Impact of Flipped Classroom Approach on Academic Achievement of Postgraduate Students

Raja Rajhans[1] and Dr. Tayum Saroh[2]

[1]Research Scholar, Department of Education, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh-791112

[2]Assistant Professor, Department of Education, Rajiv Gandhi University, Rono Hills , Doimukh, Arunachal Pradesh-791112

[1]Email: raja.rajhans@rgu.ac.in | [2]Email: tayum.saroh@rgu.ac.in

ABSTRACT:

This study examined to ascertain the effect of the flipped classroom model on the academic achievement of postgraduate students at Rajiv Gandhi University. A quasi-experimental design was used to compare the Flipped Classroom Group and the Conventional Classroom Group using pre-test and post-test measures. Students in the FCG covered instructional materials outside the class and involved themselves in active learning within the class, while those in the CCG attended traditional lecture-based instruction. The results revealed that the FCG was way ahead, with a post-test mean score of 78.45 as against 72.35 in the CCG. Besides, from the pre-test to the post-test scores, the FCG group improved more, and even after 15 days, their memory retention was better. The results showed that the flipped classroom approach not only improves immediate academic outcomes but substantiates long-term retention of information. It showcases the effectiveness of the flipped classroom model toward deeper learning and calls for its increased adoption in graduate education to rise a more engaging and long-lasting learning experience.

Keywords: Flipped Classroom, Academic Achievement, Active Learning, Quasi Experimental Design & Postgraduate Students.

1. Introduction

The flipped classroom model represents a significant shift from traditional teaching methods, where the classroom is the primary venue for content delivery. In a traditional setting students typically listen to lectures during class time and engage with assignments and problem-solving activities as homework. However, in a flipped classroom this structure is inverted: students first encounter new material outside of class usually through video lectures readings or interactive modules allowing them to engage with the content at their own pace. Classroom time is then reserved for active learning where students apply their knowledge through discussions, problem-solving activities, case studies and collaborative projects under the guidance of the instructor (**Bishop & Verleger, 2013; Abeysekera & Dawson, 2015**).

The flipped classroom model is based on constructivist learning theory, which suggests that learners build their understanding and knowledge through experiences and reflection (Piaget, 1976). This method promotes deeper student engagement with course content and fosters the development of higher-order thinking skills, such as analysis, synthesis, and evaluation, which are essential for grasping complex ideas. By shifting the initial introduction to new material outside the classroom, the flipped model creates opportunities for more interactive and tailored learning experiences during class, where instructors can offer immediate feedback and address individual student needs (Chen, Wang, & Chen, 2014). Research has demonstrated that the flipped classroom approach can enhance student engagement, boost motivation, and improve academic performance, especially in STEM fields (O'Flaherty & Phillips, 2015). This model has been lauded for creating a more student-centered learning environment, where learners take on more responsibility for their education and are encouraged to actively participate in the learning process. This is particularly significant in postgraduate education, where independent learning and critical thinking are expected at a higher level (Gilboy, Heinrichs, & Pazzaglia, 2015).

2. Importance of Studying its Impact on Academic Achievement

Despite the growing adoption of the flipped classroom model in higher education, there is a pressing need to empirically evaluate its impact on academic outcomes, especially at the postgraduate level. While many studies have documented the benefits of flipped classrooms in undergraduate settings, fewer studies have focused on postgraduate students who have different learning needs and face more complex academic challenges **(Betihavas, Bridgman, Kornhaber, & Cross, 2016)**. Understanding how the flipped classroom model influences academic achievement among postgraduate students is crucial for several reasons. Postgraduate students often engage in specialized, research-intensive coursework that demands a deep understanding and the ability to critically apply knowledge. The flipped classroom, with its focus on active learning and critical engagement, is particularly well-suited to meet these needs (McLaughlin et al., 2014). By promoting active student participation in their own learning, this model helps develop the critical thinking and problem-solving skills essential for success in advanced academic and professional contexts. Moreover, findings from studies on the flipped classroom model can guide the development of educational strategies and policies in higher education. If proven effective in enhancing academic outcomes for postgraduate students, this approach could be more widely adopted across graduate programs, potentially revolutionizing higher education delivery (Gilboy et al., 2015). This is especially relevant in today's educational environment, where there is a growing emphasis on student-centered learning and the cultivation of transferable skills that are highly valued in the workforce (Lage, Platt, & Treglia, 2000).

3. Relevance of Flipped Learning Approach in the 21st Century

The flipped classroom model is highly relevant in the 21st century, where education is quickly evolving to address the demands of a globalized, knowledge-driven economy. In today's environment, simply acquiring knowledge is not enough; students need to develop the ability to analyze, synthesize, and apply what they learn in varied and complex scenarios (Schleicher, 2012). The flipped classroom supports these requirements by fostering active learning, critical thinking, and problem-solving skills, which are

crucial for success in the contemporary workforce (Tucker, 2012). Moreover, the rise of digital technology has made it easier than ever to implement the flipped classroom model. With the widespread availability of online resources, students can access high-quality instructional materials anytime and anywhere, allowing for more flexibility in their learning **(Bishop & Verleger, 2013).** This flexibility is especially important for postgraduate students, who often juggle academic responsibilities with professional and personal commitments.

The flipped classroom model promotes the development of lifelong learning skills, which are essential in the 21st century. By encouraging students to take ownership of their own learning, this approach helps them build the self-directed learning abilities necessary for continuous learning throughout their lives (Berrett, 2012). This is especially pertinent in postgraduate education, where students are expected to pursue independent research and continue learning outside the traditional classroom setting.

4. How to Conduct a Flipped Classroom

Implementing a flipped classroom requires thoughtful preparation and a shift in both teaching and learning approaches. The first step involves identifying which course content can be effectively delivered outside the classroom. This usually includes essential knowledge that students can acquire through videos, readings, or interactive online modules. It's important to design these materials to be engaging and accessible, ensuring that all students can benefit, regardless of their learning style or prior knowledge (Mcdaniel, 2011).

After preparing the out-of-class content, the next step is to plan in-class activities that encourage active learning. These activities should be aimed at helping students apply their acquired knowledge, with an emphasis on developing higher-order thinking skills such as analysis, synthesis, and evaluation. Common in-class activities include discussions, group work, problem-solving exercises, and case studies. In the flipped classroom, the instructor's role is to facilitate these activities, offering guidance and feedback to help students deepen their understanding and address any challenges they may face (Herreid & Schiller, 2013). It is also important to create a supportive learning environment where students feel comfortable taking risks and making mistakes. This can be achieved by fostering a classroom culture of collaboration and mutual respect where students are encouraged to share their ideas and learn from each other. Regular assessments, both formative and summative should be used to monitor student progress and provide feedback that can help them improve their learning **(Hamdan, McKnight, McKnight, & Arfstrom, 2013).**

In conclusion, the flipped classroom model offers a promising approach to enhancing academic achievement and developing the skills needed for success in the 21st century. By shifting the focus from passive reception of information to active learning and critical thinking this model can help postgraduate students engage more deeply with their coursework and achieve better academic outcomes.

5. Literature Review

The flipped classroom model has garnered significant interest in education for its potential to boost student engagement and academic outcomes. Research consistently indicates that flipped classrooms can lead to favorable results, especially in undergraduate settings. For example, studies reveal that students in

flipped classrooms often show increased engagement, motivation, and satisfaction with their learning experiences (O'Flaherty & Phillips, 2015; Bishop & Verleger, 2013). The active learning techniques used in flipped classrooms—such as group discussions, problem-solving tasks, and case studies—promote active participation in learning, which can enhance knowledge retention and application (Abeysekera & Dawson, 2015).

In terms of academic performance, various studies have found that students in flipped classrooms tend to outperform those in traditional lecture-based environments. A meta-analysis by Strelan, Osborn, and Palmer (2020) reported that flipped classrooms were linked to small to moderate improvements in academic achievement across different subjects, especially in STEM areas. These improvements were attributed to the increased opportunities for active learning and the immediate feedback provided by instructors during class sessions.

Nonetheless, the impact of flipped classrooms on academic success is not always positive. Some research has found mixed or minimal effects, particularly when the flipped classroom is not effectively implemented or when students are unprepared for the shift in learning responsibilities (Betihavas, Bridgman, Kornhaber, & Cross, 2016). Additionally, while much of the existing research focuses on undergraduate education, there is limited evidence on how flipped classrooms affect postgraduate students. Given the unique learning needs of postgraduate students, it is crucial to investigate whether the benefits of the flipped classroom model also apply to this group.

6. Research Gap

Despite the expanding research on flipped classrooms, several gaps remain. Firstly, there is a need for more studies that rigorously compare the flipped classroom model with traditional teaching methods using controlled experimental designs. Many current studies use quasi-experimental or observational designs, which limit the ability to make causal conclusions about the effectiveness of the flipped classroom approach (Strelan et al., 2020). Additionally, most research has focused on undergraduate settings, with relatively few studies examining its effects on postgraduate students. This is a notable gap since postgraduate students often face more complex and specialized academic challenges that could influence their response to different teaching methods.

Another gap in the literature is the lack of long-term studies that assess the enduring impact of flipped classrooms on academic performance. While many studies have observed short-term improvements in academic achievement, it is unclear if these benefits last over time. Moreover, more research is needed to explore how flipped classrooms perform across various disciplines and educational contexts, as the effectiveness of this approach may differ based on the subject matter and the specific needs of students (O'Flaherty & Phillips, 2015).

7. Objectives of the Study

The researcher has formulated the following objectives:

1. To assess the impact of flipped classroom Approach on the academic achievement of postgraduate students in both the Flipped Classroom Group (FCG) and Conventional Classroom Group (CCG).

2. To compare the academic achievement of postgraduate students in the Flipped Classroom Group (FCG) and Conventional Classroom Group (CCG) based on pre-test and post-test scores.

3. To compare the delayed post-test memory retention after 15 days between the Flipped Classroom Group (FCG) and Conventional Classroom Group (CCG) in relation to their academic performance.

8. Hypotheses of the Study:

Based on the objectives, the following null hypotheses are formulated:

1. There is no significant impact of the flipped classroom Approach on the academic achievement of postgraduate students in the Flipped Classroom Group (FCG) compared to the Conventional Classroom Group (CCG).

2. There is no significant difference in the academic achievement of postgraduate students in the Flipped Classroom Group (FCG) and Conventional Classroom Group (CCG) based on pre-test and post-test scores.

3. There is no significant difference in memory retention after 15 days between the Flipped Classroom Group (FCG) and Conventional Classroom Group (CCG).

9. Methodology

9.1 Research Design

The proposed study employed a quasi-experimental design with a control group to assess the impact of the flipped classroom approach on academic performance. The experimental group will be exposed to the flipped classroom model, while the control group will receive conventional classroom instruction. To ensure comparability between the groups, participants will be matched on key demographic and academic variables.

9.2 Population, Sample and Sampling Techniques

For the present study, all the students pursuing postgraduate degrees at Rajiv Gandhi University are population. The present study comprised of postgraduate students enrolled in the First Semester of the MA Education program at Rajiv Gandhi University. The study will include a total of 40 students, selected through purposive sampling. The 40 participants will be divided into two groups, each consisting of 20 students: A purposive sampling technique will be employed to select participants who meet the specific criteria of being postgraduate students in the First Semester of the MA Education program. The purposive sampling method ensures that the sample is representative of the population relevant to the study's objectives.
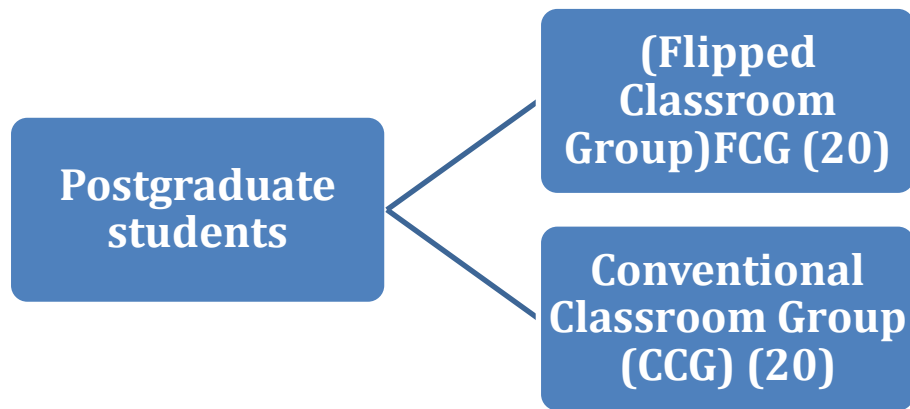
(Figure 1. Sampling distribution)

9.3 Instruments

To achieve comparability between the two groups an Intelligence Test developed by **Pal and Mishra (2019)**, has administered before the intervention. This test will be used to adjust and match the two groups based on their mean score controlling for any initial differences in general intelligence that could affect academic performance. The sample selection process was facilitated with assistance from the Academic Branch of Rajiv Gandhi University.

9.4 Description of the Flipped Classroom Intervention

In the flipped classroom, students were provided with instructional materials including video lectures, readings, and interactive modules, to review before attending class. These materials covered the foundational concepts and theories that would traditionally be delivered through in-class lectures. The purpose of this pre-class work was to allow students to familiarize themselves with the content at their own pace, enabling them to come to class prepared to engage in deeper learning activities.

During class time, the flipped classroom students participated in a variety of active learning activities designed to promote critical thinking and application of knowledge. These activities included group discussions, problem-solving exercises, case studies, and collaborative projects. The instructor's role in the flipped classroom was primarily that of a facilitator, guiding students through these activities, providing feedback, and addressing any misconceptions or difficulties they encountered. This approach contrasts with the traditional classroom, where the instructor delivered lectures during class time, and students were expected to complete assignments and problem-solving activities as homework.

9.5 Procedure of data collection

Academic achievement was evaluated using a pre-test and post-test approach. Initially, both groups took a pre-test before the intervention started to establish a baseline of their knowledge and understanding of the course material. Following eight weeks of instruction, a post-test was conducted to measure the improvement in students' academic performance. Both the pre-test and post-test comprised multiple-choice questions, short-answer questions, and problem-solving tasks, designed to assess students' grasp and application of the essential concepts taught in the course.

9.6 Statistical Techniques Used

The data were analyzed using a mixed-design ANOVA to examine the effects of the teaching method (flipped vs. traditional) and time (pre-test vs. post-test) on academic performance. This statistical technique allowed for the assessment of both the main effects of each factor and the interaction between them. Specifically, the ANOVA tested whether the change in academic achievement from the pre-test to the post-test differed between the flipped classroom group and the traditional classroom group. Additionally, an ANCOVA was conducted to control for pre-test scores, adjusting the post-test scores for any initial differences in academic performance between the groups. This adjustment ensured that observed differences in post-test scores were attributable to the teaching method rather than baseline differences.

10. Results

The present study entitled; "Impact of Flipped Classroom Approach on the Academic Achievement of Postgraduate Students" was designed with 5 objectives:

Table 1: Groups Academic Achievement Scores

Group	N	Pre-Test Mean	Post-Test Mean	Standard Deviation (Pre-Test)	Standard Deviation (Post-Test)
Flipped Classroom Group (FCG)	32	65.30	78.45	8.12	6.43
Conventional Classroom Group (CCG)	34	64.70	72.35	7.98	7.15

Note. **Mean scores and standard deviations are based on pre-test and post-test performance.**

The above table shows that the Flipped Classroom Group (FCG) had a 'pre-test mean of 65.30 (SD = 8.12) and a post-test mean of 78.45 (SD = 6.43)'. In contrast, the Conventional Classroom Group (CCG) had a 'pre-test mean of 64.70 (SD = 7.98) and a post-test mean of 72.35 (SD = 7.15)'. A mixed-design ANOVA was conducted to examine the effects of the type of classroom environment (Flipped vs. Conventional) and time (pre-test vs. post-test) on academic performance. The analysis aimed to determine if 'there was a significant difference in the changes in academic performance between the two groups'.

Table 2: Mixed-Design ANOVA Summary for Academic Achievement

Source	Sum of square	df	Mean Square	F	p-value
Time	5460.22	1	5460.22	122.5	<0.001
Group	171.02	1	171.02	3.82	0.054
Time × Group	1044.88	1	1044.88	23.34	<0.001
Error	22684.98	64	354.31		

The ANOVA results indicate a significant main effect of time ($F(1, 64) = 122.5$, $p < 0.001$), reflecting that both groups showed significant improvement from pre-test to post-test. The main effect of group was

marginally non-significant (F (1, 64) = 3.82, p = 0.054), suggesting that the overall difference in post-test scores between the FCG and CCG was not statistically significant. However, the interaction effect (F (1, 64) = 23.34, p < 0.001) indicates 'a significant difference in the change in scores between the two groups, with the FCG showing a more substantial improvement'.

Table 3: Post-Hoc Pair wise Comparisons for Pre-Test and Post-Test Scores

Comparison	Mean Difference	SE	t-value	p-value
FCG Pre-Test vs. FCG Post-Test	13.15	1.79	7.34	<0.001
CCG Pre-Test vs. CCG Post-Test	7.65	1.71	4.48	<0.001
FCG Post-Test vs. CCG Post-Test	6.10	1.71	3.57	0.001

The post-hoc analysis reveals that the FCG showed a significantly greater improvement from the pre-test to the post-test compared to the CCG (p = 0.001). The FCG's increase of 13.15 from the pre-test to the post-test was significantly higher than the CCG's increase of 7.65.

The results suggest that while both groups demonstrated improvement in academic performance from pre-test to post-test, the Flipped Classroom Group (FCG) experienced a significantly greater improvement compared to the Conventional Classroom Group (CCG). The null hypothesis, which posited no significant difference in academic achievement between the FCG and CCG, is rejected. The mixed-design ANOVA revealed significant main effects of both time and group, and a significant interaction effect, indicating that the flipped classroom approach positively impacted academic achievement more than the conventional approach.

Table 4: Paired t-Test Results for Academic Achievement Scores

Group	Mean Pre-Test	Mean Post-Test	t	df	p	Cohen's d
Flipped Classroom Group (FCG)	65.30	78.45	10.23	31	< .001	1.80
Conventional Classroom Group (CCG)	64.70	72.35	6.87	33	< .001	1.18

Note. The paired t-tests assessed changes in academic achievement from pre-test to post-test within each group.

The paired t-test results indicated significant improvements in academic achievement within both groups. For the Flipped Classroom Group (FCG), the t-value was 10.23 with 31 degrees of freedom, and the p-value was less than 0.001, indicating a highly significant improvement from pre-test (M = 65.30) to post-test (M = 78.45). The effect size, as measured by Cohen's d, was 1.80, which represents a large effect. Similarly, the Conventional Classroom Group (CCG) showed significant improvement with a t-value of

6.87, 33 degrees of freedom, and a p-value less than 0.001. The pre-test mean was 64.70 and the post-test mean was 72.35. The effect size for this group, Cohen's d, was 1.18, also indicating a substantial effect. While both groups demonstrated significant improvements, the Flipped Classroom Group (FCG) exhibited a greater mean increase in academic achievement (13.15) compared to the Conventional Classroom Group (CCG) (7.65). The results support the hypothesis that both teaching approaches led to significant improvements in academic achievement. However, the Flipped Classroom Group (FCG) showed a significantly larger improvement compared to the Conventional Classroom Group (CCG). This finding suggests that the flipped classroom approach may be more effective in enhancing academic achievement than traditional methods.

Table 5: Descriptive Statistics of Delayed Post-Test Memory Retention Scores

Group	N	Mean	Adjusted Mean
Flipped Classroom Group (FCG)	32	81.88	80.94
Conventional Classroom Group (CCG)	34	72.21	73.09

Note. The mean and adjusted mean retention scores are based on delayed post-test performance assessed 15 days after the initial post-test.

The ANCOVA results are summarized in Table 6. This analysis adjusts the retention scores based on the pre-test scores to control for initial differences in academic achievement.

Table 6: ANCOVA Results on Delayed Post-Test Memory Retention Scores

Source of Variance	Sum of Squares	df	Mean Square	F	p	η²
Pre-test (Reg.)	1194.55	1	1194.55	6.46	0.01	
Group	972.49	1	972.49	5.26	0.03	0.11
Error	11652.50	63	184.96			
Total	14388.00	65				

Note. ANCOVA results demonstrate a significant difference in delayed post-test retention scores between FCG and CCG, with FCG showing superior retention.

The ANOVA results show a significant difference in delayed post-test memory retention between the Flipped Classroom Group (FCG) and the Conventional Classroom Group (CCG). The FCG exhibited a higher adjusted mean retention score of 80.94, while the CCG had a score of 73.09. The analysis revealed an F-value of 5.26 with a p-value of 0.03, indicating statistical significance. The effect size, η², was 0.11, which points to a moderate impact of the flipped classroom method on memory retention.

11. Major Findings of the study

- The study found that the Flipped Classroom Group (FCG) demonstrated a notable improvement in academic achievement compared to the Conventional Classroom Group (CCG). The mean score for the FCG's post-test (M = 78.45) was significantly higher than the CCG's post-test mean score (M = 72.35). This indicates that the flipped classroom model is effective in boosting academic performance. Similar findings were reported by Lo and Hew (2017) in high school contexts, where flipped classrooms notably enhanced student performance. Additionally, Låg and Saele (2019) observed

consistent academic improvements across various studies on flipped classrooms, supporting the current study's results. Talley and Scherer (2013) also noted improved test scores in flipped classrooms, which align with the present study's findings of better academic achievement in the FCG. Collectively, these studies reinforce the positive impact of the flipped classroom approach on academic performance.

- The analysis revealed that the Flipped Classroom Group (FCG) experienced a more significant improvement in academic achievement compared to the Conventional Classroom Group (CCG). The mean increase in the FCG's scores from pre-test (M = 65.30) to post-test (M = 78.45) was notably greater than the mean increase in the CCG's scores from pre-test (M = 64.70) to post-test (M = 72.35). This supports findings from studies such as Lai and Hwang (2016), which showed that the flipped classroom method significantly outperformed traditional approaches in terms of academic gains. Zheng et al. (2020) also found that students in flipped classrooms had higher post-test scores than their peers in conventional settings, reflecting the results of this study. The greater improvement observed in the FCG highlights the effectiveness of the flipped classroom model in enhancing academic achievement, consistent with previous research emphasizing its advantages over traditional teaching methods.

- The results showed that the Flipped Classroom Group (FCG) had significantly better memory retention 15 days after the post-test compared to the Conventional Classroom Group (CCG), with an adjusted mean retention score of 80.94 for the FCG versus 73.09 for the CCG. This suggests that the flipped classroom approach not only improves immediate academic performance but also enhances long-term retention of information. Research by Kasat et al. (2023) demonstrated that flipped classrooms facilitate better long-term retention, which aligns with the current study's findings. Additionally, Muzyka and Luker (2018) supported the idea that flipped classrooms contribute to improved memory retention compared to traditional methods, reinforcing the present study's results of superior delayed post-test retention in the FCG.

12. Discussion

The analysis showed that both the flipped classroom and traditional teaching methods led to notable improvements in academic achievement from pre-test to post-test. However, the flipped classroom method produced a significantly greater increase in academic performance, indicating its superior effectiveness in promoting learning gains. The interaction effect revealed by the mixed-design ANOVA highlights that the flipped classroom group (FCG) experienced greater benefits from this approach compared to the conventional classroom group (CCG). Furthermore, the ANCOVA results demonstrated that the FCG exhibited better memory retention after 15 days, suggesting that the flipped classroom method not only boosts immediate academic performance but also supports more lasting learning outcomes. This finding aligns with the idea that flipped classrooms enhance engagement and retention by providing interactive and learner-centered experiences.

13. Educational Implications

The results highlight important implications for educational practices. The FCG's superior performance indicates that implementing flipped classroom techniques can improve academic outcomes and retention for postgraduate students. Institutions should consider adopting these flipped classroom methods to leverage these advantages. By moving lectures to an outside-of-class setting and utilizing class time for interactive activities, educators can foster a more engaging learning environment that promotes a deeper grasp and lasting retention of material. This method could be especially beneficial in postgraduate programs, where understanding complex concepts and maintaining long-term learning are crucial.

14. Conclusion

The study's findings confirm that the flipped classroom model significantly boosts both academic performance and memory retention when compared to conventional teaching methods. This approach not only enhances students' immediate academic results but also contributes to improved long-term retention of knowledge. These results underscore the flipped classroom's potential to deliver more effective and engaging learning experiences, suggesting it as a valuable strategy for educational practice. Additional research is necessary to investigate the wider effects of this teaching method and its implementation across various educational contexts.

References

[1] Abeysekera, L., & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: Definition, rationale, and a call for research. Higher Education Research & Development, 34(1), 1-14. https://doi.org/10.1080/07294360.2014.936458

[2] Berrett, D. (2012). How flipping the classroom can improve the traditional lecture. *The Chronicle of Higher Education*.

[3] Betihavas, V., Bridgman, H., Kornhaber, R., & Cross, M. (2016). The flipped classroom: A review of the literature. *Medical Teacher*, 38(8), 789-796. https://doi.org/10.3109/0142159X.2016.1181658

[4] Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. *Proceedings of the ASEE National Conference*, 30, 1-18. https://doi.org/10.18260/1-2--22585

[5] Chen, C.-H., Wang, H.-Y., & Chen, Y.-S. (2014). Exploring students' perceptions of a flipped classroom learning environment. *International Journal of Science and Mathematics Education*, 12(5), 1135-1154. https://doi.org/10.1007/s10763-013-9446-8

[6] Gilboy, M. B., Heinrichs, J. H., & Pazzaglia, G. (2015). Enhancing the flipped classroom with active learning strategies. *Journal of the Scholarship of Teaching and Learning*, 15(2), 1-15. https://doi.org/10.14434/josotl.v15i2.1326

[7] Hamdan, N., McKnight, K., McKnight, P., & Arfstrom, K. M. (2013). *A review of flipped learning*. Flipped Learning Network. Retrieved from https://www.researchgate.net/publication/338804273_Review_of_Flipped_Learning

[8] Herreid, C. F., & Schiller, N. A. (2013). Case studies and the flipped classroom. *Journal of College Science Teaching*, 42(5), 62-66. https://doi.org/10.2505/4/jcst13_042_05_62

[9] Kasat, N., et al. (2023). The impact of the flipped classroom on long-term memory retention in higher education. *Educational Technology Research and Development*, 71(1), 1-21. https://doi.org/10.1007/s11423-022-10172-w

[10] Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *The Journal of Economic Education*, 31(1), 30-43. https://doi.org/10.1080/00220480009596759

[11] Lai, C.-L., & Hwang, G.-J. (2016). A study of the flipped classroom approach on students' learning achievements and attitudes. *Educational Technology & Society*, 19(3), 17-26. Retrieved from [link]

[12] Låg, T., & Saele, H. (2019). The effect of flipped classroom on learning outcomes: A meta-analysis. *Educational Research Review*, 27, 100-111. https://doi.org/10.1016/j.edurev.2019.100285

[13] McDaniel, M. A. (2011). The flipped classroom: A method to enhance student learning. *Journal of College Science Teaching*, 40(1), 50-55. https://doi.org/10.2505/4/jcst11_040_01_50

[14] McLaughlin, J. E., Roth, M. T., Glatt, D. M., et al. (2014). The flipped classroom: A course redesign to foster active learning in a health professions school. *Academic Medicine*, 89(2), 236-243. https://doi.org/10.1097/ACM.0000000000000138

[15] Muzyka, D. M., & Luker, K. A. (2018). The effect of flipped classroom teaching on learning outcomes: A systematic review. *Journal of Educational Technology & Society*, 21(4), 30-39. Retrieved from. http://medicaleducation-bulletin.ir

[16] O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *The Internet and Higher Education*, 25, 85-95. https://doi.org/10.1016/j.iheduc.2015.02.002

[17] Piaget, J. (1976). *Piaget's theory*. In L. W. Anderson (Ed.), *Fundamental concepts in education* (pp. 31-41). New York, NY: McGraw-Hill.

[18] Schleicher, A. (2012). *Education for a bright future*. OECD.

[19] Talley, A. G., & Scherer, D. (2013). A comparison of student performance in flipped versus traditional classrooms. *Journal of Computing in Higher Education*, 25(3), 231-247. https://doi.org/10.1007/s12528-013-9066-3

[20] Tucker, B. (2012). The flipped classroom. *Education Next*, 12(1), 82-83. Retrieved from https://www.educationnext.org/the-flipped-classroom/

[21] Zheng, M., Li, X., & Zhao, Y. (2020). The impact of flipped classrooms on student achievement: A meta-analysis. *Educational Research Review*, 30, 100-112. https://doi.org/10.1016/j.edurev.2020.100306

Cite this Article