



# The Effect of Project-based Flipped Learning (PjBFL) in Geomatika Class: An Analysis of Undergraduate Students

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## ABSTRACT

Many believed that the traditional learning model, where the lecturer role is more dominant, might be one of the roots to why students become bored and less motivated to study, either in a classroom setting or independently. When the students are less motivated, a number of problems arise, one of which is they have a hard time completing their project due to various causes. This research was carried out to determine the effectiveness of doing project-based flipped activities in Geomatika class as one way to overcome the problem. The activities of learning in Geomatika class were flipped by conducting the practicum prior to the student-lecturer class conferences/tutoring. By employing the questionnaire as the primary data collection technique and lecturer's observation as the secondary one, the results indicated that students' preparedness for the activity of learning was highly suggested, which then resulted in them becoming active and confident in their learning. Another finding also suggested that they felt more in charge of their own learning when flipped instruction was implemented. It was also observed that during the class activities, many students became more confident in participating. The less dominant issue was the point of group assignment. Overall, the students' performances in the odd 2022 Geomatika class were markedly improved when flipped learning was implemented.

**Keywords:** *Flipped learning, Effective learning, Geomatika practicum.*

## 1. INTRODUCTION

The learning system in higher education, the same as in other levels, uses the conventional method, namely the one-way lecture method from the lecturer, causing students to feel bored and tend to be passive. Classes are controlled by lecturers/teachers where the amount of teachers' talk is extensively higher in the learning process [16]. According to Luo [10], the teacher-centered learning model results in students not having sufficient time to interact with their classmates, which in turn makes them unmotivated to think critically and to learn independently. Teaching and learning activities like this tend to be unpleasant, boring, and not engaging for students. However, despite the fact that this type of learning is found to be losing its appeal among not only lecturers but also students, it is still happening in some classes. The case also happens in some of the classes

taught in the Civil Engineering Department of Universitas Negeri Gorontalo, including in Geomatika class. Finding the right pedagogical strategies to deliver the instruction and material to promote the students' engagement in class activities has now become crucial for lecturers. This is particularly imperative in project-based courses like most classes in the Department of Civil Engineering.

The shift in paradigm from teacher-centered to student-centered instruction has introduced a number of applicable strategies that transform classroom activities and improve student engagement. Among the most popular is the flipped classroom. Applying the flipped model is seen as one way to address the problems of students' interaction and involvement with their own studies [14].

The flipped classroom model, also known as, the reverse classroom, has been widely applied and has become a trend as well as an issue of modernity or novelty, which is often raised in scientific articles [3]. According to Bergmann and Sam [2], the flipped classroom is an innovative pedagogical approach where teaching is the focus and students are centered, by reversing the traditional learning system that has been followed by lecturers so far. [11] has proposed that fundamentally flipped learning has four pillars: (1) a flexible environment; (2) a learning culture; (3) internal content; and (4) professional educators. In flipped classrooms, lectures, and direct instruction are considered ineffective teaching methods, instead of learning information in class, students will encounter information beforehand, allowing them to engage in higher-order thinking activities in class. This can be a big challenge when implementing flipped activities since the students will often be unprepared or reluctant to adapt to it first [8].

A number of benefits of flipped learning have been discussed in abundance in the literature, including: students reported better performance, learning autonomy, and preparation for classes [5]; promoting improved students engagement and deep learning process [1]; students learning outcomes were significantly improved [12]; increasing students motivation in learning [7]; has a significant effect on developing students' critical thinking skills [9]; reputed to be quite adaptable and simple for students to employ [15]; the implementation of flipped learning indicated students has more positive attitude toward learning experience compared to traditional model of learning [6]; Improved students learning experiences and satisfaction [13]; and the flipped model really helps lecturers teach material according to the objectives in the curriculum [17].

The Geomatika class used to be taught traditionally, where the interaction between the lecturer and students was mostly teacher-centered, students were not provided with sufficient knowledge prior to doing practicum, resulting in their unpreparedness, and students were not encouraged to work in groups, rather individually. These conditions lead to a number of challenges faced by the students, especially in completing their project reports for the class assignments.

Addressing these problems, the lecturer attempted to redesign the learning model by implementing flipped activities. The decision to flip the class activity was driven by several reasons, some of which are so that students become stimulated to be more active and facilitate them to uncover their potential by increasing their involvement in the flipped class activities. Before, in a traditional class, the lecturer delivered the material with the class lecture method about the content of the course, then in a flipped classroom, students were given

an independent learning experience by first conducting the practicum project with some tutoring pre, during and after the process.

Besides flipping the class activities to promote students' engagement, the Geomatika class is also a project-based course. The argument behind applying the project-based method for Geomatika class, aside from the fact that this course is practicum-based, is what Carter stated [4] that students obtain better results when using project-based learning, compared to those who do not use it. The final grades are twice as good as the traditional method, namely direct learning.

## 2. METHOD

This research was a case study with a questionnaire as the primary method of collecting the data and (lecturer) observation as the secondary one. Ten questions were solicited to disclose the students' perceptions about the effectiveness of implementing the flipped model in the class of Geomatika. The result of the survey was then analyzed qualitatively. The lecturer's observation was guided by the ten questions inquired.

Respondents of this research were 20 students enrolled in the class of Geomatika in the odd semester of 2022/2023, in the Department of Civil Engineering, Universitas Negeri Gorontalo. After the completion of the semester, a series of questions ranging from what were the students' perceptions about the lecturer's delivery of instruction material; their learning experiences during the implementation of flipped model, their preparedness during the class activities, students' enthusiasm in learning in Geomatika class, and several other questions which considered relevant to exploring their experiences regarding the implementation of the model.

## 3. DISCUSSION

### 3.1. Implementation of Flipped Classroom

Geomatika is a 16-week week/meeting class with 2 meetings for the mid-term and final examination. The instruction materials (theories, practicum instruction, and tutoring) are conducted within 14 weeks/meetings. Traditionally, the first meeting was scheduled for a class lecture about the introductory knowledge of Geomatika (theories and other relevant knowledge) and the tutoring of practicum instruction material (pre-practicum tutoring activities called *responsi*) would only start in the fifth meeting. After the teaching of practicum procedures in *responsi*, the practicum began at the sixth meeting. The data processing technique was then later introduced in meeting 7, and so on and so forth.

In the latest Geomatika class, the pre, during and post-practicum activities were flipped. The *responsi* (pre-practicum tutoring) took place in the first meeting. Students were taught the practicum procedures, controlled technique of measuring result data and the introduction of data processing techniques. The next meeting the practicum for Geomatika was done. The third meeting was for writing up the result report of the practicum where within the process the students also tutored in data processing techniques and further draw up the measurement result. During the process of composing the report, the student's self-discovery skills were promoted in terms of learning and practicing the formula to use in processing the measurement result and drawing technique.

### 3.2. Discussion

After conducting the survey inquiring ten questions to solicit the students' feedback on the effectiveness of using the flipped model in Geomatika class, and some additional information from the teacher's observation, the results of the current research are discussed as the following:

#### 3.2.1. The lecturer's explanation of the practicum at the beginning of the lecture

In the old model of this class, the lecturer first presented students with the theories and all things related to the class instruction material. This way of teaching left students mostly uninterested and sometimes confused about what was expected of them in the field during the practicum. This resulted in an undesirable result in terms of students' achievement and enthusiasm in the class activities. Using the flipped model, students' feedback indicated that there was a significant improvement in the result.

When asked what their perception was regarding the lecturer's explanation of the practicum procedures in Geomatika class, 20.83% of students suggested that they strongly agreed, and 79.17% agreed that they found it to be effective and supportive of the pre-practicum activities/tutoring.

The figure indicated that all students suggested they had a clear understanding of the necessary knowledge when practicing Geomatika in the field/practicum. The lecturer explained the tools and their functions, measurement steps and techniques, control of reading results, and calculation of height differences. Using the flipped classroom, this instruction on the practicum steps is introduced at the initial meeting as compared to the old classroom, which was delivered in the fourth week or as the pre-practicum activity.

#### 3.2.2. Students are more dominant and active with flipped classroom learning

By applying the flipped learning model, one of the student-centered learning models, the lecturer talking less is always the goal. This was not the case with the traditional class. The number of lecturer's talks was always significantly higher if not dominant. In the flipped model, the lecturer attempted to reduce the amount of time spent delivering instruction by encouraging the students to find their own learning and promoting student engagement.

When asked if, in their experiences during the Geomatika class, they felt that they talked more /more actively or were more dominant than the lecturer, the students responded that they did, with 62.50% agreeing and 37.50% strongly agreeing. They indicated that by understanding the practicum steps along with the basic theories of calculation, students were better prepared and had adequate knowledge when the lecturer explained this material at the fourth meeting, especially after the practicum. With a sufficient understanding of the theory, students are more dominant and active in lectures. The lecturer also found that there was a two-way and more active interaction in week fourth class discussion (in topic *Macam-macam Pemetaan*), as opposed to the conventional class.

#### 3.2.3. Group division has been done well

In the practicum, the class is divided into several practicum groups. The group assignment was planned by shared agreement among the students in order to make sure that they were as active and responsible as possible when completing the practicum reports and field assignments.

Survey results revealed that there were still 8.33% of students who were unsatisfied with the group assignment, even though the distribution was agreed upon among them. Later, by lecturer observation, it was discovered that the student gender distribution and the uneven distribution of students from vocational high schools were the main contributors to the conflict. Nevertheless, the group division was still deemed quite good considering 20.83% said they strongly agreed and 70.83% agreed with the group division

#### 3.2.4. Students feel more prepared for learning activities in class

One of the objectives the lecturer decided to implement the flipped model in the project-based Geomatika class is to help students to be more prepared prior to class activities (class discussion, class lecture, practicum and tutoring).

With the flipped learning format, 87.50% of students agreed and 12.50% strongly agreed that when the lecturer flipped the order of the learning activities and the instruction material, they experienced being better

prepared. As described above, when the material was about practicum and data processing of practicum results, students had already mastered it because they had received it in the first week of the classroom lecture when the practicum instructions were delivered. Students agreed that this flipped format was helpful to prepare them later in class lectures when the lecturer explains the theory.

### 3.2.5. Students feel more enthusiastic/motivated in learning activities because they are used to participating in learning activities in practicum groups

The student-centered approach suggested that an engaged and motivated student will make a more responsible participant in creating their own learning. This is found to be true in the current study.

With the application of flipped, it was suggested by the students' responses that they felt more motivated during the teaching and learning process both individually and in groups. This was also the case in the lecturer's observation. During practicum and data processing of practicum results, they worked on the project together in groups while also learning a lot independently since they had been fully involved in the group work. Students found it was greatly beneficial to them because they become more active and participating as indicated by their responses on the survey where 12.50% suggested they strongly agreed and 87.50% agreed.

### 3.2.6. Students feel confident and responsible for their learning outcomes

As was indicated earlier, when they are more prepared prior to the class the students felt more motivated and participated confidently in class activities. Further, since they had done the practicum at the beginning of the class; resulting in enhanced and improved realization when presented with the theories and basic knowledge of the subjects, naturally the

students comprehended it with ease.

When asked the question whether they experienced a sense of being in charge of their own learning when they had preparation prior to the class, 79.17% of the students agreed with this statement while 20.83% strongly agreed. This confirmed that flipped model has a positive impact on the lecture process because in class students were more confident, which in turn helped them to take charge of their own learning, becoming more responsible for their own learning outcomes. The last part is indicated by the improvement of the grade attained by this year's class grades (attested by the lecturer's documents/observation).

### 3.2.7. Students more easily understand new knowledge by doing practicum first

The emphasis of the flipped model in the current study was particularly on flipping the class lecture with the practicum. By doing the practicum first, which was preceded by the tutoring, the students shared their preferences for flipped format over the traditional practices in Geomatika class.

The survey results pointed out that 41.67% of 20 students enrolled in Geomatika class of Odd 2022 strongly agreed and 58.33% agreed that the flipped format was immensely beneficial to the improvement of their self-discovery skills. By conducting the practicum first prior to class lecture/discussion, students confirmed that they struggle less in processing the instruction, theories and knowledge taught in Geomatika class.

### 3.2.8. Students find it easier to ask for help when they encounter problems during the practicum period

One of the obvious side effects when students feel motivated and confident in their learning process is they will find it easier and more confident to ask questions and clarifications in their work. This is evidently established by implementing the flipped model in

**Table 1.** Flipped classroom implementation survey in Geomatika class

Nu.	Description	SA	A	DA	TDA
1	Generally, my teacher explains the lesson clearly and comprehensively.	20.83	79.17	0.00	0.00
2	My teacher talks less than the students by doing flipped activities	37.50	62.50	0.00	0.00
3	The group assignment is fairly organized	20.83	70.83	8.33	0.00
4	I was more prepared with my class activity with flipped instruction	12.50	87.50	0.00	0.00
5	I am engaged more in class activities when I am involved (individually and in a group)	12.50	87.50	0.00	0.00
6	When I have enough preparation prior to the class, I feel more in charge of my own learning (self-learning skill).	20.83	79.17	0.00	0.00
7	I understand things better when I discover the knowledge by myself (by doing practicum rather than if my teacher explains)	41.67	58.33	0.00	0.00
8	I feel more confident to ask for clarification after doing the practicum	41.67	58.33	0.00	0.00
9	I am more motivated by the new learning model (flipped learning)	29.17	70.83	0.00	0.00
10	I am involved in higher-order thinking (analysis, synthesis, evaluation)	20.83	79.17	0.00	0.00

Geomatika class.

During the activities of tutoring, practicum and processing practicum data/results, students were encouraged and engaged so they felt at ease to discuss as well as ask questions to their lecturer laboratory assistants, or even superior classmates when they felt unconfident about their understanding. With this freedom, students felt more at ease to solve the problems they encountered. This is in line with the survey results where 41.67% stated strongly agreed and 58.33% responded that they agreed with the observation above.

### *3.2.9. Students feel more excited and motivated by the learning model applied*

When asked about their preferences for the flipped model compared to the traditional one, 29.17% of the students in Geomatika class stated that they strongly prefer it, and 70.83% agreed that they would rather have the class in the flipped format.

It was inferred that the improvement seen in students' motivation and self-discovery skills during practicum was greatly supplemented by their previous knowledge of the instruction in flipped activities. In the traditional format, based on the lecturer's observation, the delivery of those knowledge/instructions came later, resulting in the students only being partially engaged in practicum.

### *3.2.10. Students find it easier to do analysis, evaluation, synthesis and other higher-order thinking skills*

The application of the flipped classroom was also a positive experience for students in that 79.17% of students said that they found it easier to analyze, evaluate, synthesize, and do other higher-order thinking skills, while 20.83% strongly agreed with this statement. The lecturer also observed that the flipped format of learning activities was ideal for students to develop their higher-order thinking skills since their learning process became more meaningful. The preparation and pre-knowledge acquisition exponentially helped the students in their analysis during the practicum and in writing up the report.

From the survey results above, as indicated by the students' feedback as well as attested by the lecturer's observation, it was evident that the flipped classroom learning model was very effective in Geomatika class. Students became more prepared, which in turn, made them more involved in their own learning.

As they had studied independently when writing up practicum reports, when the lecturer presented the fourth material according to the course syllabus, namely data processing techniques, students were more

confident and active in class as a result. As a result of students' increased knowledge of the material being taught/discussed, the need to explain the material in detail was significantly reduced. Moreover, observations revealed that students were more confident and enthusiastic in answering questions. This would later be indicated by their improved learning outcomes on class work as a result of their previous knowledge of how to do calculations and data processing during the process of writing up the practicum report. Another substantial fact revealed was the students' demonstration of how they took charge of their own learning, as indicated by their willingness to seek guidance and help from lecturers, lab assistants, or even their classmates during the process of writing practicum reports. In short, the implementation of the flipped model in the class of Geomatika help greatly to promote the improvement of student independence and responsibility in their own learning process as well as outcomes

## **AUTHORS' CONTRIBUTIONS**

TMY: Lecturer, Researcher, author

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## **REFERENCES**

- [1] M. F. M. Abushammala, The effect of using flipped teaching in project management class for undergraduate students, *JOTSE: Journal of Technology and Science Education*, 9(1), 2019, pp. 41-50. DOI:[10.3926/jotse.539](https://doi.org/10.3926/jotse.539). <https://doi.org/10.3926/jotse.539>
- [2] J. Bergmann, A. Sams, Flipped learning: Maximizing face time, *T+ D*, 68(2), 2014, pp. 28-31.
- [3] I. Blau, T. Shamir-Inbal, Re-designed flipped learning model in an academic course: The role of co-creation and co-regulation, *Computers & Education*, 115, 2017, pp.69-81. DOI:<https://doi.org/10.1016/j.compedu.2017.07.014>
- [4] S. Carter, Traditional Vs. Project Based Learning: The Effects on student performance and motivation in honors level mathematics courses, Doctoral dissertation, Liberty University, 2016.
- [5] H. J. Cho, K. Zhao, C. R. Lee, D. Runshe, C. Krousgrill, Active learning through flipped

- classroom in mechanical engineering: improving students' perception of learning and performance, *International Journal of STEM Education*, 8, 2021, pp. 1-13.
- [6] E. Doman, M. Webb, The flipped experience for Chinese university students studying English as a foreign language, *Tesol Journal*, 8(1), 2017, pp. 102-141.
- [7] J. C Jakob, A. Asrifan, The Role of Flipped Classroom in Developing Speaking Ability of Civil Engineering Students, Available at SSRN 4260721, 2022.
- [8] N. Lee, T. Salama, S. J. Kim, Using the Flipped Classroom Model to Improve Construction Engineering and Management Education, in: 2016 ASEE Annual Conference & Exposition, 2016.
- [9] I. Listiqowati, I. N. Ruja, The Impact of Project-Based Flipped Classroom (PjBFC) on Critical Thinking Skills, *International Journal of Instruction*, 15(3), 2022, pp. 853-868.
- [10] R. Luo, Application of 5P Teaching Method in China's Middle School English Teaching, *Theory and Practice in Language Studies*, 9(5), 2019, pp. 571-575.
- [11] N. Oktifa, Strategi Pembelajaran Flipped Classroom Alternatif seru belajar di era kenormalan baru, 2022.
- [12] F. E. Raharja, Penerapan Flipped Classroom dengan Memanfaatkan Microsoft Teams dalam Meningkatkan Hasil Belajar Peserta Didik pada Mata Pelajaran Mekanika Teknik Kelas X Bisnis Kontruksi dan Properti di SMK Negeri 5 Surakarta, 2021.
- [13] Y. García-Ramírez, It is not enough to flip your classroom. A case study in the course of Pavements in Civil Engineering, *Ingeniería e Investigación*, 39(3), 2019, pp. 62-69.
- [14] R. Farida, A. Alba, R. Kurniawan, Z. Zainuddin, Pengembangan Model Pembelajaran Flipped Classroom Dengan Taksonomi Bloom Pada Mata Kuliah Sistem Politik Indonesia, *Kwangsan: Jurnal Teknologi Pendidikan*, 7(2), 2019, pp. 104-122.
- [15] M. S. H. Ruslan, N. H. Sapiee, K. A. Kurnia, N. A. Amran, N. Abd Rahman, Student adoption and effectiveness of flipped classroom implementation for process simulation class, *Education Sciences*, 12(11), 2022, p. 763.
- [16] S. W. Utomo, M. Ubaidillah, Pemanfaatan aplikasi whatsapp pada pembelajaran berbasis masalah untuk mata kuliah akuntansi internasional di Universitas PGRI Madiun, *Jurnal Teknologi Pendidikan*, 6(2), 2018, pp. 199-211.
- [17] A. B. Wicaksono, Penerapan Model Pembelajaran Flipped Classroom dengan Pendekatan Project Based Learning Untuk Mata Pelajaran Biologi Kelas X (studikasuk: SMA N 1 SALATIGA) (Doctoral dissertation, Program Studi Pendidikan Teknologi Informasi dan Komunikasi FTI-UKSW), 2015.

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