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Exploring the flipped model in the CLIL geology classroom

Abstract. *This paper explores the application of the flipped classroom model within a Content and Language Integrated Learning (CLIL) geology course at a university level. The study examines the possibility of changing language-learning habits for students with mixed language abilities. It examines the learning outcomes and test performance of students using the flipped classroom model, comparing these results with those from traditional lecture-based instruction and a combined approach. The paper is structured as follows: The introduction is followed by a section defining the flipped learning model and providing a theoretical background. Next, it discusses both the potential benefits and drawbacks of the flipped model. Subsequently, the paper details its implementation in a specific geology classroom setting. The final section outlines the research methodology, objectives, and findings. The results show that the flipped classroom model holds valid potential for successful implementation if proper preparations are completed. Finally, given the complexity of both the flipped method and CLIL, the application of the flipped method is best initiated with first-year students. Our findings confirm that the flipped model can be successfully applied in the primary stages of university education.*

Keywords: *flipped model, CLIL, traditional method, geology, English*

Introduction

In the ever-changing world of education, teachers are always on the lookout for new ways to approach their students and improve the teaching/learning process. In the previous decade or

so, a method which started gaining popularity amongst teachers on all levels of education is the so-called “flipped classroom” method (van Alten et al., 2019: 1). This method, as the name illustrates, “flips” the classroom in such a way that the students themselves, in a manner, become their own teachers (Bergmann and Sams, 2012, p.60), whereas the teacher’s role of *sage on the stage* turns into the role

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of *guide on the side* (Dougan, 2015). In this model, the students are ushered into roles of active learners and researchers, while academics assume the mantles of instructors and stimulators (Deng, 2019, p.1352). This kind of shift has been discussed as being possibly very beneficial for a new-age classroom (Bergmann and Sams, 2012; Webb et al., 2019; O'Flaherty & Philips, 2015; Mehring & Leis, 2018; Brame, 2013; Reidsema et al., 2017). Most researchers agree that the flipped classroom model has beneficial effects on students' learning outcomes and overall performance in class, especially pointing out the effects it has had on student-teacher interactions and student motivation (Öztürk & Çakıroğlu, 2021, p.2). All of them agree that students are given more autonomy and an opportunity to develop independent study processes. However, for some the application of the flipped classroom model does not have a substantial enough effect on student performance or its impact could be perceived as negligible (Deng, 2019; Hadžiahmetović, 2021; O'Flaherty and Philips, 2015; Braseby, 2014; Setren et al., 2020; Lai and Hwang, 2016). Since there is a perceptible shift in the flipped model, it is thought that some students may not be able to cope as well with the material independently as they would with the help of the teacher, and that they may not be able to organize their time and resources successfully. This could be viewed by some as a discouraging factor for the students, thus leading to a weaker performance. (Öztürk & Çakıroğlu, 2021, p.2)

This paper represents an addition to the study of the effects of the flipped-classroom model in higher-level education, specifically students of the first and second year of studies. It analyses the effects of the flipped model within a CLIL (Content and Language Learning), or more precisely, a CEIL (Content and English Integrated Learning) classroom in the field of geology, making it a specific field of exploration. The paper will present our findings based on summative assessment of the students' learning outcomes and test performances based on the compar-

ison of teaching in the traditional setting, a flipped one, and a combination of both.

Defining the flipped classroom

The term "flipped classroom" stems from the term "flipped learning", which, as defined by the Flipped Learning Network (FLN) resides on the "four pillars" defined as follows:

1. *Flexible* environment
2. *Learning* culture
3. *Intentional* content
4. *Professional* educator.

These pillars portray the flipped learning model whereby the students determine the time and place of their studying activities (flexible environment), their active involvement in the knowledge-gaining process (learning culture) and the materials tailored to accommodate for the absence of the teacher (intentional content). In this model, the teacher's role is changed in such a way that they become guides for the students' process of knowledge acquisition. The role of the teacher is changed into that of a facilitator, of an instructor, who no longer "holds the reins" over what and how the students learn, but aids in the process all the while allowing for the students themselves to adapt the learning method to their own needs. It is on the teacher to provide the material, give the students sufficient information on what to learn and how to approach specific areas, and be there for the students for any further clarification, when and if needed (professional educator).

In essence, in flipped learning, or the flipped classroom, the first exposure to new material or subject matter happens outside the classroom (Brame, 2013). Jonathan Bergmann and Aaron Sams, authors of the book titled *Flip your classroom*, claim that there are numerous benefits to flipping, one of which being a "personalization" of education (2012, p.6) since in this model, each student tailors his or

her own learning according to their own needs, capabilities, and interests. This stems from the belief that there are different learning styles and most supporters of this theory endorse what Pashler and his team refer to as the meshing hypothesis (Pashler et al., 2009) — the belief that learning is more effective when the presentation of information aligns with a person's preferred learning style (Manojlović et al., 2023, p.2).

What is more, another aspect at play when it comes to determining not only a student's learning style, but also their motivation and approach to learning lies in Gardner's theory of multiple intelligences, which "facilitates in identifying the genetic framework and natural mindset of the student" (Kaushik, 2017, p. 336). This, in turn, enables for a recognition of the "optimum area of working allowing the process to move forward to actual learning" (*ibid.*). Thus, the flipped classroom model creates an environment in which it is possible to witness what can be described as the effectiveness of the integration of multiple intelligences with students' idiosyncratic learning styles (Alrabah et al., 2018, p.40). In this way, students become fully in charge of their own learning. This is a very important aspect of the flipped classroom since it relies on prompting and developing student accountability (Preeti, 2021, p.41). As Preeti explains, through the flipped classroom methodology students can steadily learn how not to depend solely on the teacher for gaining knowledge, but can create their own independent mechanisms for a greater sense of self-confidence, proactive thinking and engagement (2021, p.41) all based on their own personal predispositions and intrinsic motivating factors.

All things considered, the flipped classroom model's primary purpose is the development of students' learning autonomy, critical thinking skills, and increased self-confidence. This is achieved, as stated above, by allowing the students themselves to be in full control over how and when they learn, but also simultaneously opening the possibility of them

noticing and realizing their own areas of preference and interest in the subject matter. In the flipped model, the teacher "gives the students space to engage with the material and with each student's interpretation of it" (Cunningham, 2017, p.42). The teacher is also there to help with anything students might be struggling with, but in an individual and student-specific way, since there is more time in class for the teacher to dedicate to student understanding. However, as with any novel approach to learning, there cannot be a one-sided presentation of the approach, but both the advantages and possible downsides need to be taken into consideration.

Pros and cons of the flipped classroom

The flipped classroom model carries in its application a number of positive aspects. One such plus to flipping is that it can help incentivize struggling and shy students to better deal with the workload and study material (Bergmann and Sams, 2012, p.23) considering that in this way the learning environment is adjusted to their own needs. Also, the results of a 2018 study done by Nazaripour and Laie indicated that there was an overall positive effect of the flipped classroom model with students with learning disabilities in terms of self-efficacy (2020). Moreover, there are studies which claim that the flipped-classroom model helps promote different skills, from learning how to learn to learning to develop inductive and deductive logic and critical reasoning (Colomo-Magaña et al. 2020, p. 2) which is at the core of the flipped classroom model.

Another positive aspect to the application of the flipped models is the development of academic resilience (Izdanpanah, 2022, p.3). Izdanapanah defines this term as the students' ability to overcome the perceived challenges and "adverse conditions" in learning, created by a change in their habitual learning setting (*ibid.*). However, not all students will view this change in a positive light. For them it might represent additional work and demand more effort. But

this too can be “flipped” to their advantage, since all the aspects the students may perceive as burdensome and uncomfortable could eventually lead to greater student independence and an enhanced sense of accomplishment (Al-Abdeli, 2017, pp.203-204). This is where the role of the teacher as a professional educator is highlighted. In the flipped model, the teacher holds the power to create such activities and exercises in the classroom through which he/she can demonstrate that, through their successful completion, the students have overcome something they initially saw as difficult or uncomfortable (Hartányi et al., 2018, p. 45-47). In flipped learning, the student becomes the protagonist of his/her own learning (*ibid.*) and could develop skills which can help them later in all areas of life.

Nevertheless, it is precisely this factor of the students being the ones in charge of their own studying that may prove troublesome (Braseby, 2014, p.7). Some pitfalls could be a perceived lack of structure, the student’s innate propensity to procrastination, or a simple lack of self-discipline and motivation (Webb et al., 2019, p.8). Some claim that it is because of these potential problems the students may face, flipping entails even more work on behalf of the teacher, parts of which are accepting their new changed role and finding new ways of monitoring student progress (Blagdanić and Lukić, 2021, p.45). Another aspect is giving very clear and direct instructions aimed at lowering the anxieties of the students (O’Flaherty and Philips 2015, p.89). However, the workload does not increase for the teachers only. Another potentially negative aspect of the flipped classroom that the students themselves have pointed out was their own workload being increased, which they found difficult to manage (Mehring and Leis, 2018, p.3). What is more, Casadonte singled out ESL students as finding the flipped model more difficult, in general (2016, p.22). Moreover, even though the flipped-classroom model tends to be portrayed as “the panacea to the lecture” (Webb et al., 2019, p.3), the traditional method is far from being abandoned, since it is still seen as the most familiar and comfort-

able way of learning, requiring little active student participation (O’Flaherty and Philips, 2015, p.89).

All of the abovementioned points to an overarching complexity concerning the application of the flipped-classroom model. Though it bears notable benefits, as demonstrated, it is not without its fair share of downsides. When it comes to the learning outcomes, however, most study results were inconclusive (Webb et al., 2019, p.7) or showed no significant difference in results when the traditional and the flipped model were compared (Yestrebsky, 2015, p. 1117). Most authors point out that there are numerous factors to be taken into account when considering the effectiveness and applicability of the flipped classroom (O’Flaherty and Philips, 2015, p.94; Webb et al., 2019, p.7; Colomo-Magaña et al., 2020, p. 3; Hadžiahmetović, 2021, p.307). These factors include (but are not limited to) the specific subject matter, students’ prior engagement and performance, institutional setting and timing of the assessment (Webb et al., 2019, p.7).

Still, what stands as a counterclaim to these is the fact that what may serve as a pre-emptive measure is the incentive the students are given for studying as well as the quality of the pre-learning instructions (Brame, 2013). What is not to be underestimated in this context also is the matter of academic self-efficacy and a feeling of control which increases with the use of the flipped classroom, since students are put in the very center of teaching and are allowed to adjust the content to their own preferences, talents, and capabilities (Perić Prkosovački et al., 2024, p.77). Moreover, precisely because one of the jeopardizing factors could be the students’ learning skills themselves, the flipped model may prove most valuable in higher education (Berrett, 2012, p.2) which is the level where it has been studied the most (Hadžiahmetović, 2021, p.318). It is considered that at this level, students already have a certain sense of their own learning styles and capacities, and would, thus, benefit most from the flipped classroom model (Jones et al., 2019, 205).

Flipping the geology classroom

There have been several attempts at flipping the geology classroom at a university level (Breckenridge, 2014; Sample-Lord et al, 2018; Jones et al, 2018; Somma, 2022), all of which started with the presumption of it facilitating learning and contributing to faster and more effective acquisition of the material. In all these studies, the intended goal was to raise metacognitive abilities of the students (awareness of the students' own skills and abilities) and aid in better learning of the subject matter by encouraging an independent and personal approach to learning. This is in line with our practice at the Faculty of Mining and Geology, University of Belgrade, where we foster the CLIL approach for learning geology, which entails the development of students' competences, motivation, and self-confidence, alongside teaching and learning geology-specific subject matter (Beko, 2021, p.47).

In the case of the FMG, we believed that the years-long application of the CLIL method in teaching geology made way for a practical application of the flipped classroom model. Since the flipped method is based on active learning, and CLIL presupposes active student engagement for its effectiveness (Coyle et al., 2010, p. 29), combining the two presented itself as a valid field to be explored. What is more, both the flipped classroom method and CLIL emphasise the importance of developing students' analytical and creative approach to learning, which is supported by Bloom's taxonomy of different thinking processes. This taxonomy, which encompasses remembering, understanding, applying, analysing, evaluating and creating, accentuates the importance of the later stages presupposing the successful completion of the earlier ones (Anderson and Krathwohl, 2001, pp. 67-68). This is important to consider when thinking about the curriculum and class organization (Li et al., 2023, p. 2012; Coyle et al., 2010, p. 30). Both methods have a joint goal – finding the optimal method and/or approach in order to facilitate better language learning and acqui-

sition. This is especially pertinent at a university level, since students do have a clear view of their own language needs, as well as the needs of the job market, and are aware of the necessity of knowing even more than one foreign language, especially if it is for specific purposes (Janković & Buđevac, 2023, p.40).

In our classes, we had already partially applied the flipped method since it was expected of the students to read the lessons for the class beforehand. Our classroom experience seems to be in accordance with the studies showing that pre-class activities, especially reading, do not bode well with a large number of students (Podofelsky & Finkelstein, 2006, p.338; Smale, 2020, p. 1). In the study by Podofelsky and Finkelstein less than 40% of students of a physics class did their pre-class reading and 60% thought it more useful if it was done after the lecture (2006, p.338). Smale's study supports these findings and states that one of the reasons why students did not engage in pre-class reading was the fact that they did not find it crucial for their success in class (Smale, 2020, p.5). This, again, is in line with Podofelsky and Finkelstein's study where an increase in the number of students doing their pre-class reading was noticed only after they were expected to hand in reading exercises which would add to their course achievement (2006, p.338). It is also interesting to note that in their study, students connected lectures with the test and reading from the textbook with homework (Podofelsky & Finkelstein, 2006, p.341).

For this reason, we decided to organize the flipping in such a way that the students were given an incentive to do the reading at home. This was in form of points that would account for a part of their overall course grade, since this has proven to be a significant motivating factor in overall student performance (Pongračić et al., 2022, pp.90-91). As our research will show, students did find this extrinsic factor motivating for their preparation before class.

Another important aspect to consider when talking about the CLIL geology classroom at the FMG is its heterogeneity. Though having a mixed-

ability language classroom in higher education is not a new occurrence (Swensson, 2017, p.59), the fact that it does exist does not mitigate the complexities that come with teaching in such a setting. At the FMG, the English language level of our students spans from A1/A2 (basic user) levels to C1, and in a few marginal cases even C2 (proficient user) level. What is more, a mixed-ability classroom does not entail different language levels only, but it also presupposes differences in the students' learning styles, motivation to learn and attitudes toward learning, especially when it comes to foreign-language acquisition (Heng et al., 2023, p. 592). It is no wonder then that there is an established belief that all these individual differences "can predict success or failure in language learning" (Lightbown and Spada, 2013, p.75). It is evident that with a distinction as large as that in the levels of proficiency among our students, finding an adequate way of teaching may present a challenge for the EFL teacher. For this reason, having implemented the CLIL method of teaching English for geologists, we ventured to explore the possibilities of the flipped method in order to investigate its effects on student performance.

Research methodology and aims

The aim of this research is to evaluate and assess the applicability of the flipped classroom model in a CLIL geology classroom through the means of students' test performance. This is to gauge student overall learning outcomes in relation to three different models of teaching and learning.

When considering the applicability of the flipped method in our CLIL geology classroom, we set about to confirm two hypotheses:

1. *The flipped classroom method can be successfully applied in a mixed-ability classroom.* – The level of language knowledge at the FMG language classroom spans from a beginner (A1 level) to students with advanced knowledge of the English language

(C1). Considering the complexities of such a heterogenous setting, we aimed to show that even in such a language classroom it is possible to use the flipped learning method. The reasons behind our belief in the applicability of the flipped model is based on the fact that, regardless of level, when dealing with specific and narrow subject matter, all students will put in additional effort to complete the demands of a course successfully.

2. *An introductory application of the flipped model will yield satisfactory results if partially combined with the traditional method.* – Though our aim is to assess the efficiency of the flipped method compared to the traditional one, we believe that an overhaul of teaching methods is not yet possible and that the traditional method still presents the method in which students have the greatest confidence and resort to for support. This is particularly pertinent in the case of the FMG CLIL language classroom since our students have been instructed in this method from the very beginning of their schooling and it is only logical that they would find it the most effective one. Thus, combining the flipped method with certain segments of the traditional one is expected to give satisfactory results in student test performance.

For research purposes, we decided to assess the effects of the flipped classroom through three tests and the method of summative assessment in order to gain a clear picture of how exactly the flipped classroom model would affect our students' scores compared to the results of the traditional lecture and a combination of both approaches.

Our study was conducted over the course of three and a half months, during the second semester, on the obligatory English course. The study included 30 students in the first year of studies. As was

stated before, the level of English knowledge varies among the students, but all the levels of knowledge were covered in varying numbers: A1 – 4 students, A2 – 6 students, B1 – 5 students, B2 – 7 students, C1 – 6 students and C2 – 2 students. Regardless of the level, for each test, students generally have to prepare three texts which comprise one whole unit. All the tests consisted of three questions the students had to answer in their own words, in English. All the questions are directly connected to the topics covered for each test, in the sense that the topics themselves were the questions. The subject matter consisted of three units, each divided into three parts:

1. Continental drift

- Wegener's theory of plate tectonics
- Plate boundaries
- Neotectonics

2. The rock cycle, igneous rocks and volcanoes

- The rock cycle
- Igneous rocks
- Volcanoes

3. Weathering, erosion and sedimentary rocks

- Weathering
- Erosion
- Sedimentary rocks

All the units and corresponding texts with reading comprehension exercises and vocabulary explanations are found in the course textbook (Beko, 2023). The students were already familiar with it since it had already been used in the first semester. All the texts in the coursebook are in English, of equal length and on the same language level (C1) (Beko, 2023, pp. 100-111, 126-139, 152-156).

Picture 1. Examples of the text, vocabulary explanations and reading comprehension exercises from the course textbook.

 Tectonic Plates 	 Reading Comprehension 
Oceanic - Continental Convergence Oceanic plates, which are formed largely from basaltic rock, are much denser than continental plates, which are relatively buoyant. When an oceanic plate collides with a continental plate the oceanic plate will consequently subduct. As with the convergence of two oceanic plates, an oceanic trench forms and magma is created, and an arc of volcanoes, known as a continental arc, is formed, with the volcanoes projecting through the upper continental plate. The Peru-Chile Trench and the chain of volcanoes along the western seaboard of South America, formed by the subduction of the Nazca Plate beneath the South American Plate, illustrate this process. Further examples of continental arcs are the Sierra Nevada range, which is older and now inactive and further north the Cascade Range which includes active volcanoes such as Mount St Helens and Mount Rainier. In both oceanic-oceanic convergence and oceanic-continental convergence friction between the subducting plate and the overriding plate can cause earthquakes. Continental - Continental Convergence Continental lithosphere is insufficiently dense to sink through the asthenosphere. Consequently, when two continental plates converge, there is no subduction. Instead, lithospheric material is forced both upwards and downwards as the plates converge, thickening the lithosphere and causing the formation of mountain ranges, such as the Himalayas, formed by the ongoing convergence of the Indian and Eurasian Plates – this convergence began about 50 million years ago. Other mountain ranges such as the Urals, Alps and Appalachians were formed by similar plate convergences. Divergent Boundaries Divergent boundaries occur when plates move away from each other, rather than collide. The divergence of oceanic plates has already been considered in the discussion of seafloor spreading above. However, it is also possible for continental plates to diverge. Examples of such tectonic movements can be seen in the Rift Valleys of East Africa, along the boundary where the Somali and Africa Plates are diverging. In some cases, continental divergence may allow for the formation of a new sea: the divergence of Africa and Arabia allowed for the formation of the Red Sea in relatively modern geological history. Transform Boundaries/Faults When tectonic plates are moving in parallel directions, rather than converging or diverging, a transform fault is formed. In this case, two plates slide against each other, causing their edges to grind and abrade as they do so, generating friction which can cause earthquakes. The San Andreas Fault, where the North American Plate is moving to the south west, and the Pacific Plate to the north west, is probably the most famous example of a transform fault. As has already been mentioned, these events occur in extreme slow motion, and this is governed by the velocity of the plates involved. Velocity can be defined as the distance travelled within a period of time, e.g. 25km/h – after one hour, the body in motion will be 25km from its starting point. Two measures of velocity – absolute and relative – are used. Absolute velocity relates to the speed at which both/all the plates involved in a collision are moving with regard to a fixed ('motionless') point in the mantle. Relative velocity is a measurement of the speed of one plate from the perspective of another plate. For example, if plate A has a velocity of 10cm/year, and plate B a velocity of 5cm/year (and both are moving in the same direction) the relative velocity of plate A is 5cm/year; if they were moving in exact opposite directions, as might be the case in seafloor spreading, the relative velocity would then be 15cm/year. Modern satellite technology allows for the 'real time' measurement of plate velocity through the exact measurement of the distance between observation points on opposite sides of a plate boundary at fixed time intervals. In the past, magnetic stripes created by seafloor spreading have been used to calculate plate velocities.	paradigm <i>noun</i> a set of ideas that act as a model for how things should be done or thought about; <i>synonyms</i>: theory, framework, blueprint play out <i>phrasal verb</i> the action of gradually developing or happening in a particular way; <i>synonyms</i>: unfold, develop, turn out; <i>antonyms</i>: fail to happen, not take place posit <i>verb [transitive]</i> the action of stating something as true or accurate; <i>synonyms</i>: postulate, hypothesise, assert; <i>antonyms</i>: refute, doubt, discard project <i>verb [intransitive]</i> to extend in an outward direction beyond a surface; <i>synonyms</i>: protrude, bulge, jut out; <i>antonyms</i>: indent, depress, deflate relatively <i>adverb</i> used to describe a certain quality in relation to something else; <i>synonyms</i>: somewhat, to some extent, comparably; <i>antonyms</i>: very, extremely, significantly slide <i>verb [intransitive]</i> the action of moving easily without friction along a surface; <i>synonyms</i>: glide, slip, move smoothly; <i>antonyms</i>: stick, grate, judder sudden <i>adjective</i> referring to something that happens quickly or unexpectedly; <i>synonyms</i>: abrupt, swift, out of the blue; <i>antonyms</i>: slow, gradual, deliberate  <i>Opal</i> Reading Comprehension Answer the following questions based on what you have read. 1. How are tectonic plates categorised? 2. Define convergent and divergent boundaries. 3. What types of convergent boundaries are there? 4. Explain oceanic-oceanic convergence and what is formed in the process. 5. Which plate subducts in the oceanic-continental convergence? 6. Explain what a continental arc is. 7. Why is there no subduction in the continental – continental convergence? What is formed in the process? 8. What are the Rift Valleys in South Africa an example of? 9. Define transform boundaries. 10. What is plate velocity? 11. How do absolute and relative velocity differ? 12. Choose the correct answer/s: a) Which of these are true about the Peru-Chile trench? i. It was formed through oceanic-oceanic convergence. ii. Its creation may have caused earthquakes. b) Which of these are true about the Aleutian Islands? i. At first they were seamounts. ii. They are not representative of convergent boundaries. iii. There are volcanoes on these islands. iv. They were formed in the same way as Mount St Helens. c) We know oceanic plates are older than continental ones because i. they contributed to seafloor spreading. ii. the production and consumption of lithosphere occur at the same time. iii. c. they are denser than continental plates. iv. d. We do not know this.  <i>Amber bead</i>
105	107

The time allotted for each test was 45 minutes. They had no limitations on how much they could write. The maximum number of points in each test was 10.

The first test followed a fully traditional teaching method, wherein students were instructed through direct teaching by the educator over the course of three classes before taking the examination. The unit for the first test was on the topic of continental drift and plate tectonics.

The second test employed a fully flipped classroom model, requiring students to prepare the units independently while the teacher provided guidance and resources as needed. The students were given ample instructions beforehand on how to approach the reading and learning of the texts, what areas to focus on and were given additional support in terms of video clips from the Internet on the topic of the texts they were covering. The topic of the unit for this part was the rock cycle and igneous rocks.

The instructions for the students consisted of the teacher explaining which units they would have to prepare and what to focus on the most. For instance, in the first part, "Rock cycle", the students were advised on the basic division of types of rock and instructed to pay special attention to the processes which connect them and are described in the text. Additionally, a short video about this topic was posted on the student platform Moodle, so the students could also have a visual representation of what they were reading. For the second part, "Igneous rocks", in order to aid understanding, the teacher explained the different types of classification of igneous rocks, as well as the criteria based on which the classifications are made and singled out the relevant lexical units most pertinent to the matter at

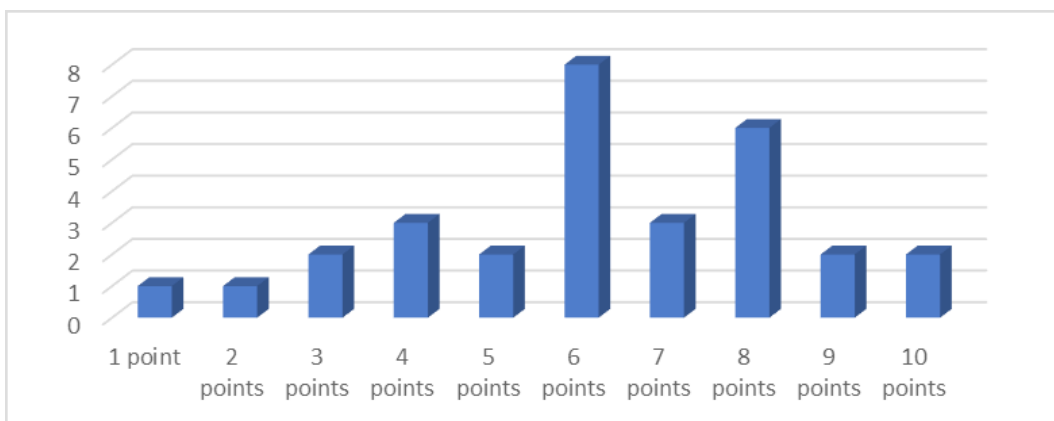
hand. The same principle was followed for the third part of the unit, "Volcanoes", with the students also being given a poster illustrating the different types of volcanoes. All of this was done without going into too much detail, lest it be no different from the traditional class. The students were basically provided with a "map" of terms that would help them better navigate the text they were to subsequently go through on their own.

The third test combined both approaches. One part of the unit (weathering and erosion) was to be prepared by the students themselves, due to the interconnectedness and inseparability of the subject matter, whereas the second part (sedimentary rocks) was taught in class. For the first two parts, the teacher explained the main terms and their interconnectedness, instructing the students what to focus on the most while reading the texts. For the third part, the lecture was held in the traditional manner, with the teacher fully explaining the topic at hand, with detailed illustrations, all the while engaging the students to participate with their own associations based on the previous parts and what they have already learnt. In this unit only, the first two parts were merged into one due to their subject connectedness. This still accounts for three texts, only the first two comprise one part. After the class with the lecture, the students had the test the following class. This methodology aimed to assess the effectiveness of these pedagogical strategies on student performance by comparing results across the different instructional approaches. The results of the three tests expressed in points are given in the table, while the distribution of points for each test individually is presented in the graphs below:

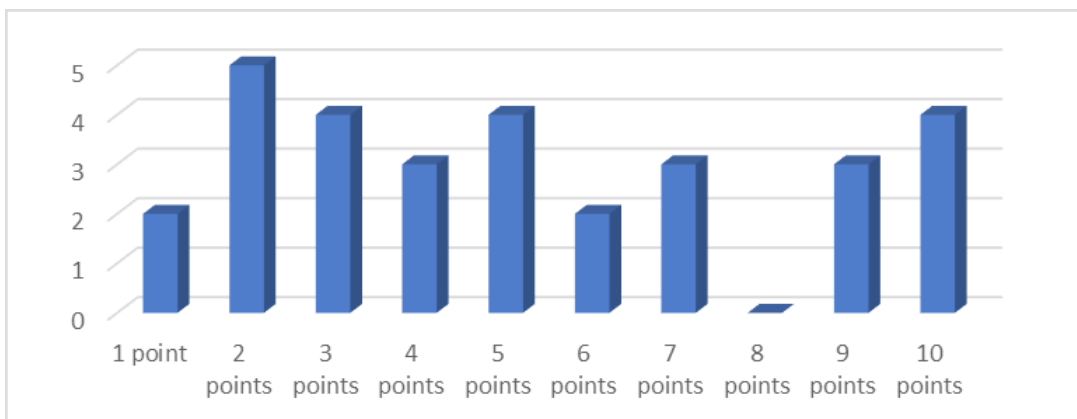
Table 1. Student scores expressed in points and percentage (all three tests).

	Test 1	Test 2	Test 3
Number of points (x/10)	Number of students (%)	Number of students (%)	Number of students (%)
1 point	1 (3.33%)	2 (6.66%)	1 (3.33%)
2 points	1 (3.33%)	5 (16.6%)	1 (3.33%)
3 points	2 (6.66%)	4 (13.3%)	4 (13.3%)
4 points	3 (10%)	3 (10%)	3 (10%)
5 points	2 (6.66%)	4 (13.3%)	5 (16.6%)
6 points	8 (26.6%)	2 (6.66%)	2 (6.66%)
7 points	3 (10%)	3 (10%)	4 (13.3%)
8 points	6 (20%)	0 (0%)	3 (10%)
9 points	2 (6.66%)	3 (10%)	4 (13.3%)
10 points	2 (6.66%)	4 (13.3%)	3 (10%)
Average number of points:	6.2	5.2	6.07

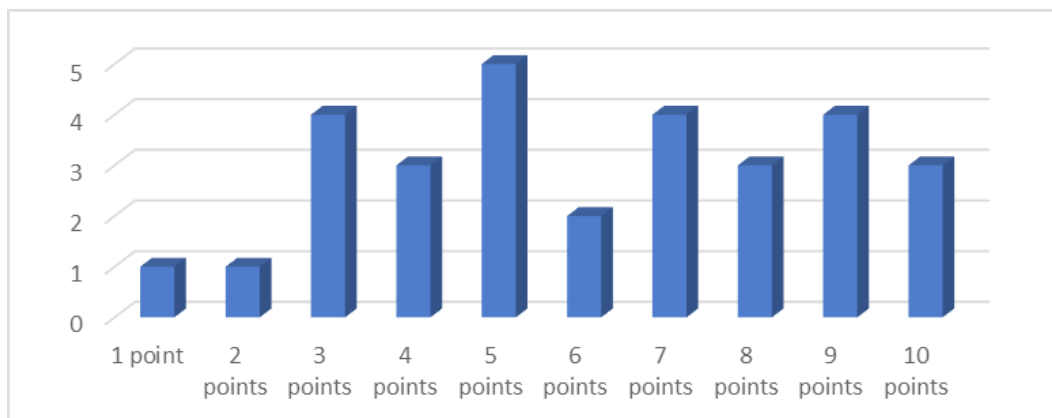
Graph 1. Test 1 – point distribution according to the number of students.



Graph 2. Test 2 – point distribution according to the number of students.



Graph 3. Test 3 – point distribution according to the number of students.



Research results and discussion

For easier interpretation, the points have been divided into three categories: low range, from 1 to 3 points, mid-range, from 4-6 points and high range, from 7-10 points.

In the first test, students received comprehensive instruction from the teacher, who provided traditional lessons and direct support. The scores reveal a higher concentration of students achieving mid to high-range points. An equal number of students achieved the mid to high-range number of points at 13 students (43,32%) respectively. The average score for this test was 6.2 points, indicating that traditional teaching led to relatively high performance. Notably, 2 students scored 9 points, and 2 students scored 10 points, while almost one third of the students scored 6 points. Considering that most students achieved higher points, it would be safe to conclude that the traditional method is most useful for students at lower language levels, since the teacher makes the subject matter “digestible” for most students and the majority can rely on class instructions when studying and revising later on their own.

In preparation for the second test, the flipped classroom model was applied. This model resulted in more students achieving low scores compared to the first test, with a decrease in the number of students with mid- to high-range points. Here, 11 stu-

dents scored between 1-3 points (more than double the number from the first test), 9 students (around 30%) achieved 4-6 points, while 10 students were in the high-range category. The average score dropped by one point to 5.2. This method resulted in a higher percentage of low scores, more than double the number from the first test. The number of students scoring 9 and 10 points rose by one and two, respectively, but the overall number of students who scored between 7-10 points dropped by 10% compared to the first test, with no one scoring 8 points. Considering an almost even distribution of points according to this model, we could state that students of all levels can benefit from this particular approach, which is in line with the flipped methodology.

The third test followed a mixed approach. The results show a point-distribution similar to the second test, but the average score closer to the first test. In the third test, 6 students (20%) were in the low-range category, 10 students (33,3%) achieved between 4-6 points, while almost half the students were in the high-range category. The average score was 6.07. This method also saw an increase in the number of students getting 9 and 10 points compared to the first test, which might indicate that integrating both methods could enhance performance for some students. Also, the number of students who scored 8 points tripled compared to the second test, indicating that for those students the addition of the traditional meth-

od may have been useful. This is especially true for the students on the intermediate level of the spectrum (pre-intermediate B1 towards intermediate), since they can appreciate the independent side of studying and preparing the matter but could still benefit from having the teacher present the harder parts first, so they are familiar with them in later stages.

Comparing the results, the traditional method achieved the highest average score of 6.2 points, with fewer students scoring low and more achieving mid to high scores. The flipped classroom method resulted in the lowest average score of 5.2 points and a broader distribution of points with a significant increase in lower scores. Notably, the number of students scoring between 1-3 points in the flipped method was almost triple the number of students in the same range in the first test. Though it showed an improvement in high-range points compared to both tests, the average for the combined method was 6.07 points, which was higher than the second, yet lower than the first test.

Based on the average number of points and the distribution of student performance, the traditional teaching method appears to be the most effective. Considering that the students were exposed to this type of learning throughout most of their schooling, it naturally follows that they would perform best following this model.

The flipped classroom model resulted in a decrease in average performance and an increase in lower scores. This was also to be expected, especially considering that this was a pilot study aimed at showing the applicability of the flipped model, which has been proven by the results. The 18% drop in the average number of points may be viewed as an indicator of the students' initial adaptation to the change in learning methods and should not be considered an indication of the lack of effectiveness of the flipped model. On the contrary, the fact that the number of points did not lower by a greater margin could be seen as a supportive sign that the flipped model could be more effective if more time was given to assess its im-

pact. This provides room for further research. What is more, the number of points was more evenly distributed when the flipped model was applied, which reinforces our hypothesis that this model can definitely be applied in a mixed-ability language classroom.

Combining both methods, however, yielded intermediate results, suggesting that while the flipped classroom model can offer benefits, it does need support in its initial phases in form of a method which the students are more used to and perceive as something "known". These results prove our second hypothesis which stated that in the primary stages of the flipped classroom approach, the teacher should include the traditional method to a certain extent in order to ease students' transition from one method of learning to the other.

Conclusion

As is the case with any new method and its initial application, our research shows that, though the results are promising, no great changes can be achieved over the course of a few months. Our intention was to explore the potential for use of the flipped classroom model in a highly specific educational setting, with a mixed-ability language classroom, all the while being aware that the full switch would not be entirely possible due to the students' years-long reliance on the traditional lecture format. Consequently, it is our opinion that the optimal time for the initiation of the flipped method would be on the first year of studies, all the while bearing in mind the fact that a full flip would not be possible until later. The implementation of the flipped method and the learning curve of our students should be monitored over a longer time period, giving the students time to adjust to a new approach. Precisely for this reason it is that we believe that introducing the flipped method on the first year of studies would benefit the students most since they would be given an opportunity to slowly start developing an educated approach to fully independent learning during their studies.

Our first hypothesis states that the flipped classroom model can be applied in a mixed-ability classroom, which has been proven. Though our study has shown a slight decrease in the number of points when this model was fully applied, it still confirms that the application of the flipped method is possible, but for its full potential to come to the forefront, more time and longer student preparation is necessary. Also, it opens up a new avenue for further research.

The second hypothesis about the necessity for the support of the traditional method in the initial application of the flipped classroom has been confirmed as well. Considering that our whole educational system, from primary school up to university education, is mostly based on the traditional teaching methodology this comes as no surprise and it was something we knew would be the case. Still, this only goes to show that even though some forms of the traditional method could prove beneficial in the first phases of switching to the flipped model, it does not undermine the possibility of a full switch. On the contrary, it demonstrates that the potential does exist, but that it requires more time and experience among teachers and students in order for it to take full effect.

Overall, the flipped classroom model does offer multiple benefits for the students, as well as teachers, notwithstanding certain difficulties both could face in terms of application. It makes ample room for students to develop their cognitive and academic independence, gives them the necessary tools for the development of critical thought, and could also lead to an enhanced feeling of self-efficacy and confidence. Another important aspect is the impact it can have on students' perception of the very process of learning, lessening the effects of the perceived hovering threat of failure and critique, since the teacher is no longer viewed as the bearer of all knowledge, but a motivated companion on the path of knowledge acquisition.

Finally, the aim of the flipped method is to provide students with an opportunity to personalize their learning styles allowing them to gain knowledge and diverse linguistic skills which could help and serve

them later on in life. The flipped method is a valid option to be considered in this context, since it holds the potential to become one-among-equals in the array of teaching methods available today. Our research shows that the flipped method should be considered not only as a replacement of any method per se, but as an additional method which could be useful for the development of educational practices.

It must be pointed out, however, that this particular type of research is limited by the inherent nature of the methodology in question. As was stated earlier, our school system does not nurture, nor even recognize, the flipped model and its practical application in the classroom. There are several reasons for this, two of them being the limitations of the class size, or curricular burden of the teachers and students. However, it is precisely these limitations that impose certain boundaries on later attempts at researching the effects of the flipped model, because for it to be researched, the model first needs to be implemented and the students need to be familiar with it. Just like any other methodology, the flipped model requires active engagement on both parties in the classroom, but also a willingness to partake in it and an openness to understand it. Our research provided pioneering insight into the possibilities of the flipped method considering that this was the first time the students were encouraged to study in this way, after more than a decade of being instructed in a different manner.

For any subsequent research of the flipped model to take place, the model itself should be carefully implemented over a longer period of time, and hopefully viewed on equal footing with the traditional method. In this way, more precise data can be collected on the effects of the model, since there would not be an element of preferential bias (the students being more accustomed to one method compared to the other) or trepidation when faced with an alternate mode of teaching/learning. Our research has proven the potential of the flipped model and its merits, hopefully paving the way for further studies to broaden these initial findings.

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ИСТРАЖИВАЊЕ МОДЕЛА ОБРНУТЕ УЧИОНИЦЕ У CLIL НАСТАВИ НА СТУДИЈАМА ГЕОЛОГИЈЕ

Модел обрнуте учионице је метод наставе који проистиче из присвојања преокренутог учења, у коме се фокус ставља на аутономност и независност ученика у процесу учења. Бројне студије указују на то да тај метод наставе у ком централну улогу заузима наставник, а не ученик, није у складу са савременим подучавањем страног језика. Стога, модел обрнуте учионице се јавља као једна од могућих иновација традиционалне наставе, којом би се унела нова динамика у учионицу и ученицима понудиле неопходне вештине за стицање академских компетенција. Обрнута учионица је уколико кориснија јер је годатно потпомаћујући методом CLIL, која постепено и плански замењује традиционални модел наставе.

Циљ нашег истраживања био је да се утврди утицај примене модела обрнуте учионице у поређењу са традиционалном методом наставе. Истраживање је извршено на Рударско-геолошком факултету Универзитета у Београду. Узорак истраживања је обухватио 30 студената прве и друге године студија, у другом семестру академске 2023/2024. године. Праћени су резултати студената различитих нивоа познавања енглеског језика, на три степена знања, из области које су одабране на основу плана и програма за дати семестар на студијама геологије.

На почетку истраживања су представљене две хипотезе. Прва хипотеза се дава моћношћу успешне примене модела обрнуте учионице у условима где постоје велике разлике у нивоима знања језика. Друга хипотеза пак сматра да ће иницијална примена модела обрнуте учионице дати задовољавајуће резултате уколико се делимично комбинује са традиционалном методом наставе.

Понуђена студија је потврдила обе хипотезе. У случају прве хипотезе, доказали смо да је могуће применити модел обрнуте учионице у настави са студентима са различитим нивоима језичког знања, што поткрепљују и резултати тестирања. У односу на традиционалну наставу, модел обрнуте учионице је дао резултат који је нижи за мање од 10%, док је комбинација метода дала резултат ближи традиционалном моделу. Ови резултати јасно указују на могућност и успешност примене модела обрнуте учионице у раду са студентима различитог језичког нивоа знања.

Друга хипотеза је такође доказана и поткрепљена резултатима студената на тестовима. Иако је, као што је речено, традиционална настава дала највиши резултат, у случају комбиновања традиционалне методе и модела обрнуте учионице пад у броју поена је мањи од 3%. Резултати јасно указују на то да примена модела обрнуте учионице јесте могућа, али да је треба увести постепеном преласком са традиционалне на иновативну CLIL методу.

Смањрамо да наше истраживање има корисне импликације на примену у пракси. Радом је доказано да је модел обрнуће учионице примењив на високошколском нивоу и да резултати показују потенцијал за даље развијање ове врсте наставе.

Кључне речи: модел обрнуће учионице, CLIL, традиционална метода, студије теологије, енглески језик