

# Assessment of the Implementation of Flipped Classroom Setup in DIFEQUATIONS at Holy Angel University – School of Engineering and Architecture

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**ABSTRACT:** Flipped classroom is an interactive teaching approach which provides active learning. In the first semester of school year 2023-2024, flipped classroom was implemented in DIFEQUATIONS under the School of Engineering and Architecture of Holy Angel University. Basic knowledge about each topic were provided by the instructors to the students before the in-campus sessions with the aid of asynchronous discussions such as pre-recorded videos and module resources and online assignments through the university's learning management system. Students were equipped with fundamental principles and knowledge which were utilized during their in-campus sessions where active and interactive learning took place, acquiring them with mathematical skills and competencies. This study was conducted to know the perception of the second year engineering students who were enrolled in DIFEQUATIONS when flipped classroom was carried out. Ten statements regarding the evaluation of the General Engineering program, which was the implementation of flipped classroom in DIFEQUATIONS, were rated by the students and indicated strongly agree response with an average rating of 4.34. Students responded agree with the flipped classroom approach, getting an average rating of 4.10, which were the evaluations from thirty statements regarding flipped classroom. Suggestions and comments were solicited from the students to recognize the challenges, know the feedback and identify ways to improve the implementation of flipped classroom. Flipped classroom was a good way of understanding, studying and learning, where students were able to grasp each lesson in a more accessible and engaging process.

**KEYWORDS:** Flipped Classroom, DIFEQUATIONS, active learning, flipped learning

## I. INTRODUCTION

Flipped classroom is a blended learning approach that makes learning active and interactive. It can be done by flipping the classroom, giving pre-recorded discussions and allots the in-campus sessions to interactive learning which can develop competencies and skills such as critical thinking and problem solving. Students were given the basic knowledge before the face-to-face class sessions through pre-recorded discussions and module resources during asynchronous sessions. Students' active engagements were facilitated through the conduct of computational class activities inside the classroom during the face-to-face sessions. Students were made ready for each topic and were guided during the actual performance for the completion of the computational class activities. A case study of Aljaraideh (2019) showed a high response of students' perception with regards to flipped classroom in Private Universities in Jordan. In flipped classroom, the student focuses on learning where there is balance between content delivery, pedagogical knowledge and technology integration.

Flipped classroom is built on four aspects namely flexibility, culture of learning, intentional content and teaching role. Using flipped classroom, there will be improvement in the learning capacity of the students by developing skills and competencies, incorporating active student engagement and participation, optimizing learning time and personalizing the learning process (Colomo-Magaña et al., 2020).

## RELATED LITERATURE

The success of flipped classroom was brought by individualized learning with flexible learning time and facilitated lectures with review opportunities. Learning motivation, learning engagement and fun were included in the strengths of flipped learning (Doo, 2022). These were also the goals of the implementation of flipped classroom in DIFEQUATIONS – active learning, flexible learning time, student engagement and learner's participation. According to Musdi et al. (2019), the students were able to prepare for learning in class, explore ideas, manage own time and measure own mathematical ability through flipped learning.

A study of Samaila et al. (2021) showed that students asserted that flipped classroom model satisfies their needs and expectations more effectively than the traditional lecture-based method. Flipped classroom increases the academic performance of students by providing flexibility, individualizing learning process and focusing on student-centered method. (Ivanytska et al., 2021).

In a study conducted by Antonio (2022), there were several advantages of flipped classroom in online distance learning during the pandemic. These includes providing flexibility and convenience to students, addressing the problem on internet connectivity and access to technological devices and offering heightened reinforcement. There were also challenges listed including needed interaction during asynchronous lecture and limited time for synchronous meetings. In the study of Divjak et al. (2022), it was found out that those who had used flipped classroom approaches successfully continued to utilize them in online environments during the COVID-19 pandemic.

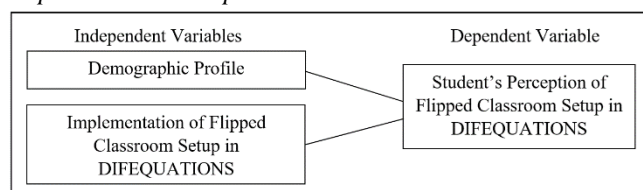
A study of Hussain et al. (2023) showed that flipped classroom has significant effect on student engagement and motivation and influences student retention and knowledge retention leading to positive impact on the performance of students. There is a strong relationship between flipped classroom strategy and student satisfaction with the learning process promoting critical thinking, problem solving and metacognitive skills. Flipped classroom fosters student-centered learning environment which enhances self-regulated, active and collaborative learning, promotes technology integration and accommodates diverse learning styles and preferences.

Bergmann & Sams (2012) note that flipped classroom approach provides the students to complete inside classroom activities at home and accomplish assigned homework in class. There were significant improvements in the performance of students academically when flipped classroom approach was employed as compared to the traditional methodology in a study conducted by Torres-Martin et al. (2022). Student’s attitudes towards flipped learning experience include usefulness, engagement, satisfaction, motivation and anxiety (Keskin, 2023).

## THEORETICAL/CONCEPTUAL FRAMEWORK

**Figure 1**

*Dependent and Independent Variables*



The variables of this research study are shown in Figure 1. The dependent variable is the perception of the second year engineering students in the flipped classroom setup in

DIFEQUATIONS. The two independent variables are demographic profile and the implementation of flipped classroom setup in DIFEQUATIONS. The demographic profile includes program, gender, age and strand in senior high school. The implementation of flipped classroom setup in DIFEQUATIONS includes pre-recorded lectures, module resources, asynchronous discussions, assignments and in-campus computational class activities.

## RESEARCH PROBLEM

The general problem of the study is: What are the perceptions of the second year engineering students of Holy Angel University on the implementation of flipped classroom setup in DIFEQUATIONS in the First Semester of School Year 2023-2024?

Specifically, the study will seek answers to the following questions:

1. What is the demographic profile of the students in terms of program, gender, age and strand in senior high school?
2. What are the perceptions of students in flipped classroom?
3. What are the perceptions of students in the implementation of flipped classroom setup in DIFEQUATIONS?

## SCOPE AND DELIMITATIONS OF THE STUDY

The study is limited to the perception of the second year engineering students from the School of Engineering and Architecture at Holy Angel University about the implementation of flipped classroom setup in DIFEQUATIONS in the First Semester of School Year 2023-2024. The effectiveness of flipped classroom, the course outcomes assessment and the relationship of the grades and academic performance of the students with the implementation of the flipped classroom setup are beyond the scope of this study.

## SIGNIFICANCE OF THE STUDY

The study was important to see the perception of the students with regards to the implementation of flipped classroom. It would show what areas in the implementation need emphasis and improvement, what areas or activities demonstrate strengths and weaknesses and what other factors could help in the success of its implementation. Suggestions and comments were solicited from the respondents to improve its implementation not only in DIFEQUATIONS but also with the other General Engineering subjects. Additionally, it would help to identify the challenges and concerns brought by the implementation of flipped classroom and it would aid in the improvement, development and continuation of this teaching strategy to a more flexible and comprehensive approach. It would benefit the General Engineering department of the School of Engineering and Architecture at Holy Angel University. It would also help other departments

and institutions in the decision of implementing flipped classroom in the future.

## II. METHODS AND PROCEDURES

### Research Design

The study used mixed-methods approach, utilizing both quantitative and qualitative research. The quantitative data were derived from the ratings of the students about flipped classroom and its implementation in DIFEQUATIONS. The qualitative data were obtained from the suggestions and comments provided by the respondents for the improvement of the flipped classroom approach. This paper utilized descriptive statistics, through the computation of mean and standard deviation. The mean would indicate the average of the ratings and the standard deviation would dictate the variation of the rating from the mean in each statement about flipped classroom and its implementation in DIFEQUATIONS.

### Locale of the Study

The study was conducted at the School of Engineering and Architecture of Holy Angel University in Angeles City. The assessment of flipped classroom were collected from the students who were enrolled in the subject DIFEQUATIONS in the First Semester of School Year 2023-2024.

### Respondents (with Sample and Sampling Procedure)

A number of 185 second year engineering students at Holy Angel University who were enrolled in DIFEQUATIONS for the First Semester of School Year 2023-2024 were the respondents of this study. The sample was composed of civil, aeronautical, industrial and mechanical engineering students. This study used a non-probability sampling technique called convenience sampling. The samples were not taken randomly, instead all the students who were enrolled in DIFEQUATIONS of the First Semester of School Year 2023-2024 were included as respondents of this study.

### Data Gathering Instruments

A survey questionnaire through Google form was distributed to the respondents. The form consisted of three parts: Demographic Profile, Evaluation of the General Engineering Program - Flipped Classroom in DIFEQUATIONS and Student's Perception of Flipped Classroom. The statements for the evaluation of the flipped classroom setup in DIFEQUATIONS was a survey form adopted from the General Engineering department which was used for its program evaluation and the statements for the student's perception of flipped classroom was adopted from the study of Aljaraideh (2019). Suggestions and comments were also been asked from the respondents to provide feedback about the implementation and improvement of the flipped classroom approach.

### Data Gathering Procedure

All students that were enrolled in DIFEQUATIONS in the First Semester of School Year 2023-2024 were given the link for the survey questionnaire in Google form. Students were asked to answer the form in their free time. Demographic profile and ratings for each statement regarding flipped classroom and its implementation were collected and tabulated. All data were collected anonymously to keep confidentiality.

### Data Analysis Technique

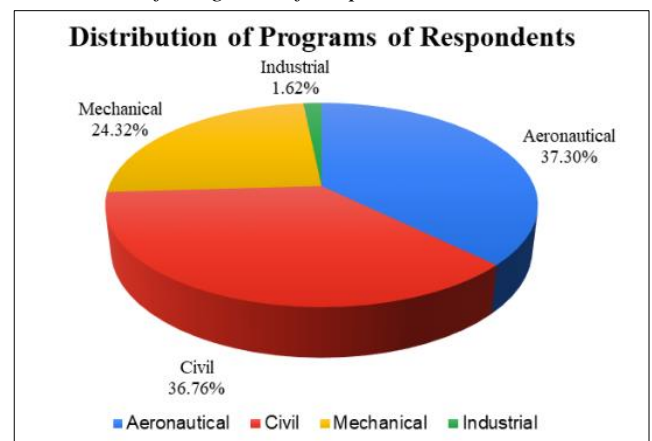
All ratings were collected and tabulated using Microsoft Excel. The mean and standard deviation for each statement in flipped classroom and its implementation were computed. A five-point Likert scale was used for the student's perception which includes 5 for strongly agree, 4 for agree, 3 with neutral, 2 for disagree and 1 for strongly disagree. Statements were rated by the students using the previously stated rating based on their perceptions about flipped classroom and its implementation in DIFEQUATIONS. Descriptive statistics was used to analyze the demographic profile of the students such as gender, age, program and senior high school strand. Mean and standard deviation were used for studying and analyzing the data from the ratings of the respondents.

## III. RESULTS AND DISCUSSION

### Demographic Profile of the Respondents

Figure 2

Distribution of Programs of Respondents



From the 185 respondents, 3 are industrial engineering students (1.62%), 45 are mechanical engineering students (24.32%), 68 are civil engineering students (36.76%) and 69 are aeronautical engineering students (37.30%), which can be seen in Figure 2.

**Figure 3**

*Distribution of Gender and Age of the Respondents*

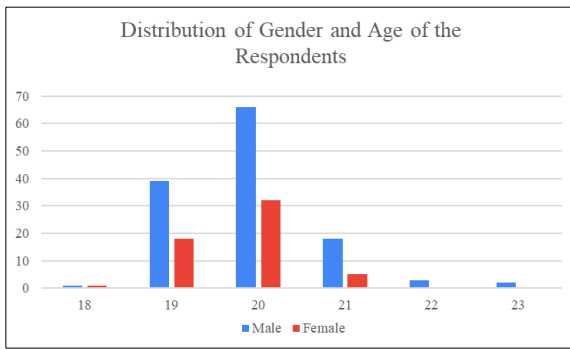
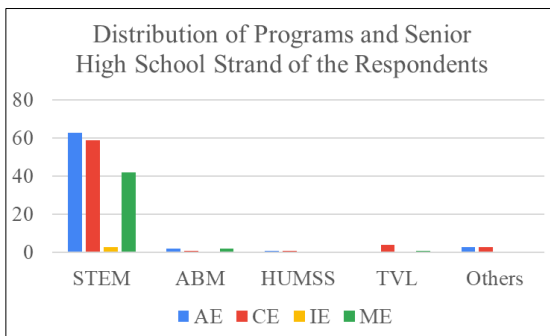


Figure 2 shows the distribution of programs and Figure 3 shows the distribution of gender and age of the respondents. 129 respondents were male (69.73%) and 56 were female (30.27%).

**Figure 4**

*Distribution of Programs and Senior High School Strand of the Respondents*



Among the respondents, 90.27% took Science, Technology, Engineering, Mathematics (STEM) strand, 2.70% took Accountancy, Business, Management (ABM) strand, 1.08% took Humanities, Education, Social Science (HUMSS) strand, 2.70% took Technical, Vocational, Livelihood (TVL) strand and 3.24% took other than the previously stated senior high school strands. Figure 4 provides the distribution of strand in senior high school of the respondents with each program.

**Evaluation of the General Engineering Program – Flipped Classroom in DIFEQUATIONS**

The average evaluation of the students for the General Engineering Program, which is the implementation of flipped classroom in DIFEQUATIONS, is 4.34 which exhibits strongly agree response based on the Likert-Scale interval.

**Table 1. Likert-Scale Interval**

Likert-Scale	Likert-Scale Interval	Likert-Scale Description
5	4.21-5.00	Strongly Agree
4	3.41-4.20	Agree
3	2.61-3.40	Neutral
2	1.81-2.60	Disagree
1	1.00-1.80	Strongly Disagree

The Likert-Scale interval was adopted from the study of Sozen and Guven (2019). It defines 5 descriptions namely strongly agree (4.21 to 5.00), agree (3.41 to 4.20), neutral (2.61 to 3.40), disagree (1.81 to 2.60) and strongly disagree (1.00 to 1.80). These intervals, as presented in Table 1, were used in the description of the average of the respondents’ ratings.

Table 2 shows the evaluation of the respondents on the implemented program of the General Engineering department which was the flipped classroom setup in DIFEQUATIONS.

**Table 2. Evaluation of the General Engineering Program – Flipped Classroom in DIFEQUATIONS**

Statements	Average	Description	Standard Deviation
1. The program is well-structured and organized.	4.37	Strongly Agree	0.76
2. The program materials adequately covered the essential topics.	4.44	Strongly Agree	0.71
3. The program included sufficient examples or practice problems.	4.35	Strongly Agree	0.81
4. The program provides activities that are engaging and intellectually stimulating.	4.35	Strongly Agree	0.77
5. The content of the program were presented in clear and understandable manner.	4.41	Strongly Agree	0.70
6. The program enhanced my confidence in solving computational problems.	4.25	Strongly Agree	0.86
7. The program significantly improved my grasps of difficult concepts.	4.21	Strongly Agree	0.81
8. The program provided a positive impact on my academic performance after attending it.	4.29	Strongly Agree	0.81
9. The tutor, resource faculty, or designer of review materials demonstrated a deep understanding of the subject matter.	4.44	Strongly Agree	0.76
10. Overall, I am satisfied with the academic program of the General Engineering Department.	4.30	Strongly Agree	0.78
<b>Average</b>	<b>4.34</b>	<b>Strongly Agree</b>	

Based from the assessment of the respondents, the program materials adequately covered the essential topics and the tutor, resource faculty, or designer of review materials demonstrated a deep understanding of the subject matter got the highest rating which is 4.44 signifying strongly agree response while the statement the program significantly improved the grasps of difficult concepts got the lowest rating which is 4.21, still a strongly agree response from the respondents. All of the statements for the evaluation of flipped classroom setup in DIFEQUATIONS attained strongly agree response with 4.34 average rating from the respondents. It can also be seen that the computed standard deviation is a value less than 1 which means that each rating was close to the computed mean for each statement.

**Student’s Perception of Flipped Classroom**

Table 3 shows the perception of students on flipped classroom where thirty statements were rated. The statements were adopted from the study of Aljaraideh (2019) regarding the student’s perception of flipped classroom in private universities in Jordan.

Based from the results, only five statements obtained strongly agree response and the remaining twenty five statements gained agree response. The respondents strongly agreed that understanding of material was enhanced by the learning

foundational content before the class and the ability to frequently pause or repeat some parts of the provided videos, learning was efficiently done by watching videos and taking notes and practicing critical and creative thinking were encouraged by flipped classroom. All the computed standard deviations are values less than 1 which indicates that each rating was close to the computed mean for each statement. Overall, students agreed to flipped classroom approach with an average rating of 4.10.

**Table 3. Student’s Perception of Flipped Classroom**

Statements	Average	Description	Standard Deviation
1. Flipped classroom gives me greater opportunities to communicate with other students.	4.11	Agree	0.77
2. Flipped classroom is more engaging than the traditional classroom.	4.06	Agree	0.92
3. Flipped courses did not limit my interaction with instructors.	4.04	Agree	0.87
4. I got the ability to self-pace my learning with flipped courses.	4.16	Agree	0.87
5. Flipped classroom gives me the opportunity to ask more questions inside the classroom.	4.06	Agree	0.89
6. I feel that mastering learning through flipped classroom improved my course understanding.	4.08	Agree	0.87
7. I feel that mastering learning through flipped classroom improved my academic achievement.	4.03	Agree	0.88
8. Flipped classroom improved collaborative learning.	4.06	Agree	0.89
9. Flipped classroom learning has reduced my dependency on the instructor.	4.10	Agree	0.84
10. Learning foundational content prior to class greatly enhances my understanding of material.	4.26	Strongly Agree	0.75
11. I am more motivated to learn the concepts of course via the flipped classroom.	4.07	Agree	0.88
12. Flipped classroom gives me less class time to practice the concepts of course.	4.01	Agree	0.90
13. I would recommend flipped classroom to a friend.	4.01	Agree	0.90
14. I like watching the lessons on video.	3.96	Agree	0.97
15. I wish more instructors use the flipped or inverted classroom model.	3.92	Agree	0.90
16. Flipped classroom can be a suitable teaching strategy.	4.15	Agree	0.82
17. Flipped classroom can improve interest in class.	4.03	Agree	0.86
18. Flipped classroom can improve interest in exploring topics.	4.08	Agree	0.86
19. Flipped classroom, along with delivery of content outside class and problem solving in class, is an instructional method appropriate for my specialization.	4.13	Agree	0.82
20. I frequently pause or repeat parts of the videos in order to increase my understanding of the material.	4.41	Strongly Agree	0.78
21. I believe that I am able to learn material with flipped classroom instruction better than with traditional lecture-based instruction.	4.07	Agree	0.88
22. I try to learn as much as possible while watching the videos.	4.34	Strongly Agree	0.81
23. I feel that watching videos and taking notes contribute efficiently to my learning.	4.30	Strongly Agree	0.82
24. I felt prepared to complete course tasks in class after listening to the video content.	4.13	Agree	0.88
25. With flipped classroom model, I feel more prepared for my exam.	4.03	Agree	0.89
26. With flipped classroom, we have to do more work out of the classroom.	4.05	Agree	0.85
27. Flipped classroom matches my learning style.	3.97	Agree	0.96
28. Flipped classroom attracts my attention to learning and teaching process.	4.07	Agree	0.87
29. Flipped classroom reduces the effort to understand the basic knowledge of the subject matter.	4.01	Agree	0.94
30. Flipped classroom encourages me to practice critical and creative thinking.	4.26	Strongly Agree	0.79
Average	4.10	Agree	

**Suggestions and Comments of the Respondents**

Suggestions and comments were asked from the respondents to know the perception, identify the problems that had been encountered and the challenges that had been faced during the

implementation of flipped classroom in DIFEQUATIONS. Some respondents say that flipped classroom helped them build their sense of responsibility and digest each lesson properly, enhanced their interaction, encouraged participation, provided collaboration with peers and opportunities to learn and to apply their knowledge with the combination of face-to-face and online learning methods that were engaging and accessible. Additionally, other respondents say that by engaging with lectures and materials beforehand, they were more prepared to delve into deeper discussions and problem-solving sessions during class, the active participation not only solidified their grasp on the subject matter but also fostered a collaborative learning environment where they could seek clarification and exchange ideas with peers and instructors. They also appreciated how the professors adeptly break down key concepts, making them easier to grasp both in face-to-face sessions and while studying at home, the detailed explanations enhanced their learning experience significantly. Most of the comments were positive towards the overall view of flipped classroom. There were also suggestions and concerns that were specified in the survey which will be used for the improvement and development of the implementation of flipped classroom in DIFEQUATIONS and in other General Engineering subjects.

**IV. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

**Summary of Findings**

The demographic profile of the respondents, the evaluation of the General Engineering program – flipped classroom in DIFEQUATIONS and the student’s perception of flipped classroom were gathered, collected, tabulated and analyzed. Dependent and independent variables were used in this study. The dependent variable is the perception of the second year engineering students in the flipped classroom setup in DIFEQUATIONS and the two independent variables are demographic profile of the respondents and the implementation of flipped classroom setup in DIFEQUATIONS. The demographic profile of the respondents include program, age, gender and strand in senior high school. The respondents were composed of civil, mechanical, aeronautical and industrial engineering students, 69.73% of them were male and 30.27% were female. The respondents rated thirty statements and averaged 4.10 signifying to an agree response in the student’s perception of flipped classroom with standard deviations less than 1. Ten statements were evaluated by the respondents with regards to the implementation of flipped classroom in DIFEQUATIONS and obtained strongly agree response with an average of 4.34 and standard deviations less than 1. Descriptive statistics was used to determine the mean and standard deviation of the ratings. Positive feedbacks were

obtained from the comments and suggestions part of the survey form. The respondents strongly agree that the implementation of flipped classroom in DIFEQUATIONS was well-structured, organized and clearly presented, the materials were adequate and sufficient, the activities were engaging and intellectually stimulating and the implementation enhanced their confidence and understanding and improved their academic performance.

## CONCLUSIONS

Flipped classroom offers active learning and interactive teaching methodology that develops student's skills and competencies. Flexibility, intentional content, individualized learning and learning time, active engagement and participation were some of the positive feedbacks with the implementation of flipped classroom. In this study, the demographic profile of the respondents were collected in terms of program, age, gender and strand in senior high school. The perception of the respondents in flipped classroom gained an average of 4.10 with an agree response. The respondents agreed that flipped classroom enhanced their learning and understanding through the provided detailed lectures, appropriate materials, comprehensive videos and engaging activities. The evaluation for the implementation of flipped classroom in DIFEQUATIONS for the first semester of school year 2023-2024 obtained an average of 4.34 signifying a strongly agree response. The respondents strongly agreed that the implementation of flipped classroom in DIFEQUATIONS provided a positive impact on their performance through active participation, interactive learning, collaboration with peers and instructors and personalized learning experience. Overall, the flipped classroom and its implementation in DIFEQUATIONS attained positive responses and positive feedbacks from the respondents.

## RECOMMENDATIONS

Based from the summary of findings and conclusions drawn from this study, the researchers recommend that the General Engineering department will implement flipped classroom approach in all subjects. The challenges and problems encountered should be addressed attentively in the next implementation. The implementation of flipped classroom should be planned thoroughly and be assessed periodically. It is also recommended to test the effectiveness of implementing flipped classroom in DIFEQUATIONS and in other General Engineering subjects. It is also suggested that the assessment of course outcomes will be included in future researches.

## REFERENCES

1. Abosede, P., Onasanya, S. & Ngozi, O. (2024). Students self-assessment of demonstration-based

flipped classroom on senior secondary school students' performance in physics in Ilorin Metropolis, Nigeria. *Indonesian Journal of Teaching in Science*, 4(1), 27-40.

2. Aljaraideh, Y. (2019). Students' perception of flipped classroom: A case study for private universities in Jordan. *Journal of Technology and Science Education*, 9(3), 368-377. <https://doi.org/10.3926/jotse648>.
3. Antonio, R. (2022). Assessing flipped classroom in flexible learning environment via community of inquiry framework. *English Teaching Learning and Research Journal*, 8(1), 94-107. <https://doi.org/10.24252/Eternal.V81.2022.A6>.
4. Bergmann, J. & Sams, A. (2012). Flip your classroom: reach every student in every class every day. *International Society for Technology in Education*. Retrieved from [https://www.rcboe.org/cms/lib/GA01903614/Centricity/Domain/15451/Flip\\_Your\\_Classroom.pdf](https://www.rcboe.org/cms/lib/GA01903614/Centricity/Domain/15451/Flip_Your_Classroom.pdf).
5. Colomo-Magaña, E. et al. (2020). University students' perception of the usefulness of the flipped classroom methodology. *Education Sciences*, 10(10), 275. <https://doi.org/10.3390/educsci10100275>.
6. Deng, F. (2019). Literature review of the flipped classroom. *Theory and Practice in Language Studies*, 9(10), 1350-1356. <http://dx.doi.org/10.17507/tpls.0910.14>.
7. Divjak, B. et al. (2022). Flipped classrooms in higher education during the COVID-19 pandemic: findings and future research recommendations. *International Journal of Educational Technology in Higher Education*, 19(9). <https://doi.org/10.1186/s41239-021-00316-4>.
8. Doo, M. Y. (2022). Understanding flipped learners' perceptions, perceived usefulness, registration intention, and learning engagement. *Contemporary Educational Technology*, 14(1), ep331. <https://doi.org/10.30935/cedtech/11368>.
9. Hussain, M. et al. (2023). Assessing the effectiveness of flipped classroom strategy on student performance. *European Chemical Bulletin*, 12(8), 2883-2896.
10. Ivanytska, N., Dovhan, I., Tymoshchuk, N., Osaulchyk, O., & Havryliuk, N. (2021). Assessment of flipped learning as an innovative method of teaching english: a case study. *Arab World English Journal*, 12(4) 476-486. <https://dx.doi.org/10.24093/awej/vol12no4.31>.
11. Keskin, D. (2023). Implementation of flipped model in EFL reading classrooms. *Turkish Online Journal of Distance Education*, 24(3). ISSN 1302-6488.
12. Lapitan, L. et al. (2023). Design, implementation, and evaluation of an online flipped classroom with

- collaborative learning model in an undergraduate chemical engineering course. *Education for Chemical Engineers*, 43, 58-72.  
<https://doi.org/10.1016/j.ece.2023.01.007>.
13. Musdi, E. et al. (2019). Students' perception toward flipped classroom learning. *Journal of Physics: Conference Series* 1317 012132.  
<https://doi.org/10.1088/1742-6596/1317/1/012132>.
  14. Nouri, J. (2016). The flipped classroom: for active, effective and increased learning – especially for low achievers. *International Journal of Educational Technology in Higher Education*. 13(1).  
<https://doi.org/10.1186/s41239-016-0032-z>.
  15. Samaila, K, Masood, M., & Chau, K. T. (2021). Using flipped classroom model: factors influencing students' satisfaction. *European Journal of Interactive Multimedia and Education*, 2(2), e02112.  
<https://doi.org/10.30935/ejimed/11260>.
  16. Sozen, E. & Guven, U. (2019). The effect of online assessments on students' attitudes towards undergraduate-level geography courses. *International Education Studies*, 12(10). <https://doi.org/10.5539/ies.v12n10p1>.
  17. Torres-Martín, C., Acal, C., El-Homrani, M. et al. (2022). Implementation of the flipped classroom and its longitudinal impact on improving academic performance. *Education Technology Research and Development*, 70, 909–929.  
<https://doi.org/10.1007/s11423-022-10095-y>.
  18. Yang, X., Sheng, Y. & Wu, Y. (2018). Survey on the implementation of flipped classroom and countermeasures. *Advances in Social Science, Education and Humanities Research* 237, 522-526.