



The Influence of Learning Styles and Attitudes on Academic Performance of College Students in a Flipped Learning Environment

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This study looks into how flipped classrooms affect college students with different kinds of learning styles, attitudes, and academic performance. The purpose of the study is to provide empirical support for the effectiveness of the flipped classroom model in accommodating a variety of learning styles. Survey questionnaires and midterm grades of students were used as instruments for data analysis on 85 participants in a state university in the Philippines. Statistical tools such as frequency counts, percentages, mean, standard deviation, Kruskal-Wallis test, and Kendall's tau-b were employed for a comprehensive analysis. The data analysis revealed that a majority of respondents identified as auditory learners, expressing agreement with the flipped classroom model and demonstrating excellent performance within this learning environment. Significantly, the positive attitude and excellent performance exhibited no significant differences across various learning styles. Clear evidence emerged indicating that a positive attitude toward the flipped classroom correlated with exceptional academic achievements. Consequently, the study implies that the flipped classroom proves effective in catering to diverse learning styles while maintaining students' excellent academic performance. Furthermore, it could be concluded that their positive attitude in a flipped classroom model have boosted their academic performance in general. Understanding the connection between students' attitudes toward particular pedagogical approaches and their academic performance offers important insights that can greatly enhance the processes of teaching and learning, resulting in better educational outcomes fostering a positive learning environment.

Keywords: Flipped learning, learning styles, learning attitudes, academic performance, college students

INTRODUCTION

In the fast-paced, ever-evolving landscape of education, the flipped classroom model proves to be highly successful in reshaping the traditional teaching and learning experience through fostering increased interaction between the teachers and students (Critz & Knight, 2013; Moffett, 2015). As a matter of fact, 96.1% of students expressed satisfaction with the implementation of this method in the classroom (Tica et al., 2021) and even recommended it for their professors to use (Calimeris, 2018). Indeed, the

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flipped classroom has been found to be one of the most preferred approaches by students and faculty in various disciplines (Gilboy et al., 2015).

The concept of flipped classroom is certainly the reversal of the lecture sequence in a traditional teaching-learning process. Students engage with reading and video materials before class and use in-class time for interactive discussions and collaborative learning (Subramaniam & Muniandy, 2016; Gilboy et al., 2015; Straw et al., 2016; Sravat & Pathranarakul, 2022). Furthermore, it is a learner-centered approach that combines traditional teaching with innovative methods to promote problem-solving skills, collaboration, and the integration of digital technologies (Cong, 2019; Lin-xia, 2015; Zhao & Kang, 2020; Wasserman et al., 2017; Seery, 2015; Moffett, 2015). In a nutshell, flipped learning's intention is to seamlessly integrate student learning across contexts by allowing teachers to utilize face-to-face time for deeper learning support, resulting in more effective student engagement and improved teaching outcomes (Sharma et al., 2015; González-Gómez et al., 2016; Hwang et al., 2015).

In recent years, researchers have shown an increased interest in flipped classrooms. They consistently found that students in flipped classrooms demonstrated increased engagement and greater overall satisfaction compared to traditional teaching methods, highlighting the efficacy of the flipped classroom approach in improving academic performance and retention rates (Calimeris, 2018; Blázquez et al., 2019; Sarker et al., 2023; Cilli-Turner, 2015; Miedany et al., 2017). Furthermore, using this approach to educate students showed evidence of improved self-directed learning ability, critical thinking disposition, learning motivation, engagement, and test scores than those who are in the traditional classroom (Jung & 允, 2017; Martínez-Jiménez & Ruiz-Jiménez, 2020; Alsadoon, 2016; Ozudogru & Aksu, 2019; Calimeris & Sauer, 2014). The implementation of a flipped classroom approach, characterized by a positive learning experience, higher engagement, and improved involvement in self-directed learning activities, meets students' self-determination needs, leading to better satisfaction, self-efficacy, and motivation, while concurrently enhancing overall learning and teaching activities with lower stress and anxiety levels related to homework and learning (Alamri, 2019; Sergis et al., 2018; Khaolok & Chaiyasung, 2022; Fisher et al., 2018; Steen-Utheim & Foldnes, 2018; Hernández-Nanclares & Pérez-Rodríguez, 2016; Roshan, 2015; Kunitak, 2018; El-Miedany et al., 2018; Hew et al., 2021).

In the success of its implementation, there is evidence showing that learning styles play a crucial role in regulating the effectiveness and adaptability of the chosen instructional methods, ultimately influencing the overall learning outcomes (Evans & Kozhevnikov, 2016; Mariono, 2018; Neto & Gomes, 2016; Rasheed & Wahid, 2018). Various researchers have asserted the value of understanding and considering individual learning styles as essential in shaping educational outcomes, influencing academic achievements, and contributing to the overall quality of education. They emphasized the crucial role of learning styles in designing adaptive learning systems that effectively cater to individual learner preferences, fostering self-regulation of learning strategies for optimal educational impact (Ivana & Ivan, 2018; Rasheed & Wahid, 2018; Waladi et al., 2021; Lawson, 2018). For instance, the effect of learning styles on flipped

classroom adoption is evident in the positive reception by students with a theoretical learning style and lower perception among those with a reflective style (Rahman et al., 2014; Fornons et al., 2021). Moreover, the 10% higher performance of logical learners in a flipped classroom emphasizes the importance of aligning instructional content with individual learning styles for optimal outcomes (Nwokeji & Holmes, 2017; Gunawardena & Liyanage, 2018). Certainly, understanding learning styles facilitates increased self-awareness for both students and educators, shedding light on individual strengths and weaknesses as learners, ultimately impacting the effectiveness and adaptability of instructional methods (Feldman et al., 2015). The critical role of learning styles in regulating instructional effectiveness becomes apparent, particularly when considering variations in learning outcomes (Mariono, 2018). Identifying and tailoring instructional methods to individual preferences, such as visual, auditory, or kinesthetic styles, ensures their effectiveness and adaptability, fostering a more personalized and engaging learning experience (Ahmadi, 2018). Aligning instructional approaches with students' cognitive styles not only enhances learning performance but also contributes to a more positive emotional experience in the learning process (Huang et al., 2018).

However, research has consistently shown that there is a lack of empirical evidence or scientific support for the effectiveness of adapting the flipped classroom in higher education to students' learning styles (Neto & Gomes, 2016). While there is a belief in the positive impact of aligning teaching with learning styles, previous studies highlighted the absence of concrete scientific evidence to back up this practice. A good example of this can be found in the article by Evans and Kozhevnikov (2016), who pointed out that "learning styles have the capacity to influence instruction, but their effectiveness remains under-explored." Newton, Salvi (2020), and Mia (2017) also reported that there is currently no empirical evidence supporting the idea that matching the instruction to learners' learning styles can improve their learning performance. Even the textbooks do not have any recommendations regarding the matching of instructional methods with learning styles, yet teachers still believe that aligning the teaching approach with learning styles improves student learning experiences (Wininger et al., 2019). To date, most of the work carried out on the flipped classroom, learning styles, attitude, and academic performance lacks compelling evidence of clarity and congruities regarding its effectiveness to improve students' learning outcomes and satisfaction compared to traditional teaching methods (Lo & Hew, 2017; Alten et al., 2019; Betihavas et al., 2016; Vangka et al., 2019; Goedhart et al., 2019; Evans, 2018). This indicates a need for further investigation and understanding of how learning styles could influence the attitude and academic performance of students in a flipped classroom learning environment. Besides, very few studies in the recent decade have attempted to determine the effectiveness of this approach in a higher education context (Hew et al., 2021; McNally et al., 2017; Goedhart, 2019; Neto & Gomes, 2016). Several published studies acknowledged that they were context-specific and used limited samples (Tan et al., 2015; Kurtz et al., 2014). Furthermore, there were contradicting findings, such as those of Gilboy et al. (2015) and Güvenç (2018), regarding their experience with flipped classrooms. Moreover, previous reports only presented the satisfaction ratings of students on the implementation of a flipped classroom but not on its outcomes, such as grades of students in higher education institutions (Webb et al.,

2021; Gilboy et al., 2015), and the process of implementing it (Betihavas et al., 2016) is still inadequate. Hence, this indicates a need to understand the effectiveness of a flipped classroom for college students.

Thus, this study aims to determine the influence of the flipped classroom model on college students with different kinds of learning styles, attitudes, and academic performance. Assessing its effectiveness across various learning styles is crucial for gaining insights into how this teaching approach caters to diverse student needs and informing educators about the potential benefits and challenges. Understanding its impact on students' attitudes and academic achievement helps refine instructional strategies, fostering a more inclusive and tailored learning environment. The primary aim of this paper is to provide empirical evidence that contributes substantial insights into the evolving landscape of flipped classroom pedagogy. This study further attempts to reconcile the conflicting findings regarding the implementation process, learners' satisfaction, and overall academic performance.

METHOD

This quantitative type of researcher used the descriptive research design as an approach to carry out this study to ensure that the manner of collecting the data is well-organized, valid, and capable of answering the research questions and testing hypotheses effectively. Researchers use descriptive research design if the aim of the study is to merely describe and interpret the phenomena, such as conditions, relationships, opinions, ongoing processes, results, and effects, without treatment or control (Linarwati et al., 2016). In the context of this study, the researcher administered a survey questionnaire to determine the attitude and performance of students exposed to a flipped classroom environment. With the guiding principle of this design, it was guaranteed that the manner of data collection to gain favorable insights in comparing the various experiences of students under the flipped classroom methodology was correct and much more appropriate to use.

Moreover, the research study was conducted during the first semester of the 2023–2024 academic year at a State University located in Negros Occidental, Philippines. This period was selected to coincide with the course offerings (methods of research) in the two undergraduate programs at the two colleges. The data collection spanned from January 15 to March 22, 2024, encompassing 18 days of exposure or twice a week of regular class. During this period, there were fewer non-academic and academic-related activities that students needed to attend; no disruption of classes happened because of the fair weather; and there were fewer holidays. Therefore, students could focus on their studies, and the implementation of a flipped classroom is spontaneous as there is no need to modify the modality. In addition, participants were selected using a stratified sampling method, resulting in a sample size of 85 generated through an online randomizer from a population of 134. The researcher, acknowledging the importance of equal representation, opted to stratify the selection of respondents into four classes. This approach ensures a balanced and representative sample across different sections. Additionally, the researcher prioritized the safety and ethical considerations of the participants.

The instrument used in this study, the Learning Style Questionnaire from the University of Texas Learning Center (2006), has been widely validated in prior research. Notably, it was also utilized by Azhari et al. (2020), Alkooheji and Al-Hattami (2018), and Cavite and Gonzaga (2023) in their respective studies. This consistent application across various studies reinforces the reliability and credibility of the questionnaire in assessing learning styles, which is why the present researcher chose to use this instrument. Three learning styles, namely auditory, kinesthetic, and visual, were identified. The tool consisted of twenty-four statements, equally distributed among the three learning style preferences. Questions 2, 3, 7, 10, 14, 16, 19, and 22 were tailored for visual learners, while questions 1, 5, 8, 11, 13, 18, 21, and 24 were designed for auditory learners. Questions 4, 6, 9, 12, 15, 17, 20, and 23 were specific to tactile or kinesthetic learners. To measure the attitudes of students of open education towards the flipped classroom strategy, the researcher used the instrument of Aburayash (2021), which is composed of 24 statements that solicited students' attitudes towards the use of the flipped classroom approach in their course and self-assessment of their learning styles. The midterm exam results of the students were used as a measure of their academic performance.

Consequently, the researcher took measures to guarantee that participation in the study was entirely voluntary, emphasizing the importance of participants willingly choosing to be involved. This ethical stance aligns with the researcher's commitment to conducting a study that respects the autonomy and well-being of each participant from the very beginning. After which, the data gathering activity commenced from January 8 to 12, 2024. After collecting the data from the participants, the researcher analyzed it using both descriptive and inferential statistics such as frequency counts, percentages, mean, standard deviation, Kruskal-Wallis test, and Kendall's tau-b to summarize, present, draw conclusions, and generalize the findings from a sample to a larger population to make informed decisions.

FINDINGS AND DISCUSSION

Table 1
Learning styles of the students

Learning Styles	Frequency	Percentage
Visual	36	42.4
Auditory	40	47.0
Kinesthetics	9	10.6
Total	85	100

Table 1 shows the distribution of the students who participated in this study in the three categories of learning styles presented using frequency and percentage distribution as its statistical tools. As shown in Table 1, auditory learners have the highest frequency count of 40, or 47%, followed by visual learners (36, or 42.4%) and kinesthetics (9, or 10.6%), respectively. This distribution suggests a predominant preference for auditory learning among the participants. A closer inspection of the table reveals additional insights into the variety of learning styles among the students, providing a foundation for further analysis and discussion on the effect of these preferences on educational outcomes or the use of instructional strategies, such as flipped classrooms, by teachers.

Furthermore, the findings of this study indicate that more students prefer to process information primarily through listening and speaking. However, it's important to note that while some students may have a dominant learning style, individuals often have a mix of preferences, and varied instructional methods can still be beneficial for a comprehensive learning experience.

Prior studies that have noted the importance of studying the concept of learning styles are essential for educators as they help them tailor their teaching methods to the preferences and strengths of individual learners. Learning styles play an important role in adaptive e-learning systems, affecting students' motivation and performance (Karagiannis & Satratzemi, 2018). Understanding this could also help teachers design flexible and more inclusive learning environments that may address issues about how students retain information that they learn for a longer time and improve understanding of the concepts (Rasheed & Wahid, 2021). Further, by recognizing and leveraging various learning styles, educators can optimize learning environments, promoting engagement and active participation among students (Padmanabha, 2020; Dantas & Cunha, 2020; Dinsmore et al., 2022). Furthermore, aligning teaching methods with learning styles contributes to improved student outcomes and allows for a more nuanced approach to curriculum design. Additionally, the concept of learning styles serves as a catalyst for ongoing professional development among educators, encouraging a reflective and adaptive approach to teaching. Ultimately, studying learning styles contributes to the continuous improvement of educational practices, emphasizing the importance of catering to diverse learning preferences and empowering students to take an active role in their education (Oelszlaeger-Kosturek, 2021).

Table 2
Attitudes of students on flipped classroom

Statements	M	SD	Interpretation
1. I feel comfortable in the class meetings where the inverted class strategy is applied.	3.616	1.097	Agree
2. Preparing my pre-course material according to a flipped class strategy helped me understand the course topics well.	3.709	0.906	Agree
3. I feel the pleasure of learning when submitting scientific material according to a flipped class strategy	3.488	0.930	Agree
4. I feel the scientific benefit of understanding the content of a science subject when introducing an inverted classroom strategy rather than memorizing it.	3.581	0.988	Agree
5. Learning with an inverted classroom strategy gave me the opportunity to self-learn.	4.035	0.913	Agree
6. Learning with the inverted classroom strategy gave me the opportunity to engage with technology.	3.942	0.938	Agree
7. I found it easy to answer all my papers LMS For courses that use the inverted class strategy.	3.547	0.954	Agree
8. I feel fun in class meetings that implement the inverted class strategy.	3.767	0.942	Agree
9. I found that learning in an inverted classroom strategy requires more effort.	3.698	0.921	Agree
10. I feel that learning in an inverted classroom strategy has changed my attitudes toward my studies.	3.884	0.926	Agree
11. The activities given to us helped me in understanding the subject.	3.430	0.965	Agree
12. Whatever was said about teaching inverted classroom strategy, it increased my motivation to learn.	3.802	1.015	Agree
13. I feel that teaching inverted classroom strategy corresponds to my needs for the digital world.	3.674	0.926	Agree
14. Learning in the inverted class strategy contributed to increasing interaction with my teacher.	3.616	0.870	Agree
15. I take responsibility for learning in the inverted classroom strategy.	3.733	1.034	Agree
16. Through inverted classroom strategy, I found an answer to all questions related to the decisions that employ this strategy.	3.744	1.008	Agree
17. Learning in an inverted classroom strategy helped me increase my outreach and interactivity with my colleagues.	3.814	0.939	Agree
18. Learning in an inverted classroom strategy helped me increase contact with the university's faculty.	3.640	0.932	Agree
19. I see a Flipped class strategy as essential for all teachers.	3.814	0.988	Agree
20. Classroom encounters are preferred in which an inverted classroom strategy is employed.	3.709	0.919	Agree
21. The Inverted Classroom Strategy helped me to develop research and survey skills.	3.698	1.041	Agree
22. The Inverted Classroom Strategy helped me to follow the courses in different ways.	3.779	1.034	Agree
23. The inverted classroom strategy makes me exhausted.	3.221	1.011	Neutral
24. The flipped classroom strategy increased my understanding of the scientific content of the course.	3.779	0.913	Agree
Grand Mean	3.697	0.055	Agree

Table 2 presents the summary statistics of the students' attitude toward the flipped classroom, analyzed using the mean and standard deviation as its statistical tools. Looking at the second table, it is apparent that most of the students are in agreement that the flipped classroom gave them the opportunity to self-learn ($M = 4.035$; $SD = 0.913$), engage with technology ($M = 3.942$; $SD = 0.938$), increase their outreach and interactivity with their colleagues ($M = 3.814$; $SD = 0.988$), and most importantly,

change my attitudes toward my studies ($M = 3.884$; $SD = 0.926$). What is more interesting about the data in this table is that the respondents were neutral if the flipped classroom strategy made them exhausted ($M = 3.221$, $SD = 1.011$). The results of this study imply positive perceptions among the students regarding the flipped classroom approach. These findings indicate that the students found value in the flipped classroom model for fostering independent learning, leveraging technology, and promoting collaboration among peers. The findings also elucidate a balanced perception regarding the potential challenges or demands associated with this instructional approach.

These results match those observed in earlier studies regarding the interconnected factors that play pivotal roles in shaping students' educational experiences. Having a positive attitude among students heightens the engagement of their hippocampal learning-memory system and the adoption of efficient memory-based strategies, demonstrating the complex relationship between attitude and cognitive processes (Chen et al., 2018), while having a negative attitude could detrimentally affect their proficiency and interactions with their teachers, resulting in disobedience, aversion to assignments, and low academic achievement (Habók & Magyar, 2018; Ali, 2019; Maison, 2021). This also accords with the earlier observations, which showed that student interaction with their colleagues contributes positively to their attitudes towards learning, emphasizing the significance of collaboration and dialogue (Diez-Palomar et al., 2020). Overall, the positive attitudes toward various aspects of the flipped classroom underscore its perceived benefits and effectiveness in facilitating student learning and engagement. A possible explanation for this might be that the positive attitudes of the students towards the flipped classroom were influenced by the perceived usefulness and ease of the approach, which led to their intentions to embrace this as an instructional strategy to educate them (Buabeng-Andoh, 2020).

Table 3
Academic performance of students in a flipped classroom environment

Learning Style	Mean	SD	Minimum	Maximum	Interpretation
Visual	90	3.833	80	96	Excellent
Auditory	89	3.098	82	95	Excellent
Kinesthetics	91	3.257	86	95	Excellent
Total	89	3.473	80	96	Excellent

Table 3 provides the summary statistics for the academic performance of the students in a flipped classroom environment. As can be seen from the table above, it is apparent that visual ($M = 90$; $SD = 3.833$), auditory ($M = 89$; $SD = 3.098$), and kinesthetic ($M = 91$; $SD = 3.257$) had excellent performance. A closer look into the results, as shown in Table 3, indicates that the minimum grade earned by one student in this learning environment was 80 and the highest was 96. These learners were both categorized as visual learners. Yet, collectively, the 85 students who were categorized into three learning styles had performed excellently ($M = 89$; $SD = 3.473$). Thus, the excellent academic performance of these students across visual, auditory, and kinesthetic learning styles in the flipped classroom environment implies that this instructional approach caters effectively to diverse learning preferences. The findings manifest that the flipped classroom model, with its emphasis on self-directed learning and varied instructional

materials, provides a conducive environment for students with different learning styles to excel academically. Perhaps adopting flipped classroom strategies will contribute to fostering a positive and inclusive learning environment that enhances academic achievement for a broad spectrum of learners.

Measuring the academic performance of students following an intervention is a critical aspect of assessing the effectiveness of educational strategies. According to Westphale et al. (2021), Marwaha et al. (2021), and Chico and Montaña (2022), assessing changes in academic performance enables educators to determine the effectiveness of an intervention in their teaching approaches. This process involves, but is not limited to, the measurement of learning gains, aiding in the identification of specific student characteristics, and providing valuable insights for instructional adjustments (Rogaten & Rienties, 2018). Also, monitoring the academic performance of students could help improve teaching pedagogies, teaching skills, media of instruction, selecting learning materials, and time (Hannum, 2021; Yang & Li, 2018). It even helps teachers identify students who are at risk of failure (Bujang, 2023). Measuring academic performance is vital for student well-being, psychological development, and socio-emotional development (Moore, 2019).

Table 4
Difference on students' attitude when grouped according to learning styles

Learning Style	N	Mean Rank	H	Df	p	Conclusion
Visual	36	43.54	0.948	2	.622	Not significant
Auditory	40	41.00				
Kinesthetics	9	49.72				
Total	85					

.05 level of Significance

Table 4 presents a comparison of student attitudes towards the flipped classroom, categorized based on their learning styles. The results indicate that those kinesthetics learners (MR = 49.72) had a relatively higher preference for using this approach in teaching, while visual learners (MR = 43.54) and auditory learners (MR = 41.00) had a moderate and potentially lesser preference for this. Surprisingly, based on the available data and the chosen significance level, there is not enough evidence to assert that the observed differences in attitudes among students with various learning styles are statistically significant ($H = 0.948$; $p = .622$). Thus, the researcher did not find sufficient evidence to reject the null hypothesis based on the data and the chosen significance level.

The statement suggests that the observed differences in attitudes among students with various learning styles, as indicated by their preferences for the flipped classroom teaching approach, may not be attributed to any meaningful or significant impact of the teaching method. Instead, these differences could be the result of random chance or other factors that are not statistically significant. Therefore, the findings suggest that any variations in attitudes observed could be incidental and not necessarily linked to a substantial effect of the teaching approach on students with different learning styles. This suggests that the flipped classroom model can be broadly effective across diverse learning preferences without disproportionately benefiting or disadvantaging any

particular group. Consequently, educators and institutions can confidently adopt and integrate the flipped classroom approach, knowing it supports a wide range of learners. Overall, the flipped classroom appears to be a versatile and inclusive pedagogical strategy.

Other studies have also reported mixed results regarding the association of learning styles and attitudes towards a certain teaching pedagogy. Yet, this finding is consistent with that of Anuar et al. (2020), who found that there was no association between learning styles and attitudes towards a certain instructional pedagogy. In the study, they highlighted that it is possible that factors other than learning styles, such as students' motivation or individual differences, may have a stronger influence on students' attitudes and academic performance. This also accords with earlier observations by Naenah (2022), which showed that no significant correlation was determined between learning styles and academic achievements among ESL students. The researcher has associated it with its small sample size of 32 students in order to detect significant relationships. Other factors, such as individual differences in language proficiency or motivation, may have had a stronger influence on attitude and academic performance than learning styles.

The practical implication of these research findings is that, regardless of students' diverse learning styles, there is a unanimous agreement that the flipped classroom approach is effective and beneficial for students. The lack of a significant difference across the three learning styles suggests a consistent positive perception of the flipped classroom method among students, regardless of whether they are visual learners, auditory learners, or kinesthetic learners. This implies that educators can confidently consider implementing the flipped classroom model as a teaching strategy, knowing that it is likely to be well-received and perceived as effective by a broad range of students with varying learning preferences. It emphasizes the versatility and applicability of the flipped classroom approach, making it a potentially valuable instructional method for fostering positive learning experiences across diverse student populations.

Table 5
Difference on the academic performance when grouped according to learning styles

Learning Style	N	MR	H	Df	p	Conclusion
Visual	36	44.64	3.25	2	0.197	Not significant
Auditory	40	38.93				
Kinesthetics	9	54.56				
Total	85					

.05 level of Significance

Table 5 presents the result of the Kruskal-Wallis H test conducted to assess the difference in academic performance among different learning styles. A closer inspection of the table shows that there was a statistical variation in terms of the mean ranks of visual learners (44.64), auditory learners (38.93), and kinesthetic learners (54.56). However, despite these differences, the findings from the Kruskal-Wallis H test revealed a non-significant result ($H = 3.25$; $p > 0.05$), indicating that there is no statistically significant difference in the student's academic performance among the three learning styles. Therefore, the study failed to reject the null hypothesis, suggesting

that students' academic performance does not vary significantly across learning styles. This only indicates that there is no significant difference in academic performance among visual, auditory, and kinesthetic learners. This finding implies that the flipped classroom approach is equally effective for all types of learners, reinforcing its potential as a universally applicable teaching method. Educators can thus implement this approach without needing to tailor instructional strategies to specific learning styles, simplifying course design and delivery. Furthermore, this suggests that other factors, such as student engagement and access to resources, may play a more critical role in academic success than learning style alone, guiding future research to explore these variables in greater depth.

Several reports have shown that monitoring the students' academic performance enables the teachers to adjust their instruction in order to improve their students' learning outcomes and proactively promote student success (Hasan et al., 2019). Moreover, the findings from the two separate studies of Soto & Blanco (2020) and Phuong et al. (2018) were that the academic performance of their students in the statistics course and in a nursing class, respectively, does not differ according to their predominant learning styles. Consequently, other researchers have also found that there was no significant relationship between the learning styles of the students and their academic achievement (Mozaffari, 2020; Fanai, 2019; Cada, 2021).

The findings of this study only imply that the educational approach employed, which is the flipped classroom, is effective in catering to the diverse learning styles without compromising the overall outstanding academic achievements of the students. This further suggests that the college instructors can maintain the current teaching methods, as they seem to be equally beneficial for all learning style preferences, resulting in consistently high academic performance.

Table 6
Relationship between students' attitude and academic performance

	Grades
Attitudes	.126**

**correlation is at .05 level

The table 6 shows the relationship between attitude and academic performance of students in a flipped classroom environment analyzed using the Kendall's Tau-b as its statistical tool. Clearly, it revealed through this table that there is a positive moderate correlation between the attitude and academic performance of the students as indicated by Kendall's Tau correlation ($\tau = 0.126$, $p < 0.05$). The positive correlation suggests that as their attitude towards flipped classroom increases, there is a moderate tendency for students' grades to also increase. Thus, this study rejects the null hypothesis, indicating a significant relationship between the attitude and academic performance of the students in a flipped classroom environment. The statistical significance ($p < 0.05$) indicates that this relationship is unlikely to be due to random chance, providing evidence of a meaningful association between students' grades and their attitude on the implementation of flipped classroom methodology. These results imply that fostering

positive perceptions of the flipped classroom methodology could be a key strategy in enhancing student performance. Therefore, educators and institutions should focus on strategies that improve student attitudes towards this pedagogical approach, such as providing clear explanations of its benefits, offering adequate support, and ensuring engaging and well-structured course content.

Other research has consistently highlighted the influential role that students' attitudes towards specific instructional pedagogies play in attaining higher academic grades (Windiyani & Suchyadi, 2020). Mao et al. (2021) pointed out in their study that students' positive attitudes in their science class correlates to their learning achievement because of their shown interest, perceived societal relevance, and mixed attitudes; while the performance of low-performing students were associated to their behavior and motivation to learn (OECD, 2016). This finding also broadly supports the work of Subia, et al. (2018) stating that a more positive attitude towards mathematics is significantly linked to improved performance, whereas a more negative attitude is associated with lower performance. Additionally, intrinsic and extrinsic motivation and academic motivation are closely connected with your attitude towards learning (Taşgın & Coskun, 2018). These results further supports the claim of Halim et al. (2022) that "learning styles significantly influence students' knowledge, skills, and attitudes and that of Wikanti (2019) who pointed out that Variation in teaching style and student attitude positively and significantly affect learning outcomes.

Perhaps, the practical implication of the findings is that as students' positive attitudes towards the flipped classroom increase, there is a moderate likelihood of improvement in their grades. With this result, educators can consider fostering positive attitudes towards the flipped classroom, as it appears to contribute meaningfully to enhanced academic performance in this learning environment (OECD, 2016).

CONCLUSION

In conclusion, this study delved into the influence of the flipped classroom approach on students' learning styles, attitudes, and academic performance. The data revealed that auditory learners exhibited the highest frequency count, followed by visual learners and kinesthetic learners. The results manifest positive perceptions among students regarding the flipped classroom model, emphasizing its value in promoting independent learning, utilizing technology, and fostering collaboration. Despite acknowledging potential challenges, students' outstanding academic performance across diverse learning styles indicates the effectiveness of the flipped classroom in catering to varied preferences. The findings reported here shed new light on the collective responses among students, which, irrespective of learning style, highlight the method's overall effectiveness and positive reception. Ultimately, the study implies that the flipped classroom is an effective educational approach that accommodates diverse learning styles without compromising students' remarkable academic achievements. Additionally, the findings suggest a moderate likelihood of improved grades with increased positive attitudes towards the flipped classroom, reinforcing the practical benefits of this instructional method.

On the other hand, it was found to be difficult to account for the diversity and complexity of individual learning preferences, this study was restricted to only three learning styles: kinesthetics, auditory, and visual. Furthermore, it was challenging to create a unified syllabus while balancing various styles, and learning style theories can be applied incorrectly. Furthermore, learning preferences of students can vary with time and situation, calling for flexible and adaptive teaching strategies that appeal to a wide range of students. Consequently, the comparatively small sample size of this research study, which might not accurately reflect the larger student population, also had an impact on its shortcomings. A bigger sample size could yield more strong and accurate data on the relationship between learning styles, attitudes, and academic performance in a flipped classroom setting, which could have an impact on the findings' generalizability. To validate and build upon these results, future research endeavors have to contemplate enlisting a more extensive and heterogeneous cohort. The study further has certain limitations on the selected data collection strategy. The range and depth of the data that was gathered might have been limited by relying mostly on surveys and questionnaires. There are also restrictions imposed by the time frame in which the study was done. The data was gathered over the course of one semester, which might not have been enough to see patterns and impacts of the flipped classroom strategy over the long run. It frequently takes longer for educational interventions to fully influence students' learning and attitudes. It's also important to recognize any potential bias resulting from self-reported scores. In the context of this study, individuals may react in a way they think is appropriate or anticipated. This bias may distort the outcomes and compromise the reliability of the conclusions. Future research should include objective indicators of academic achievement and potentially anonymous data collection techniques to lessen the impact of these biases and improve the data's dependability in order to lessen this.

Because the outcomes of this study are correlational rather than causative, readers should proceed with caution when interpreting the data. Although there is a strong positive link between students' attitudes regarding the flipped classroom method and their academic achievement, this does not mean that better marks are a direct result of the flipped classroom. Both attitudes and performance may also be influenced by additional underlying elements, such as past knowledge, motivation on the part of the students, and external support. Therefore, in order to prove causation and completely comprehend the dynamics at work, additional research utilizing experimental or longitudinal designs is required.

Therefore, this study has important future implications for educational research and practice. Given that the results indicate a favorable relationship between students' perceptions of the flipped classroom and their academic achievement, educators and institutions should think about adopting and endorsing this educational strategy more widely. There is potential to improve overall academic achievement by creating interesting and encouraging flipped classroom environments that support positive student attitudes. Furthermore, this study opens up new avenues for investigation into the causal links between student performance and flipped classroom approaches. Subsequent research endeavors may additionally examine the enduring consequences of this methodology and pinpoint particular tactics that optimize its advantages for a range

of learning modalities. By putting these ideas into practice, educators may be able to create more successful, student-centered learning environments that enhance learning outcomes.

This paper also provides an overview of one important issue linking the relationship between students' attitudes and their academic achievement. Research indicates that students who adopt and feel positively about the flipped classroom approach are more likely to participate actively in class, engage deeply with the material, and make effective use of the resources that are available. These positive attitudes toward the flipped classroom approach appear to be associated with higher academic achievement. This relationship emphasizes how crucial it is to foster positive attitudes by outlining the advantages clearly, offering sufficient assistance, and setting up a stimulating and participatory learning environment. Teachers can potentially improve students' enthusiasm, perseverance, and academic achievement by encouraging a positive perspective regarding the flipped classroom. This underscores the critical role that attitude plays in educational outcomes.

Further research could usefully explore how to assist in the deployment of flipped classrooms, make investments in technology infrastructure and resources, such as hardware, software, and faculty training. College deans may also plan faculty development workshops and training sessions so they can acquire the skills needed to apply the flipped classroom model successfully. The teachers may accept and modify the flipped classroom paradigm to meet different learning goals and course materials while accounting for students' varied learning styles. The students may assume responsibility for interacting with the pre-class materials and arrive ready to contribute fully to class discussions. Whereas, future researchers could conduct longitudinal studies spanning several semesters or academic years are advised to find out how the flipped classroom strategy affects students' attitudes and academic performance over time in order to better capture the long-term impacts and potential changes in student performance and attitudes.

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