Flipped Classroom in the Czech Republic

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Abstract: The Flipped Classroom approach, advocated since the 1990s by scholars such as Alison King, Eric Mazur, Maureen J. Lage, Glenn J. Platt, and Michael Treglia, involves students independently learning theoretical content before class via e-learning resources like video recordings and self-directed programmes. This allows educators to use class time for discussions and scaffolding as students engage in problem-solving tasks individually and in groups. Notable milestones include the establishment of Khan Academy in 2004, MEF University's adoption of flipped teaching in 2011, the founding of the Flipped Learning Network in 2016, and the extensive use of e-learning during the COVID-19 pandemic. This paper examines implementing a flipped classroom project in environmental education in the Czech Republic. In 2018, three academics from different universities initiated the flipping of environmental education courses. The research, framed as combined action research, employed a questionnaire as the primary tool. Data were collected twice: in 2021, at the end of mandatory online teaching due to the COVID-19 pandemic, and in 2024, after three years of regular education. Responses from 288 students were analysed using standard statistical methods, while open-ended responses from 82 students and interviews with four university lecturers were qualitatively assessed. The findings underscore the benefits of electronic materials, particularly students' appreciation for interactive elements, time flexibility, and the ability to review content multiple times. Students' willingness to watch digital lectures at home decreased post-pandemic, and the perceived efficacy of this method was higher among students during the pandemic. Although students find the flipped classroom method effective, they favour its combination with traditional teaching methods. Educators, cognisant of the method's potential, interpret these results as indicative of "virtual environment fatigue", noting students' reluctance to prepare in advance as a significant barrier. They advocate for the widespread implementation of the flipped classroom model across faculties to optimise instruction and eliminate the need for switching between traditional and flipped approaches. This study offers a practical example and insights for educators seeking to integrate the flipped classroom methodology with e-learning tools into their teaching practices.

Keywords: COVID-19 impact on education, Digital learning tools, Higher education, Flipped classroom, e-Learning resources

1. Introduction

The Flipped Classroom has emerged as a transformative pedagogical approach since the 1990s. The approach was expressed as a concept in its present form in 2000, championed by academics such as Eric Mazur (1997), Alison King (2017), Maureen J. Lage, Glenn J. Platt, and Michael Treglia (2020), Wesley J. Baker (2000), etc. With the advancement and proliferation of educational technologies, interest in the Flipped Classroom model has grown in the last years.

This method involves students independently learning theoretical content before class, utilising various e-learning resources like video recordings, self-learning programs, and chatbots. Consequently, class time is dedicated to discussions and providing support, or scaffolding, as students engage in problem-solving tasks independently or in groups.

Over the years, the Flipped Classroom model has gained significant milestones. The establishment of Khan Academy in 2004 marked a turning point by providing accessible, high-quality educational videos. In 2011, MEF University became the first higher education institution to fully adopt the flipped teaching method. In 2012

the book Flip Your Classroom: Reach Every Student in Every Class Every Day (Bergmann, Sams, 2012) was published. The founding of the Flipped Learning Network in 2016 further solidified this approach, and the global shift to e-learning during the COVID-19 pandemic underscored the importance and effectiveness of digital learning resources. A comprehensive research study on the subject was provided by Ağırman and Ercoşkun (2022), who focused on questions such as: *What was the historical development of the FC model? What are the different uses of the FC concept in the literature? What is the frequency of use of the FC concept in the literature?*

This paper presents a research study on using the flipped classroom in higher education. It aims to present experiences with the flipped classroom method in several universities in the Czech Republic, one of the European post-communist countries. The technique's use in teaching affected by the pandemic (in emergency remote teaching) and in regular teaching (after the COVID-19 pandemic) is compared.

2. Characterization of the Czech Republic Focused on Higher Education in a Historical Context

The Czech Republic has a long and rich tradition of higher education, dating back to the Middle Ages. The oldest university in Central Europe is Charles University, founded in 1348 by Emperor Charles IV in Prague.

Higher education in the Czech lands expanded during the 19th and early 20th centuries. New universities and technical schools were established. These institutions contributed to the industrialisation and modernisation of the Czech lands. During the Second World War (1939–1945), all ten universities existing at that time were shut down by the Nazis. Academics found themselves unemployed, and nearly all students were deprived of the opportunity to pursue their studies. Only in exceptional cases were students able to continue their education abroad. After the Second World War, Czech universities were reopened. Students were allowed to complete their studies in an accelerated mode. During the communist regime (1948–1989), the state strictly controlled higher education in Czechoslovakia and emphasised ideological education and political loyalty. The faculties of education, philosophy and theology were under the most significant control. Contact with foreigners was minimal, and literature was censored. After the Velvet Revolution of 1989, universities were gradually reformed.

Today, higher education in the Czech Republic is characterised by high quality, a wide range of study programs, and a solid scientific and research foundation. Czech universities collaborate with international partners, participate in exchange programs, and contribute to developing European and global scientific knowledge. Czech academics were allowed to explore, experiment with, and implement modern methods of university pedagogy, including the flipped classroom method (Conelly, Gruttner, 2005; Greger, Walterová, 2007).

In March 2020, Czech universities were closed due to the COVID-19 pandemic. Emergency remote teaching lasted for four semesters in 2020 and 2021. This provided a strong incentive to create video lectures. Many of these videos were made in amateur settings using tools like Camtasia.

From June to July 2021, the Czech Ministry of Education, Youth and Sports surveyed 23,256 students and 4,597 academic staff from universities. Most respondents indicated that universities responded flexibly to this crisis and adapted well. For two-thirds of the students, studying during the pandemic was more time-consuming than in the previous period. Physical health deteriorated for 45% of students, while mental health declined for 55% of them. The financial situation worsened for 27% of students.

Three-quarters of academic staff felt better prepared for distance learning during the pandemic than at its beginning. Over 50% of academic staff assessed students' work within distance learning as worse than the previous in-person format. Academic staff felt support from the university mainly in providing technical equipment or courses on using technology and programs and, to a large extent, adjusting working conditions. Conversely, they perceived that they needed to improve in psychological and financial support, recognition for proactive approaches, or support in the didactics of distance learning and methods of motivating students. The results were presented at the Higher Education Teaching Days conference (see https://msmt.gov.cz/dopady-pandemie-covid-19-na-studenty-vs).

3. The Flipped Classroom Method in the Czech Republic

The first information about the flipped classroom method reached the Czech universities around 2008. In a year in which, according to an interview with Aaron Sams, 15% of teachers in the USA used this method routinely, Czech teachers are just learning about it and are being introduced into the classroom by several innovative individuals (Sudíková, 2017).

In 2018, three academics from three different Czech universities (Masaryk University in Brno, Purkyně University in Ústí nad Labem and Charles University) agreed on the project “Application of the Flipped Classroom model for teaching Environmental Education courses at universities”. It aimed to produce video lectures for environmental education courses for their lectures and use in the broader community. Together, they prepared and published 26 video lectures with a total length of 20 hours. The NGO BEZK provided

technical implementation as part of follow-up projects. All materials are freely available and can be used by academics and students from other universities (see https://evvoprednasky.cz/).

This proved very useful during university closures due to the COVID-19 pandemic.

4. Research Methodology

The research was conducted as action research (Elliott, 1981) using the combined (mixed) method QUAN—> qual (Morse, Niehaus, 2016).

The monitored teaching using the flipped classroom method took place from 2020 to 2024, which includes two years of emergency remote learning due to the COVID-19 pandemic and two years of standard teaching.

During this period, two questionnaire surveys were conducted in May 2021 and May 2024 (Table 1).

Table 1: Number of respondents to the questionnaire survey

	Total number of students	Completed questionnaires (percentages)
2021	180	75 (42%)
2024	108	39 (36%)
Both	288	114 (40%)

The data were processed using standard statistical methods. The evaluation primarily focused on descriptive statistics of individual variables (mainly absolute and relative frequencies). Due to the nature of the data (categorical or discrete values), normality was not tested. A test of equality of proportions and the chi-square test on a contingency table was used to determine the relationships between variables across different years. The significance level for all tests was set at 0.05. Responses to the open-ended questions of the questionnaire were evaluated using qualitative methods, with sentiment analysis being the primary method used. The data processing was carried out using R 4.4.0 and Microsoft Excel 2019.

Although the main findings were quantitative, a sub-qualitative investigation was also conducted. This was based on

a) students' answers to open-ended questions (“Name the advantages of the flipped classroom method” and “Name the disadvantages of the flipped classroom method”) and

b) open-ended interviews with four academics.

The obtained data were evaluated using the Grounded Theory method, namely concept searching and categorisation (Strauss, Corbin, 1998).

5. Results

5.1 Characteristics of the Respondents

Teacher students were respondents to the questionnaires. In 2021, there were 73 students in the Faculty of Education, 90% of whom were women. In 2024, 39 students completed the questionnaire, 2/3 from the Faculty of Education and 1/3 from the Faculty of Science – almost (97%) all women.

Four academics from four different Czech universities were interviewed, and the results showed that they regularly used the flipped classroom method.

5.2 Where Were Students Introduced to the Flipped Classroom Method?

In this course, most students were first introduced to the flipped classroom method in both periods studied (Table 2).

Table 2: You learned about the 'flipped classroom' method – answers from the years 2021 and 2024

	2021	2024
In this subject	74% (54)	73% (27)
Earlier	26% (19)	27% (10)

The proportion of students who had previously learned about the flipped classroom method mostly stayed the same from one year to the next. This is confirmed by a test of equality of proportions ($p > 0.05$). Thus, the method may have grown little after reverting to its standard state.

5.3 How Many Other Subjects Using the Flipped Classroom Method did the Students Have?

In 2024, the proportion of students who did not use the flipped classroom method in any course is significantly higher than in 2021 ($\chi^2(1, 112) = 4.203$, $p = 0.045$). Notably, in 2021, nearly a quarter of students used the method in three or more courses, whereas in 2024, only 5% of students used the technique in such a number of courses. Also surprising is the number of students who used the method in five or more courses.

Suppose we test on a contingency table with merged categories (see Table 3). In that case, we conclude that there was a statistically significant difference between 2021 and 2024 in the number of individual courses students reported learning using the flipped classroom method ($\chi^2(3, 112) = 9.405$, $p = 0.024$).

Table 3: How many other subjects have you studied using the 'flipped classroom' method? – answers from the years 2021 and 2024

Number of subjects	2021	2024
0	23 (32%)	20 (51%)
1	16 (22%)	12 (31%)
2	16 (22%)	5 (13%)
Three and more	17 (24%)	2 (5%)

5.4 Did the Students use Digital Lectures for Your Preparation?

In 2024, students were far less likely to use digital lectures (over 90% if we take the Yes + Rather Yes categories) than in 2021 (where the two categories combined are around two-thirds of the total). However, this is due to the course itself, where in 2024, students had digitised lectures only as a supplement (see Figures 1 and 2).

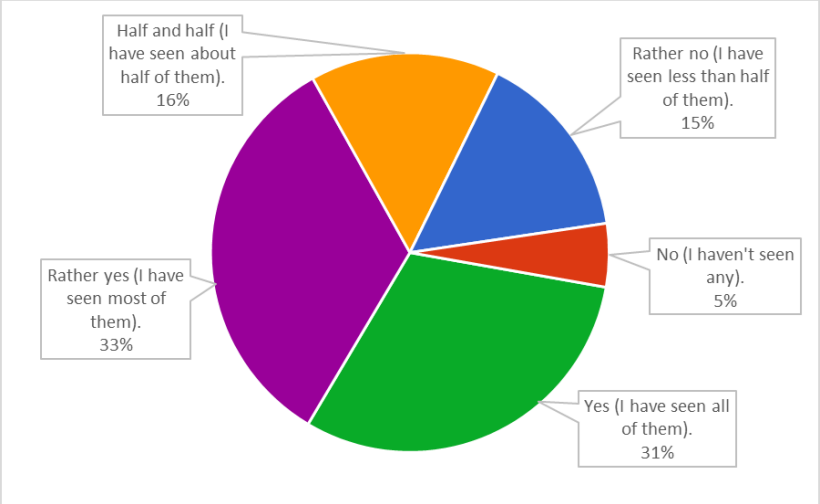

Figure 1: Did you use digitalised lectures for your preparation? – answers from the year 2021

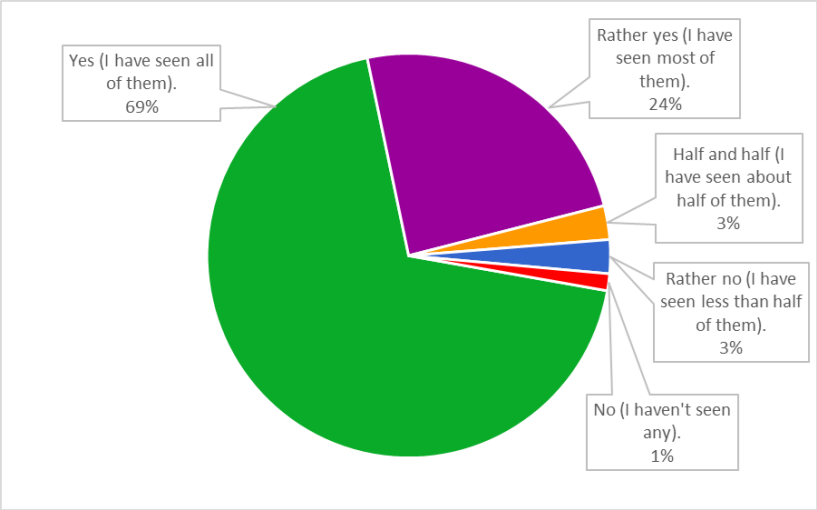

Figure 2: Did you use digitalised lectures for your preparation? – answers from the year 2024

5.5 How does the Student Evaluate the Digitised Lectures and Time Allocation of the Course?

In general, digitised lectures were rated very useful in both years (97% in 2021 and 90% in 2024). Regarding the evaluation of the level of lecture processing, students were more critical in 2024 than in 2021. In 2024, 72% of students rated the level as high or relatively high, compared to 85% in 2021. The remaining proportions fall, for the most part, into the neither high nor low category. This could be interpreted as the fact that 2024 online lectures were already standard, whereas, in 2021, this way of teaching was relatively new. In both years, students agreed that the sound quality could be improved. Other suggestions for improvement were to shorten the lectures (i.e. to split a long lecture into several shorter ones) or to provide additional study materials (answers from the year 2021).

The majority of students rated the course as time-adequate, with the percentage rating it as such being higher in 2024. Conversely, in 2021, we found more students who spent less time studying the course than its time allotment—more than a fifth compared to eight per cent in 2021. Around the same proportion of students said they spent more time studying the course than its time allotment (Table 4).

Students evaluated whether the time they spent on the course, i.e. watching lectures, online meetings, or even completing assignments in Moodle and consultations, corresponded to the credits (the time allocation is about 30 hours for one credit).

Table 4: Evaluation of course time allocation – answers from the years 2021 and 2024

Evaluation of course time allocation	2021	2024
Adequate	61 %	69 %
Inadequate, I managed in less time	22 %	8 %
Inadequate - I needed more time	11 %	18 %
Other Answers	6 %	5 %

5.6 How do the Students Evaluate the Flipped Classroom Methods?

Most respondents see the potential of the flipped classroom method. In 2021, over 80% of students saw potential in the flipped classroom method, with a drop of about ten percentage points in 2024. However, this decline has been in favour of the 'don't know' response. Interestingly and positively, only individuals do not see potential with this method—four students in 2021, with no students expressing this view in 2024 (see Figures 3 and 4).

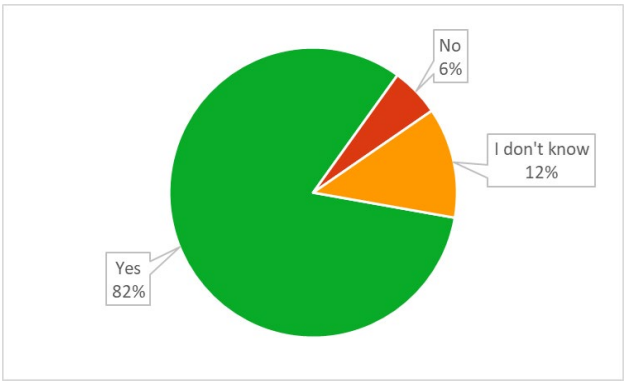

Figure 3: Do you see the potential of the 'flipped classroom' method? – answers from the year 2021

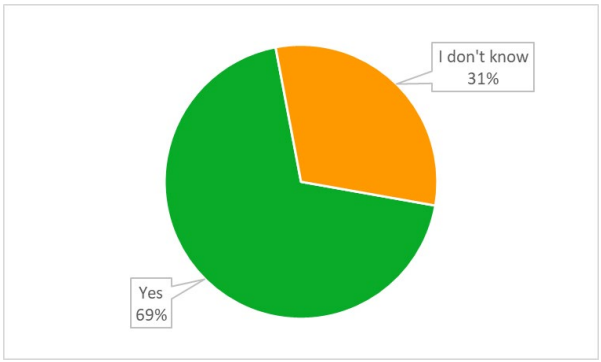

Figure 4: Do you see the potential of the 'flipped classroom' method? – answers from the year 2024

In 2021, nearly three-quarters of students would like to continue studying using the flipped classroom method. In 2024, just under 40% of these students will be in the flipped classroom, half in 2021 (Figures 5 and 6). We do not presume to assess the reasons for these responses, but the number of 'yes' responses has decreased in favour of neutral 'don't know' responses. The number of students who do not wish to study further by this method is low in both years, with seven students (10% of respondents) in 2021 and just one student (3% of respondents) in 2024.

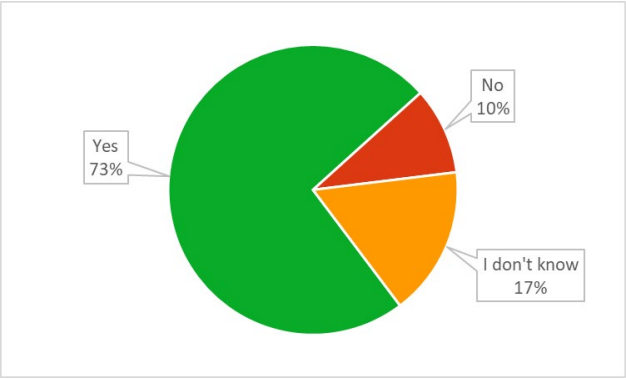

Figure 5: Would you like to continue studying using the 'flipped classroom' method? – answers from the year 2021

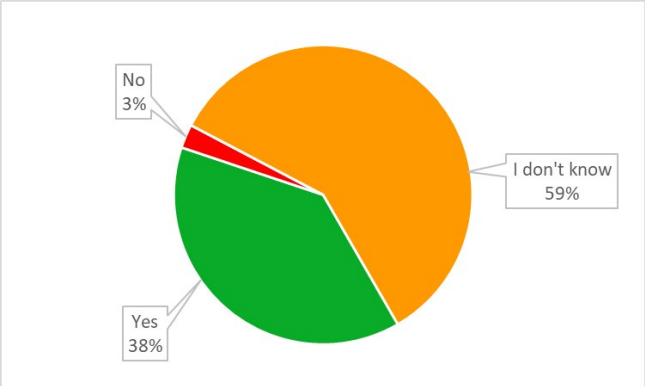

Figure 6: Would you like to continue studying using the 'flipped classroom' method? – answers from the year 2024

It is interesting to compare the relationships between the answers to the last two questions (see Tables 5 and 6. In 2021, most of those who see potential in the flipped learning method want to continue studying with this method (52/60 = 87%). In 2024, only half of such students are already there (13/27 = 48%). In the case of the other answers, the students are already relatively consistent - if they do not see the potential in the method, they do not want to use it to study; the same is usually valid for the answer "don't know".

Table 5: Contingency table for the questions: Do you see the potential of the 'flipped classroom' method? Would you like to continue studying using the 'flipped classroom' method? – answers from the year 2021

Do you see the potential of the 'flipped classroom' method?	**Would you like to continue studying using the 'flipped classroom' method?**			
	Yes	No	I don't know	**Total**
Yes	52	1	6	**60**
No	0	4	0	**4**
I don't know	1	2	6	**9**
Total	**53**	**7**	**12**	**72**

Table 6: Contingency table for the questions: Do you see the potential of the 'flipped classroom' method? Would you like to continue studying using the 'flipped classroom' method? – answers from the year 2024

Do you see the potential of the 'flipped classroom' method?	**Would you like to continue studying using the 'flipped classroom' method?**			
	Yes	No	I don't know	**Total**
Yes	13	0	14	**27**
No	0	0	0	**0**
I don't know	2	1	9	**12**
Total	**15**	**1**	**23**	**39**

5.7 A Qualitative Analysis of Open-Ended Questions

We processed responses from 82 students, 57 (75%) from 2021 and 25 (64%) from 2024.

Students' responses to the open-ended questions were very similar in both surveys. They see the disadvantage in the time required for home preparation and the limited contact with the teacher, including the impossibility of asking about uncertainties immediately.

The most frequently mentioned positives were time flexibility (the ability to listen to the lecture at any time) and the ability to play the lecture repeatedly, stop, rewind, return to more complex content, or play it again during the exam period. Approximately a quarter of the responses (totalling 23) demonstrated an understanding of the flipped classroom method, highlighting aspects such as the freedom to learn, the ability to study at one's own pace, coming to class prepared, and spending class time on activities. The ability to learn from home and avoid travel or a better fit with employment were less frequent responses.

The most frequently mentioned disadvantages included the absence of social contact (only in 2021), the time-consuming nature of preparation, concerns about the ability to understand more complex topics, such as photosynthesis, without the instructor's presence, and the acknowledgement that internal motivation is necessary. One respondent would welcome the flipped classroom method in all subjects taught at the university. Four respondents recommended introducing it partially. No respondent spoke against using an inverted classroom (see Tables 7 and 8).

Table 7: Analysis of open-ended questions – advantages of the flipped classroom method

Answers	2021	2024
time flexibility (I can start the lecture at any time)	25	11
possibility to stop the lecture and start again	16	12
learn from home/no need to travel to higher learning	9	2
the efficiency of the flipped classroom (I will learn more, freedom of learning, responsibility for learning, the opportunity to come equipped with concepts and theoretical knowledge and to actively participate)	14	8

Table 8: Analysis of open-ended questions – disadvantages of the flipped classroom method

Answers	2021	2024
absence of social contact	7	0
time-consuming home preparation	2	5
concerns about whether they will correctly understand complex subjects such as photosynthesis without the presence of a teacher	2	4
lack of motivation	3	0

5.8 A Qualitative Analysis of Short Interviews With Teachers

All four university teachers consider the flipped classroom method an effective and modern approach and are “fans” of it. They began using it before or shortly after compulsory distance learning was implemented due to the Covid-19 pandemic and the resulting closure of colleges.

They see the positives and strengths of this method in the fact that students come to class prepared with knowledge of theory and terminology. This allows class time for developmental activities such as discussions, excursions, walks, didactic games, nature observation, experiments, and project work.

The most significant area for improvement is the requirement that students do homework. Students who do not prepare at home and feel disoriented during class threaten learning effectiveness. All four respondents encountered situations where students disagreed with homework. One of them even received critical feedback from several students for requiring them to prepare at home.

All respondents interspersed the flipped classroom method with conventional teaching methods (lectures), although they believed in and were fully prepared to adopt the flipped classroom approach. Two respondents felt it would be helpful if all faculty teachers switched to the flipped classroom method, making it a conventional mode of teaching rather than an alternative one. Digital lectures are used more by part-time students than by full-time students. They also serve as a resource for absences due to illness, etc.

Three respondents interpreted the survey results as indicating “online fatigue”. Students who have been taught remotely for two years welcome face-to-face contact with their teacher. Overall, respondents still see potential in the flipped classroom method and are determined to continue using it in their undergraduate teaching.

6. Conclusion

This study examined the implementation and reception of the flipped classroom method at several Czech universities. The technique, which focuses on pre-class independent learning and in-class interactive activities, saw increased use during the COVID-19 pandemic.

In 2021, many students engaged with the flipped classroom method across multiple courses.

By 2024, engagement decreased, possibly due to online fatigue and a return to traditional teaching preferences.

Digital lectures were widely used and appreciated, though students in 2024 were more critical of their quality than in year 2021.

Regarding the advantages and disadvantages of the flipped classroom method, students from both samples agree that the main benefits they most often cited are the flexibility of studying and the possibility of repeating the lecture. They also mention the more efficient use of time during the "contact" part of the class (2024) and that they can think through the concepts/content thoroughly beforehand (2021). Students cite the need for more personal contact with the teacher and classmates and needing immediate feedback as a major shortcoming. They also mention the need to spend more time on home preparation, which sometimes clashes with other study obligations or the motivation to "force" themselves to study. Even though students find this teaching appropriate in their courses, they are concerned that the risk of not understanding the material is relatively high (e.g. photosynthesis is mentioned) for the more difficult parts.

While enthusiasm for the method remained high, perceived potential slightly declined from 2021 to 2024.

Teachers found the method effective and appreciated the preparedness it fostered in students.

A key challenge was ensuring students completed their preparatory work.

Other Czech colleagues are also achieving similar results (Pšenáková, Pšenák and Szőköl, 2024).

The flipped classroom method has significant potential but – in the Czech Republic now – requires balanced integration with traditional teaching methods and robust support for student preparation. Future research should focus on long-term outcomes and ways to optimise the flipped classroom method for broader use.

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