https://doi.org/10.1007/978-3-030-11991-1_2
- Capone, R., De Caterina, P., & Mazza, G. A. G. (2017). Blended learning, flipped classroom and virtual environment: challenges and opportunities for the 21st century students. *Edulearn17 Proceedings*, 10478-10482. <https://doi.org/10.21125/edulearn.2017.0985>
- Hardy, I., Decristan, J., & Klieme, E. (2019). Adaptive teaching in research on learning and instruction. *Journal for educational research online*, 11(2), 169-191. <https://doi.org/10.25656/01:18004>
- Hwang, G. J., & Chen, P. Y. (2023). Effects of a collective problem-solving promotion-based flipped classroom on students' learning performances and interactive patterns. *Interactive Learning Environments*, 31(5), 2513-2528. <https://doi.org/10.1080/10494820.2019.1568263>
- Kara, N., & Sevim, N. (2013). Adaptive learning systems: Beyond teaching machines. *Contemporary Educational Technology*, 4(2), 108-120.
- Marzano, R. J., & Toth, M. D. (2013). *Teacher evaluation that makes a difference: A new model for teacher growth and student achievement*. ASCD.
- Murphy, L., Eduljee, N. B., & Croteau, K. (2021). Teacher-centered versus student-centered teaching: Preferences and differences across academic majors. *Journal of Effective Teaching in Higher Education*, 4(1), 18-39. <https://doi.org/10.36021/jethe.v4i1.156>
- Nedeva, V., Dineva, S., & Ducheveva, Z. (2019). Students in blended learning by flipped classroom approach. *Information technologies and learning tools*, 72(4), 204.
- Perna, L. W. (2005). The benefits of higher education: Sex, racial/ethnic, and socioeconomic group differences. *The Review of Higher Education*, 29(1), 23-52. <https://doi.org/10.1353/rhe.2005.0073>
- Rincon-Flores, E. G., Castano, L., Guerrero Solis, S. L., Olmos Lopez, O., Rodríguez Hernández, C. F., Castillo Lara, L. A., & Aldape Valdés, L. P. (2024). Improving the learning-teaching process through adaptive learning strategy. *Smart Learning Environments*, 11(1), 27. <https://doi.org/10.1186/s40561-024-00314-9>
- Rosen, J. A., Porter, S. R., & Rogers, J. (2017). Understanding student self-reports of academic performance and course-taking behavior. *Aera Open*, 3(2), 2332858417711427. <https://doi.org/10.1177/2332858417711427>
- Srinivasa, K. G., Kurni, M., & Saritha, K. (2022). Adaptive teaching/learning. In *Learning, Teaching, and Assessment Methods for Contemporary Learners: Pedagogy for the Digital Generation* (pp. 201-240). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-19-6734-4_9
- Struyven, K., Dochy, F., & Janssens, S. (2010). 'Teach as you preach': the effects of student-centred versus

- lecture-based teaching on student teachers' approaches to teaching. *European Journal of Teacher Education*, 33(1), 43-64. <https://doi.org/10.1080/02619760903457818>
- Suleiman, N. A. (2018). Implementing blended learning and flipped learning models in the university classroom: A case study. *Teaching English with Technology*, 16(4), 34-47.
- Szabo, Z., & Schwartz, J. (2011). Learning methods for teacher education: The use of online discussions to improve critical thinking. *Technology, Pedagogy and Education*, 20(1), 79-94. <https://doi.org/10.1080/1475939X.2010.534866>
- Tang, K. H. D. (2023). Student-centered approach in teaching and learning: What does it really mean?. *Acta Pedagogica Asiana*, 2(2), 72-83. <https://doi.org/10.53623/apga.v2i2.218>
- Tishkovskaya, S., & Lancaster, G. A. (2012). Statistical education in the 21st century: A review of challenges, teaching innovations and strategies for reform. *Journal of Statistics Education*, 20(2). <https://doi.org/10.1080/10691898.2012.11889641>
- Tlhoaele, M., Hofman, A., Winnips, K., & Beetsma, Y. (2014). The impact of interactive engagement methods on students' academic achievement. *Higher Education Research & Development*, 33(5), 1020-1034. <https://doi.org/10.1080/07294360.2014.890571>
- Wasilko, A. T. (2020). *An investigation of technology implementation through the lens of student centered learning and the technological pedagogical content knowledge paradigm* (Doctoral dissertation, Duquesne University).
- Westwood, P. (2018). *Inclusive and adaptive teaching: Meeting the challenge of diversity in the classroom*. Routledge. <https://doi.org/10.4324/9781351061261>
- Zia, M. Q., Shabroz, E. K., & Khan, E. (2021). Influence of personal and work characteristics on employees' Self-guided development. *Global Management Journal for Academic & Corporate Studies*, 11(2), 163-175.