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EFFECT OF FLIPPED CLASSROOM APPROACH ON HIGHER SECONDARY STUDENTS' ACADEMIC PERFORMANCE

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Abstract

This study explored the effect of FCA on academic performance of students at higher secondary level. The study based on quasi-experimental research design. Students of intervention group were taught to focus the filliped classroom approach while control group taught through traditional method. The study sample comprised 30 to 40 education students of secondary school from Lahore, Pakistan. After three months of teaching through FCA, assessment was conducted to find the effect of FCA. The intervention was conducted through online component as well as formal classroom activities. However, other group was taught by lecture method. Reliability and validity of the instrument was also ensured. The ANCOVA analysis after data collection was made through SPSS. It was depicts by the research findings that intervention and control group in terms of academic achievement was significantly differ.

Keywords: *Flipped Classroom Approach (FCA), Academic Performance (AP)*

Introduction

Flipped classroom approach (FCA) is an emerging teaching approach as a modern instructional strategy for students' active learning. The flipped learning is a creative learning that utilizes technology to move the conventional lecture beyond the scheduled class period and to involve students in face-to-face tasks (Preeti, 2021). It is equally good for all level of students, intelligent as well as those who have certain learning difficulties (Al-Rawashdeh et al., 2021; Munna & Kalam, 2021). In traditional learning, teacher remains instrumental and disseminator of knowledge in a classroom (Hassan et al., 2014). Such teacher-centric strategies are just like a spoon-feeding to the students that diminishes their cognitive abilities (Bishop & Verleger, 2013). Contrarily, FCA is a blended technique to learn at the platforms, which are more appropriate, suitable, affordable and accessible for the students (Han & Rokenes, 2020).

Student academic performance means student scores on exams (Freeman et al., 2014). The factors that determine a student's academic performance include their involvement in class, their assignments in class, their homework at home, tests, exams and their participation in contests or other events (Kapur, 2018). Inquire about is required to get it any a relationship which will exist between the FC approach of instruction and academic performance as compared to a conventional classroom demonstration of instruction.

Pavanelli (2018) explained that the flipped classroom makes use of video technology to offer online seminars and classroom meetings with active learning activities. Before 2013, few empirical studies on the effectiveness of the FCA have been completed, despite its growing popularity (Bishop & Verleger, 2013). Though there is a research on the effect of fliiped approach on grades and students' achievement (Ferreri & O'Connor, 2013; Findlay-Thompson & Mombourquette, 2014; Haughton & Kelly, 2015), the evidence on the benefits of using the

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approach to improve academic performance is mixed (Findlay-Thompson & Mombourquette, 2014).

In a flipped classroom, technology and social media are used in addition to visual media to satisfy student needs and increase academic performance (Franciszkowics, 2009; Bergmann & Sams, 2012). Research on how FCA affects student learning outcomes, however, has led to contradictory findings. For instance, when flipped and traditional educational techniques were compared, certain studies (Davies et al., 2013) indicated minor variations in students' academic achievement; in other circumstances, however, FCA generate greater outcomes (Guy & Marquis, 2016).

However, numerous educators are restricted to flip the classrooms as this method is challenging compared to lecturing (O'Flaherty & Phillips, 2015; DeLozier & Rhodes, 2016). These challenges include: (1) low student motivation; (2) resistance from students to participate actively; (3) low literacy in terms of computer; (4) workload pressure for teachers in terms of locating, choosing, and creating instructional tasks; (5) limited duration; and (6) diversified cultures. Both material covering and the development of disciplinary habits of mind were successfully achieved by an FC using a student-centered instructional style. Moreover, the results supported that video lectures might enhance students' pleasure and learning experience (Kazanidis et al., 2018).

Marca and Longo (2017) assert that in order to facilitate collaboration and provide a flexible, personalized, and inclusive environment that can adapt to ongoing changes, the learning space must inspire students and encourage their learning activities. Cognitive abilities and teamwork are among the anticipated learning outcomes in the setting of higher education institutions. (Lang, 2017). The anticipated learning outcomes are therefore greatly influenced by the flipped learning mode. These days, technology is incorporated into workplaces and lifestyles, improving learning in the classroom and yielding better results (Salimi & Yousefzadeh, 2015). In addition, it was discovered that students in flipped classrooms felt greater nervousness about the online learning environment than their mixed course counterparts, who felt more satisfied, valuable, and capable of self-control (Korkmaz & Mirici, 2021).

Therefore, the goal of the flipped classroom strategy was to improve course administration efficiency while also raising student attendance and participation. Furthermore, the learning activities were designed to be interactive, adaptable (to accommodate different learning styles), collaborative, and provide students some latitude in selecting the subjects and information for their projects for both in-class and after-class activities. It was projected that major learning and evaluation methodologies would be redesigned to enhance student learning and encourage active knowledge construction (Awidi & Paynter, 2019).

Overall, the literature's insights show a consistent pattern and are encouraging. More precisely, the findings showed that students' cognitive learning outcomes increased significantly according to statistics when the FCA was incorporated into the teaching and learning process. Most of these types of insights have been documented in earlier publications (Aidinopoulou & Sampson, 2017;

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Kim et al., 2014; Tanner & Scott, 2015). As a result, this study offered supporting data to grow and strengthen this body of knowledge. Furthermore, further supporting the preliminary earlier findings (e.g., Kostaris et al., 2017); it was discovered that the students with the lowest performance levels reported the biggest performance gains. The fact that these results were obtained in a variety of subject areas suggests that the FCM may offer an efficient means of improving the performance of students who are having difficulty in "traditional," in-person educational contexts. This would assist educators in better meeting potential external accountability requirements while also assisting teachers in bettering the learning environments provided to students (Sergis et al., 2018).

There is limited focus of FCA in student's performance (Findlay-Thompson & Mombourquette, 2014). In order to encourage discussion and debate in the classroom, a teacher's position must shift from that of an authoritative figure to that of a facilitator and guide (Graziano, 2017). Another factor is that most of the focus of FCA has been on the tertiary level. There is no doubt that students of developing countries are also using and adopting technological environment frequently with technological devices or platforms. Thus, in the light of respective limited studies, following are the research question with research hypothesis to be answered in line with this purpose:

1. What is the effect of FCA on students' academic performance?
2. There is no statistically significant effect of FCA on students' academic performance.

Method

Research Design: The current study examines the flipped classroom strategy in Pakistani higher secondary schools in Lahore using a quasi-experimental research design. The administration did not allowed randomization; quasi experimental method was employed to take the groups as control and treatment groups in making comparison between them.

Sample: It was comprised of the first-year students studying the subject of 'Education' There were two groups of 30 to 40 students, intervention group received FCA treatment and control group received traditional pedagogical instruction. Both groups were from the same college and the intervention was carried out by the researcher. A random sample of pupils from the experimental class was chosen.

Instrumentation: Eight chapters from the 11th class subject of Education (BISE Lahore) were taught and used for instrumentation. First, both groups were participated in a pre-test. A post-test of both groups (intervention/control) was administered after a three month of intervention, focusing on the chapters that were taught. In addition, the test was framed using Bloom's revised taxonomy to see how it affects students' academic achievement. Pilot testing and expert opinion was used to insure the test's validity and reliability.

Students were given videoed instructions and other online connections to pertinent materials after being briefed on the topics in class. Homework was also assigned to the learners. The researcher's recorded lectures were shared with the students through cell phones. Students were provided with many links related to this topic (e.g., YouTube, Khan Academy, Sabak, etc.) for

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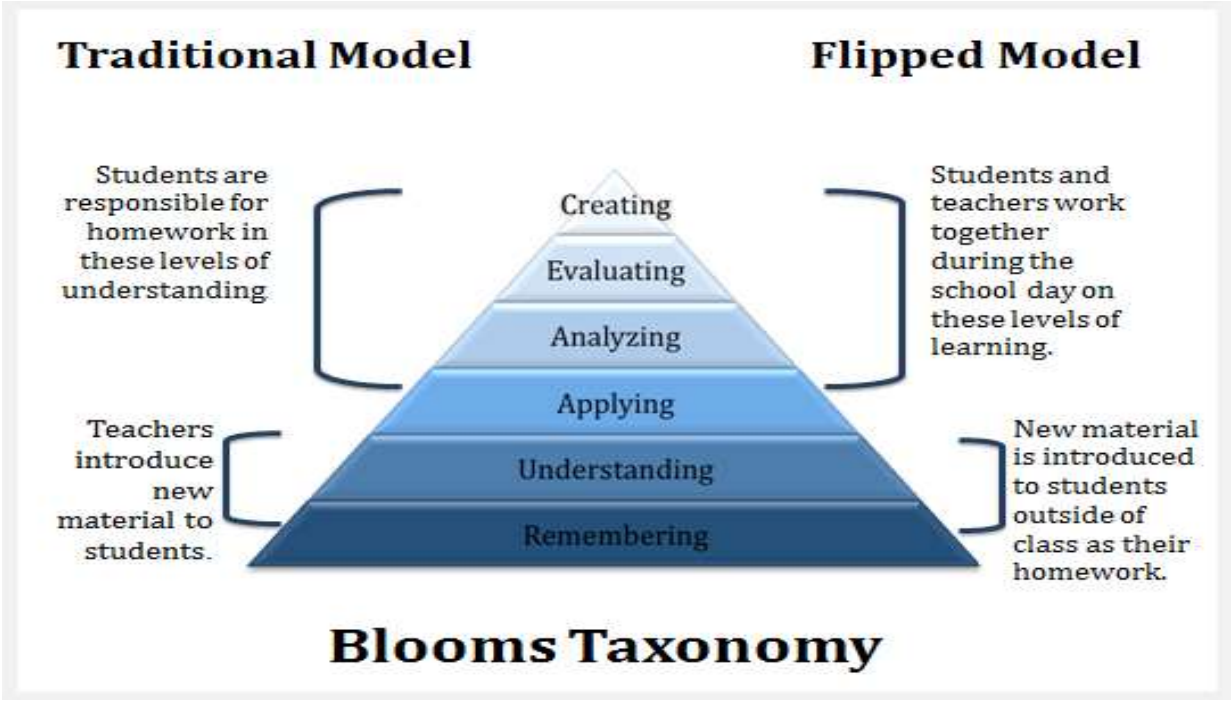
self-learning. Meanwhile, the researcher builds a WhatsApp group for students to ask questions and share other information. The treatment plan is presented in the following figure.



Data Collection: A hundred-mark test was produced in accordance with the guidelines set forth by the Board of Intermediate and Secondary Education (BISE), located in Lahore. Both objective and subjective question categories are used in this test. Because this is quasi-experimental research, data was gathered using tests that were reviewed by an impartial party (several colleagues were asked to review the tests in order to minimize researcher bias). Students were shown every checked paper to make sure the marking was accurate. In this work, ethical principles were given great consideration. The goal of ethical guidelines is to safeguard participants as well as researchers.

Data Analysis: For analysis, data from the intervention and control groups were imported into SPSS version 25. To analyze the data, descriptive and inferential statistics were applied. To determine the difference between the experiment and control groups on the post-test scores of Academic Achievements, Additional Analysis of Covariance (ANCOVA) was used.

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Results

Table 1.Summary of ANCOVA: Effect of Flipped classroom approach on students' Academic Achievement (MCQs)

Source	Type III SS	df	MS	F	Sig.	Partial η^2
Intercept	10383.40	1	10383.40	139.991	<.001	.528
Pre-Test Score (MCQs)	2569.10	1	2569.10	34.637	<.001	.217
Group (Intervention., Cont.)	22140.22	1	22140.22	298.499	<.001	.705
Error	9271.47	125	74.17			
Total	295021.00	128				

Note. Adjusted R^2=0.719, MCQs -Pre-Test Score as Covariate)

An analysis of covariance (ANCOVA) was used to check the impact of the flipped classroom approach on the aspect of students' CTS, specifically their post-test score of MCQs. The model comprised an intercept, pre-test score of MCQs as a covariate, and the group (experimental vs. control) as the independent variable. The main effects of the intercept (F(1, 125) = 139.991, p =.001, η2 =.528) and the pre-test score MCQs (F(1, 125) = 34.637, p =.001, η2 =.217) were both statistically significant. This suggests that the intercept and pre-test score of MCQs had a considerable impact on the students' post-test score of MCQs. Furthermore, the main impact of groups was significant (F (1, 125) = 298.499, p=.001, 2 =.705), indicated that the FCA significantly enhanced students' critical thinking skills when compared to control group. The estimated mean square of the error term was 74.17. The adjusted R-squared value was 0.719 for the model illustrate that it can explain roughly 13.9% of the variance in post-test score of MCQs. In summary, after controlling the influence of pretest scoring of MCQs, the ANCOVA results reveal that the significant effect of FCA on students' critical thinking skills, as demonstrated by their post-test score of MCQs.

Table 2.Summary of ANCOVA: Effect of Flipped classroom approach on students' Academic Achievement (Short Questions)

Source	Type III SS	Df	MS	F	Sig.	Partial η^2
Intercept	12113.02	1	12113.02	253.35	<.001	.670
Short Questions -Pre-Test Score	8.9	1	8.95	.18	.666	.001
Group (Exp., Cont.)	14445.57	1	14445.57	302.14	<.001	.707
Error	5976.39	125	47.81			
Total	375243.00	128				

Note. Adjusted R^2=0.703, Short Questions -Pre-Test Score as Covariate)

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ANCOVA was used to find out the impact of FCA on the aspect students' CTS (critical thinking skills), specifically their post-test score of 'Short Questions'. The model comprised an intercept, pre-test score of 'Short Questions' as a covariate, and the group (experimental vs. control) as the independent variable. The main effects of the intercept (F (1, 125) = 253.35, p =.001, η2 =.670) was statistically significant and the pre-test score of 'Short Questions' (F (1, 125) = .18, p =.666, η2 =.001) was not statistically significant. This suggests that the intercept score of 'Short Questions' had a considerable impact on the students' post-test score of 'Short Questions' and pre-test score of 'Short Questions' had not a considerable impact on the posttest scores of 'Short Questions'. Furthermore, main impact of groups was significant (F (1, 125) = 302.14, p =.001, η2 =.707), indicating that the FCA significantly effects on students' CTS when compared to the control group. The estimated mean square of the error term was 47.81. The adjusted R-squared model value was 0.703, indicates that it can explain roughly 13.9% of the variance in post test score of 'Short Questions'. In conclusion, the results of the ANCOVA suggest that the intercept and group variables had a significant impact on students' post-test score. However, the pre-test did not show significant effects on students' critical thinking skills, as measured by post-test score.

Table 3.Summary of ANCOVA: Effect of Flipped classroom approach on students' Academic Achievement (Long Questions)

Source	Type III SS	df	MS	F	Sig.	Partial η^2
Intercept	18252.38	1	18252.38	225.39	<.001	.643
Long Questions -Pre-Test Score	261.77	1	261.77	3.23	.075	.025
Group (Exp., Cont.)	4236.83	1	4236.83	52.32	<.001	.295
Error	10122.47	125	80.98			
Total	360513.81	128				

Note. Adjusted R^2=0.294, Long Questions -Pre-Test Score as Covariate)

ANCOVA was performed to check the impact of the FCA on the aspect students' CTS (critical thinking skills), specifically their post-test score of 'Long Questions'. The model comprised an intercept, pre-test score of 'Long Questions' as a covariate, and the group (experimental vs. control) as the independent variable. The main effects of the intercept (F (1, 125) = 225.39, p =.001, η2 =.643) was statistically significant and the pre-test score of 'Long Questions' (F(1, 125) = 3.23, p =.075, η2 =.025) was not statistically significant. This suggests that the intercept 'Long Questions' had a considerable impact on post-test score of 'Long Questions' and pre-test score had not a considerable impact on post-test score of 'Long Questions'. Furthermore, the group's main impact was significant (F (1, 125) = 52.32, p =.001, η2 =.295), indicating that the FCA had a significant effect on students' CTS when compared to the control group. The estimated mean square of the error term was 197.587. The value of adjusted R-squared for the model was 0.294, shows that it can explain roughly 13.9% of the variance in post-test score of 'Long Questions'. In summary, the results of the ANCOVA suggest that the intercept and group

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variables had a significant impact on students' post-test score. However, the pre-test did not show significant effects on students' critical thinking skills, as measured by post-test score

Table 4.Summary of Paired samples t-test for comparison pre-test and post-test scores on control group of Academic achievement

Achievement scores	Pre-test		Post-test		Paired Samples t-test		
	Mean	*SD*	*Mean*	*SD*	t-value	p-value	Effect size
MCQs	30.62	9.16	32.37	10.21	-1.95	0.055	0.18
Short Question	39.75	6.95	42.18	6.55	-1.93	0.058	0.36
Long Question	44.02	11.05	46.37	9.53	-1.67	0.100	0.23
Total	38.13	5.45	40.31	5.13	-3.16	0.002	0.41

Table 4 provides the summary of pre-test and the post-test for the achievement test of control group. There are 3 components of the test i.e. for the five aspect i.e. MCQs, Short Question, and Long Question. Moreover, the summary of total score has been also given. The table shows the score of 'MCQs' in pretest as (M=30.62, SD=9.16) and for posttest (M=32.37, SD=10.21) for t(1.95) and P=0.055 and effect size= 0.18. The table indicate the score of 'Short Questions' in pretest as (M=39.75, SD=6.95) and for posttest (M=42.18, SD=6.55) for t(1.93) and P=0.058 and effect size= 0.36. The table indicate the score of 'Long Questions' in pretest as (M=44.02, SD=11.05) and for posttest (M=46.37, SD=9.53) for t(1.67), P=0.100 and effect size= 0.23. The table indicate the total score in pretest as (M=38.13, SD=5.45) and for posttest (M=40.31, SD=5.13) for t(3.16), P= 0.002 and effect size= 0.41. It can be found that statistical difference found in the mean values of total score of pre and post-test of the control group as $P \leq 0.05$. There is no statistical difference was significant in MCQs, Short Questions, and Long Questions as $P \leq 0.05$.

Table 5.Summary of Paired samples t-test for comparison pre-test and post-test scores on Experimental group of Academic achievement

Achievement scores	Pre-test		Post-test		Paired Samples t-test		
	Mean	*SD*	*Mean*	*SD*	t-value	p-value	Effect size
MCQs	30.08	9.57	58.43	9.13	18.80	<.001	3.03
Short Question	39.99	8.47	63.44	7.23	18.34	<.001	2.99
Long Question	43.28	12.23	57.79	8.58	7.40	<.001	1.39
Total	37.78	8.23	59.89	6.03	17.87	<.001	3.10

Table 5 provides the summary of pre-test and the post-test for the achievement test of treatment group. There are 3 components of the test i.e. for the five aspect i.e. MCQs, Short Question, and Long Question. Moreover, the summary of total score has been also given. The table shows the

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score of 'MCQs' in pretest as (M=30.08, SD=9.57) and for posttest (M=58.43, SD=9.13) for t(N-1)= 18.80 and P=0.001 and effect size= 3.03. The table indicate the score of 'Short Questions' in pretest as (M=39.99, SD=8.47) and for posttest (M=63.44, SD=7.23) for t(N-1)= 18.34, P=0.001 and effect size= 2.99. The table indicate the score of 'Long Questions' in pretest as (M=43.28, SD=12.23) and for posttest (M=57.79, SD=8.58) for t(N-1)= 7.40, P=0.001and effect size= 1.39. The table indicate the total score in pretest as (M=37.78, SD=8.23) and for posttest (M=59.89, SD=6.03) for t(N-1)= 17.87, P=.001 and effect size= 3.10. This show that there is a statistically significant difference (P≤0.05) between the mean scores of all components exists in experimental group's overall pre- and post-test scores.

Table 6. Summary of Independent sample t-test for comparison experiment and control groups on pre-test of Academic achievement

Achievement scores	Experiment		Control		Independent samples t-test		
	Mean	*SD*	*Mean*	*SD*	t-value	p-value	Effect size
MCQs	30.08	9.57	30.62	9.16	0.324	0.747	0.06
Short Question	39.99	8.47	39.75	6.95	0.171	0.865	0.03
Long Question	43.28	12.23	44.02	11.05	0.361	0.718	0.06
Total	37.78	8.23	38.13	5.45	0.284	0.777	0.05

The achievement test scores for the experimental and control groups are summarized in Table 6. There are 3 components of the test i.e. MCQs, Short Question, and Long Question Moreover, the summary of total scores has also been given. It has been shown that treatment groups' scores for the component 'MCQs' as (M=30.08, SD= 9.57) and the score of the control group (M=30.62, 9.16) for t (N-2) = 0.324, P= .747 and effect size= 0.06. It has been shown that treatment groups' scores for the component 'Short Questions' as (M=39.99, SD= 8.47) and the score of the control group (M=39.75, 6.95) for t (N-2) =0.171, P= 0.865 and effect size= 0.03. It has been shown that the scores of the experimental group in the component 'Long Questions' as (M=43.28, SD= 12.23) and the score of the control group (M=44.02, 11.05) for t (N-2) =0.361, P= 0.718 and effect size= 0.06. It has been shown that the scores of the treatment group in the total score as (M=37.78, SD= 8.23) and the score of the control group (M=38.13, 5.45) for t (N-2) = 0.284, P= .777 and effect size= 0.05. Based on the given data, it can be concluded that there is no significant statistical difference between the experimental group's and the control group's mean pretest scores (P≤0.05).

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Table 7.Summary of Independent sample t-test for comparison experiment and control groups on post-test of Academic achievement

Achievement scores	Experiment		Control		Independent samples t-test		
	Mean	*SD*	*Mean*	*SD*	t-value	p-value	Effect size
MCQs	58.43	9.13	32.37	10.21	15.205	<.001	2.69
Short Question	63.44	7.23	42.18	6.55	17.447	<.001	3.09
Long Question	57.79	8.58	46.37	9.53	7.116	<.001	1.26
Total	59.89	6.03	40.31	5.13	19.811	<.001	3.51

Table 7 provides control and the experimental group summary about mean scores' achievement test in the post-test. There are 3 components of the test i.e. MCQs, Short Question, and Long Question Moreover, the summary of total scores has also been given. It has been shown that the experimental group scores in the component 'MCQs' as (M=58.43, SD= 9.13) and the score of the control group (M=32.37, 10.21) for t (N-2) = 15.205, P= .001 and effect size= 2.69. It has been shown that the experimental group scores in the component 'Short Questions' as (M=63.44, SD= 7.23) and the score of the control group (M=42.18, 6.55) for t (N-2) = 17.447, P= 0.001 and effect size= 3.09. It has been shown that the experimental group scores in the component 'Long Questions' as (M=57.79, SD= 8.58) and the score of the control group (M=46.37, 9.53) for t (N-2) = 7.116, P= .001 and effect size= 1.26. It has been shown that the scores of the experimental group in the total score as (M=59.89, SD= 6.03) and the score of the control group (M=40.31, 5.13) for t (N-2) = 19.811, P= .001 and effect size= 3.51. It indicates that there is a statistically significant difference between the control and experimental groups' post-test results, with P≤0.05 for the overall score and mean scores of each component.

Table 8.Summary of ANCOVA: Effect of Flipped classroom approach on students' Academic Achievement (Total Score)

Source	Type III SS	df	MS	F	Sig.	Partial η^2
Intercept	7799.62	1	7799.62	259.33	<.001	.675
Total-Pre-Test score	178.11	1	178.11	5.92	.016	.045
Group (Exp., Cont.)	12332.40	1	12332.4	410.05	<.001	.766
Error	3759.47	125	30.08			
Total	335486.72	128				

Note. Adjusted R^2=0.764, Total-Pre-Test score as covariate)

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ANCOVA was performed to investigate the impact of the FCA on the aspect students' CTS (critical thinking skills), specifically their posttest 'Total Score'. The model comprised an intercept, pre-test 'Total Score' as a covariate, and the group (experimental vs. control) as the independent variable. The main impacts of the intercept ($F(1, 125) = 259.33$, $p = 0.001$, $\eta 2 = 0.675$) and the 'Total Score' in pre-test ($F(1, 125) = 5.92$, $p = 0.016$, $\eta 2 = .045$) were both statistically significant. This suggests that the intercept and pre-test 'Total Score' had a considerable impact on the students' 'Total Score' in the post-test. Furthermore, the group's main impact was significant ($F(1, 125) = 410.05$, $p = 0.001$, $\eta 2 = 0.766$), indicating that the FCA had a significant effect on students' CTS when compared to control group. The estimated mean square of the error term was 30.08. The adjusted value of R-squared for this model was 0.764, indicating that the model can explain roughly 13.9% of the variance of 'Total Score' in the post-test. In conclusion, the ANCOVA results show that the FCA had significant impact on students' CTS, as evidenced by their "Total Score" in the post-test, even after adjusting for the influence of the pre-test and post-test scores.

Table 9.Summary of Independent sample t-test for comparison experiment and control groups on Academic achievement test conducted at Board of Intermediate and Secondary Education Lahore (BISE)

	Experiment		Control		Independent samples t-test		
BISE	*Mean*	*SD*	*Mean*	*SD*	t-value	p-value	Effect size
1st years results	59.03	14.99	46.23	15.92	4.680	<.001	0.83

Academic achievement scores summary given by table 9 for both groups. The scores of academic achievement were declared by the board of intermediate and secondary education. The table shows that experimental group scores (M= 59.03, SD= 14.99) and control group (M= 46.23, SD= 15.92) for t (4.680), and P= 0.001 and effect size= 0.83. It can be found that a significant difference as P<.005. Moreover, value of effect size also indicted a high effect size.

Discussion: The discussion section provides an in-depth interpretation of the findings and their broader implications. The results of the study provide insightful information on the research concerns and theories pertaining to how the FCA influences students' AP (academic performance).

Results of this study strongly refute Hypothesis 1. The analysis of students' academic performance, as assessed through a variety of measures, consistently demonstrates the positivity to flipped classroom approach. In Table 9, where academic achievement scores from the Board of Intermediate and Secondary Education Lahore (BISE) are compared, the treatment group outperforms then the traditional group. The substantial effect size of 0.83 suggests a practical significance, highlighting the difference in academic achievement between both groups. Additionally, throughout Tables 1 to 8, which evaluate academic performance through different

components such as MCQs, Short Questions, and Long Questions, the flipped classroom approach consistently leads to substantial improvements in students' academic achievement. These results provide compelling evidence in favor of the hypothesis that students' academic performance is positively and statistically significantly impacted by the FCA.

Conclusion: The present study examines the effect of the FCA on students' AP (academic performance). The findings, as discussed in the preceding sections, provide compelling evidence of the positive influence of such innovative method.

Contrarily, initial hypothesis that posited no statistically significant effect of the FCA on academic performance of students, the results overwhelmingly support the conclusion that the FCA significantly enhances students' learning. This was evident across various assessment components, including Multiple Choice Questions (MCQs), Short Questions, and Long Questions. The treatment group consistently outperformed and effect sizes were substantial. Notably, the flipped classroom approach maintained its impact even after controlling for pre-test scores, suggesting that it is an effective strategy for improving academic performance.

The results academic achievement scores (BISES Lahore) emphasize on the innovation of FCA. The intervention group achieved highest academic scores, as evident by a significant t-value. It highlights the potential significance of the FCA on students' learning outcomes and the practical importance of their performance.

Recommendation

On the basis of the research analysis, the present study recommends some future implications to implements FCA to improve students' academic performance.

1. All public and private institutes must foster the learning under the paradigm of flipped classroom approach.
2. The online component should be structurally managed through flipped classroom model.
3. Give training workshops to students that help them to navigate the online content efficiently.
4. Develop clear assessment system that allows students to receive constructive feedback on their work.
5. Consider students' level of prior knowledge before implementing the flipped classroom model.
6. The technological infrastructure should be practically supported in terms of flipped model.

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