Anja Pfennig, 2026

Volume 10 Issue 1, pp. 41-61

Received: 11th February 2026

Revised: 08th January 2026, 23rd January 2026

Accepted: 23rd February 2026

Date of Publication: 17th June 2026

DOI- https://doi.org/10.20319/pijtel.2026.101.4161

This paper can be cited as: Pfennig, A. (2026). Reflecting on the Role of the Lecturer in Inverted Classroom Teaching Scenarios. PUPIL: International Journal of Teaching, Education and Learning , 10(1), 41-61

REFLECTING ON THE ROLE OF THE LECTURER IN INVERTED CLASSROOM TEACHING SCENARIOS

Anja Pfennig

School of engineering and life science, HTW Berlin, University of Applied Sciences, Wilhelminenhofstr. 75A, 12459 Berlin, Germany

anja.pfennig@htw-berlin.de

Abstract

It has widely been reported that students` motivation and self-attentiveness increase when teaching students via "inverted classroom" teaching scenarios in a blended learning environment. Inverting the classroom is a method to encourage students to self-study the science and then take time to work on their questions and do extended hands-on lectures or exercises in class. Therefore, a sufficient number and variety of teaching material aiming at different learning skills of the students has to meet the diversity of the first year class as well as the overall learning outcome of the course. But, most important for succeeding in inverted classroom environments is to respond to the change of the role as a lecturer from in-front teaching to a more cooperative and collaborate way of teaching. Set-backs are common when starting this teaching method because despite the advantages there are many aspects that need to be taken into account, such as: what to do with *unprepared students or easy questions where to go in class during group work. Only if these negative aspects are clear from the beginning and there are answers to problems arousing this teaching method will increase the fun of teaching and be of success for students as well as lecturers. In this practice paper, difficulties are named and possible ways of handling are suggested as the author is still in the procedure of professionalizing the teaching method.*

Keywords:
Inverted Classroom, Flipped Classroom, First Year Students, Material Science, Engineering

1. Introduction

The inverted classroom, often referred to as the flipped classroom, has emerged as a transformative pedagogical strategy that reconfigures the traditional teaching model (Seteren et al., 2019, Pfennig, 2021, Pfennig, 2024, Walsh, O'Brien, Costin, 2021, Haynes and Currie, 2020, Kamo and Zvereva, 2017). Especially in STEM classes inverted classroom scenarios have been successful in capturing student interest and improving learning outcomes (Pfennig, 2024; Setren, 2019, Berret, 2012; Brame, 2015; Zheng et al., 2020, Galindo-Dominguez, 2021, Fischer & Spannagel, 2012; Braun et al., 2012), Educause, 2016). At its core, this approach involves requiring students to engage with instructional material—often through digital platforms—prior to attending class, thereby shifting the initial learning experience outside the classroom (Pierce et al., 2012; Cui et al., 2017). Students are required to study at their own pace, asynchronously and independently (Pfennig, 2016; Pfennig, 2018). This preparatory work allows classroom-time to be utilized for active learning, collaborative exercises, and deeper exploration of the subject matter through student-led discussions and problem-solving activities (Lord, 2012, CSU, 2015, Goto and Schneider, 2010). Such a shift enhances motivation (Berrett, 2012; Brame, 2015), fosters critical thinking and self-paced learning, as students take ownership of their educational process (Cui et al., 2017; Fischer und Spannagel, 2012).

Digital resources like lecture videos and virtual labs support this model, acknowledging various learning techniques and encouraging deep engagement with the content (Pierce and Vox, 2012, Thai et al., 2017, Pfennig, 2024, Pfennig, 2018). Notably, effective learning requires monitoring understanding through methods such as interpolated questioning to counteract overconfidence with video-based learning (Szpunar et al., 2014).

Beyond merely altering where learning takes place, the inverted classroom model redistributes within education. Instructors transition from being the primary source of knowledge to facilitators of learning, guiding students in interactive sessions that build on their preparatory work (Pfennig, 2018). This redefinition encourages a participatory learning environment where students are encouraged to engage actively with their peers, thus cultivating communication skills and enhancing self-efficacy (Goto and Schneider, 2010; Pfennig, 2024).

While the inverted classroom has been praised for boosting academic performance, developing critical thinking skills, and enhancing intrinsic motivation, especially in STEM fields (Thai et al., 2017; Setren et al., 2019), it is important to acknowledge that the transition can present challenges. For instance, some studies indicate that outcomes such as final exam scores may not significantly differ from traditional teaching methods (Geist et al., 2015; Harrington et al., 2015), and the increased demand for out-of-class preparation has occasionally led to student dissatisfaction (Simpson et al., 2015).

To effectively harness the benefits of the inverted classroom, certain practical strategies have been recommended. These include starting with low-threshold tasks to acclimate students to the flipped model, providing close guidance during self-study periods, and organizing courses to maintain transparency in learning outcomes and assessment expectations (Pfennig, 2021/1, 2021/2). Additionally, leveraging online platforms to support these endeavors can mitigate time and location constraints, offering flexibility for both students and educators (Stockwell et al., 2015; Eryilmaz, 2015, Pfennig, 2016).

1.1 The Materials Science Course Setting

For first-year mechanical engineering students understanding their own study habits, preferences for learning materials, and effective study methods is crucial for successfully progressing to higher semesters. They must acquire a scientific foundation and be able to apply this knowledge to engineering problems. Education at HTW Berlin leverages technological advancements and diverse teaching methods to meet students' needs comprehensively. A "design-led" approach, as discussed by (Ashby et al., 2013), emphasizes practical engagement and was introduced into first-year Material Science courses in 2014 (Pfennig, 2018).

The diverse backgrounds of engineering students at HTW Berlin necessitate flexible and inclusive teaching strategies. The flipped classroom approach promotes meaningful interaction and peer learning, facilitating exploration of complex concepts collaboratively (Pfennig, 2018; Setren et al., 2019). Assessment methods have evolved to be more inclusive and precise, embracing standards-based grading which aligns assessment with objectives and offers personalized feedback (Sadler, 2005, Guskey & Pollio, 2012). By integrating summative with formative assessments, educators provide varied learning paces and styles, aiding in comprehensive assessment of student competencies (Carberry et al., 2012, Marbouti et al., 2016).

In the materials science lecture and assessment concept, a blended learning framework was established to accommodate both fully online and hybrid teaching contexts (Pfennig, 2021). Typically, the course includes weekly face-to-face sessions corresponding to 5 ECTS credits, focusing on continuous learning and accommodating diverse learning capacities through a decentralized evaluation process (Pfennig, 2018). Key resources include peer-produced videos (Pfennig, 2018) and micro-lectures on Moodle, supplemented by additional teaching materials such as worksheets, mind-maps, quizzes, and web-based modules (Figure 1) (Table 1). The inverted classroom model supports varied learning styles and accommodates diverse personal and social backgrounds among students (Pfennig, 2021).

Graded assignments culminate in a total of 100 points, with a final Moodle test contributing 15 points. This structure encourages consistent engagement, offering an option for a final exam as an alternative to cumulative assessments, accommodating diverse student needs including those transferring mid-semester or retaking the course.

Table 1. *Rough Outline of Materials Science Course Structure*

Week	**Theme**	**online/ presence**	**Homework**	**Main graded activity**
1	Materials families	online	properties	2 micro lectures
2	Properties	presence	micro structure	1 micro lecture
3	Elasticity and stiffness	presence	crystalstructure	homework, test
4	Elasticity and stiffness	online	Youngs mod.	Test, glossary, lectures
5	Strength and ductility	online	lattice defects	Test, 2 micro lectures
6	Strength and ductility	presence	stress-strain	homework, 1 l lecture
7	Strength and ductility	presence	manipulating strength	Test, glossary, 2 microlectures, forum
8	Phase diagrams	online	Lecture videos	homework
9	Phase diagrams	presence	binary PD	test
10	Nomenclature	presence	materials	Homework, glossary
11	Fe-C phase diagram	presence	ECPD	Test, glossary, forum
12	Heat treatment of steel	presence	heat treatment	2 micro lectures, test
13	Steels and cast iron	presence	steels groups	prepare for final test

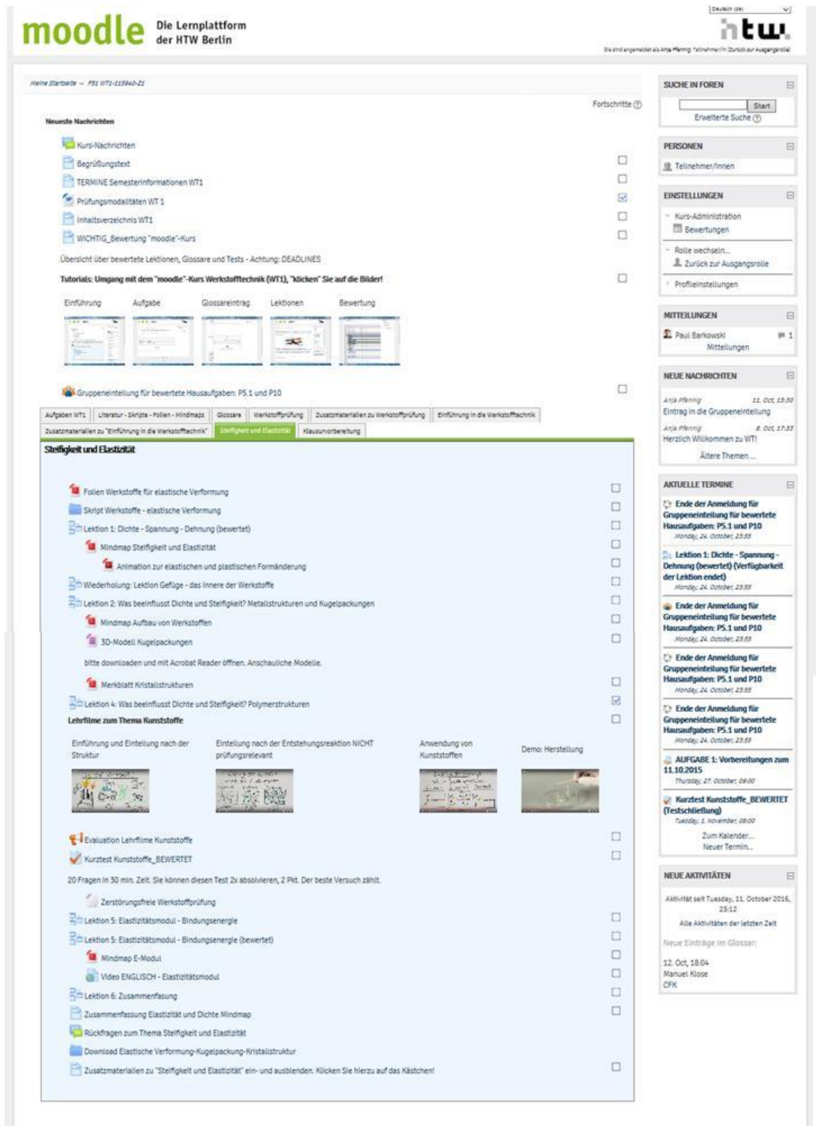

Figure 1. *Example of Moodle Course, Theme: Stiffness and Elasticity*

2. Example of Inverted Classroom Teaching Scenario

The assignment focused on the scientific principles underlying the four hardening mechanisms in materials science, which alter the microstructure to enhance material strength. This included studying Moodle lectures, using memory sheets, and optionally reading a short scientific paper. Students also completed online quizzes and explained a technical term in a related glossary, which the lecturer reviewed and provided feedback on during the week of the assignment.

In the classroom, the open-source software "invote" (invote, 2016) facilitated peer review (Simon et al., 2010), allowing the lecturer to gauge students' understanding. This also enabled students to monitor their learning progress. Individual questions were addressed, and key concepts were clarified. Students were organized into groups of 4-6 to summarize one of the four mechanisms, detailing microstructural changes and their effects on mechanical properties, using a specified template. To ensure uniform understanding, students struggling with home assignments received basic tasks and later joined groups engaged in practical lessons on hardening mechanisms. Each student then prepared and presented their findings to the class and submitted a concise one-page summary. The summaries were reviewed by peers and the lecturer before being uploaded to Moodle for collective access. Subsequently, students tackled two engineering problems related to strengthening steels in pairs. The following week's evaluation demonstrated comprehension, with various outcomes over the last decade. (Figure. 2).

The analysis of student performance from 2016 to 2025 was performed with consistent exam difficulty and curriculum. Data excludes drop-out students, and language ability isn't separately analyzed, given the course's supportive structure for German as a Second Language students (Pfennig, 2021).

High scores, such as the 94.10% mean in WS 2016/17, may indicate the effectiveness of inverted classroom teaching methods and a well-aligned curriculum. Lower scores, like those in SS 2022 (mid-40s average), could reflect challenges related to the COVID-19 pandemic (2020-2022). While median scores generally align with means, discrepancies indicate non-normal score distributions, possibly due to outliers. This shows that while many students perform around the average, some achieve notably higher or lower.

Further insight comes from examining the range of scores. Some students regularly achieve near-perfect scores, highlighting inverted classroom teaching scenarios as successful for high achievers. However, very low scores, below 20%, suggest struggles for certain students. This underscores the need to identify and address learning gaps potentially linked to the self-study phases including preparation and understanding, or personal circumstances.

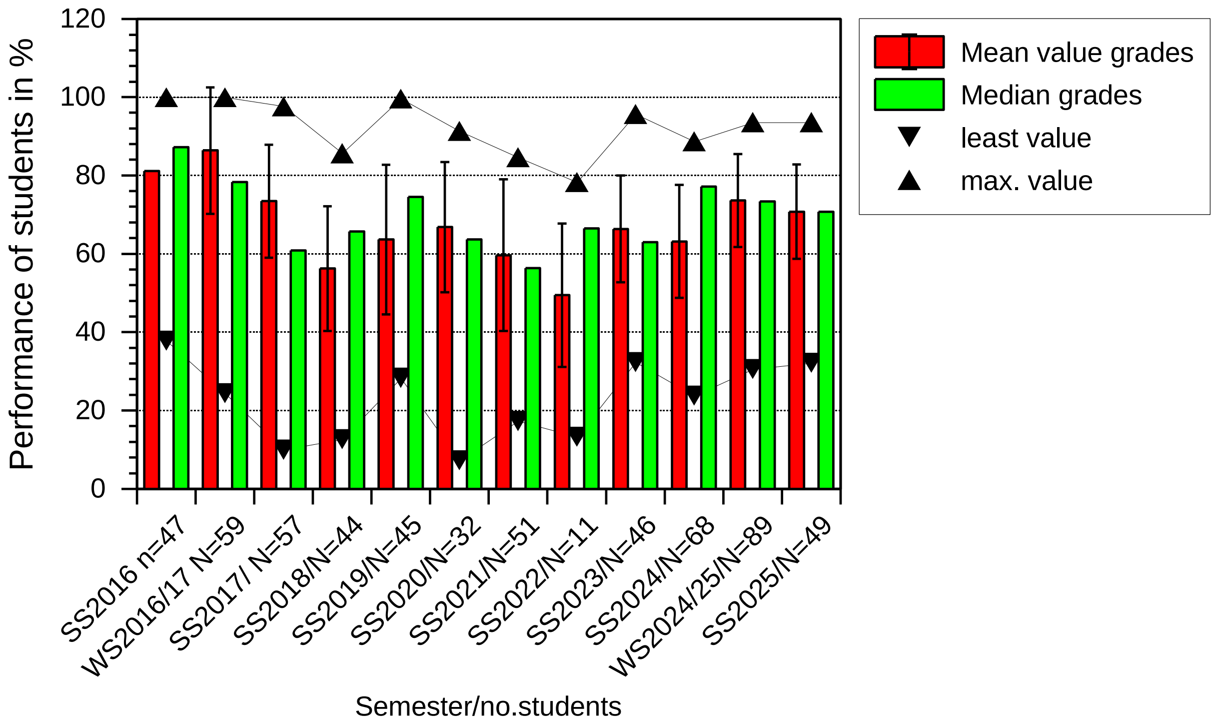

Figure. 2. *Test Results on Strengthening Mechanisms (45 Problems, 90 Minutes, 2 Trials)*

3. Acceptance of Inverted Classroom Teaching Scenarios

The data of student questionnaires provided offers insight into student preferences and experiences with the inverted classroom teaching concept and different teaching materials.

Figure 3 focuses on the self-study component of inverted classroom scenarios. It finds that many students (up to 78.78%) perceive self-study as beneficial for understanding underlying scientific concepts, appreciating its repeatability and independence. This suggests that a considerable number of students value the opportunity to engage with material at their own pace. Furthermore, self-study is seen as a means to prepare effectively both before (59.38% to 70%) and after class (40.63% to 58.82%), pointing to its in reinforcing learning. However, approximately half of the students (31.25% to 58.53%) find self-study to be scientifically challenging. This could indicate that while some students find intellectual stimulation and benefit from this challenge, others might feel overwhelmed. The consistency with which students engage in self-study varies, reflecting differing levels of self-discipline and time management skills. Lastly, only a small fraction of students reported not participating in self-study, which could suggest satisfaction with the face-to-face time only or a lack of engagement with the self-study format.

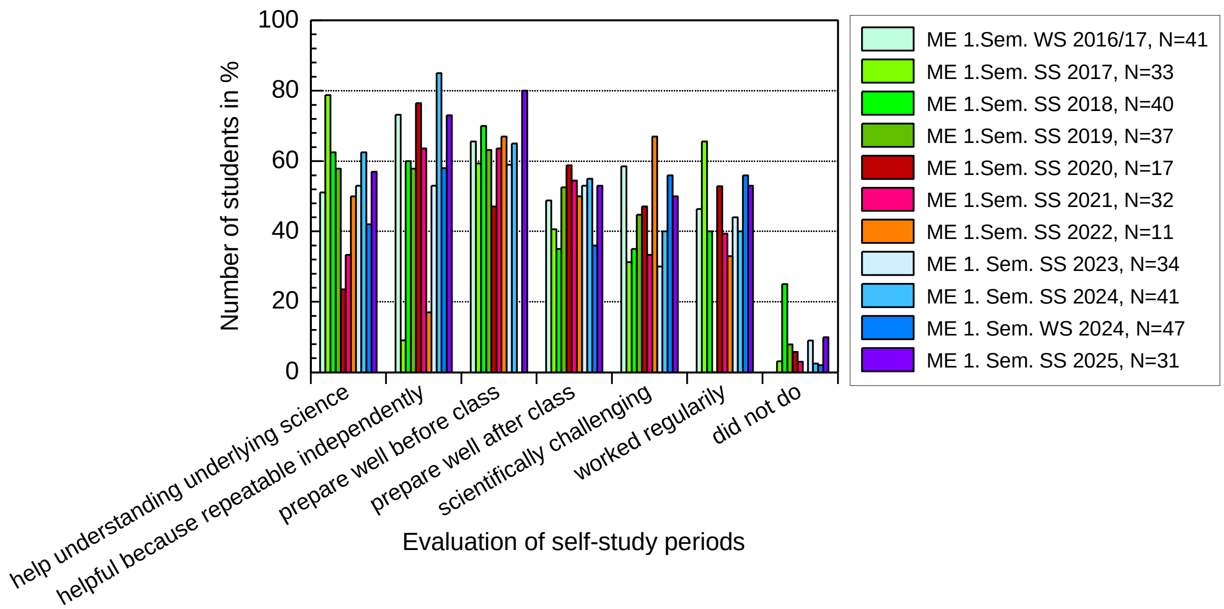

Figure. 3. *Student Evaluation of Self-Study Periods (Red, COVID-19 Pandemic)*

Figure 4 provides insights into student experiences with inverted classroom teaching material before class. A substantial percentage of students (54% to 78.78%) report being well-prepared for face-to-face sessions, indicating readiness and engagement with this interactive approach. However, there are challenges; some students (9.09% to 22%) find it difficult due to feelings of insecurity, and a small percentage find the material either too difficult or too easy, showing the varied levels of comfort and adaptability among students. A notable group of students, particularly in one subset (up to 52.63%), expresses a preference for traditional frontal teaching, indicating that the inverted classroom method is not universally accepted or effective for all. The preparatory phase is described as very time-consuming by a high percentage (39.47% to 62.5%) of the students, implying that while the method may foster preparedness, it also demands significant time commitment, which can be a potential barrier or challenge for some students.

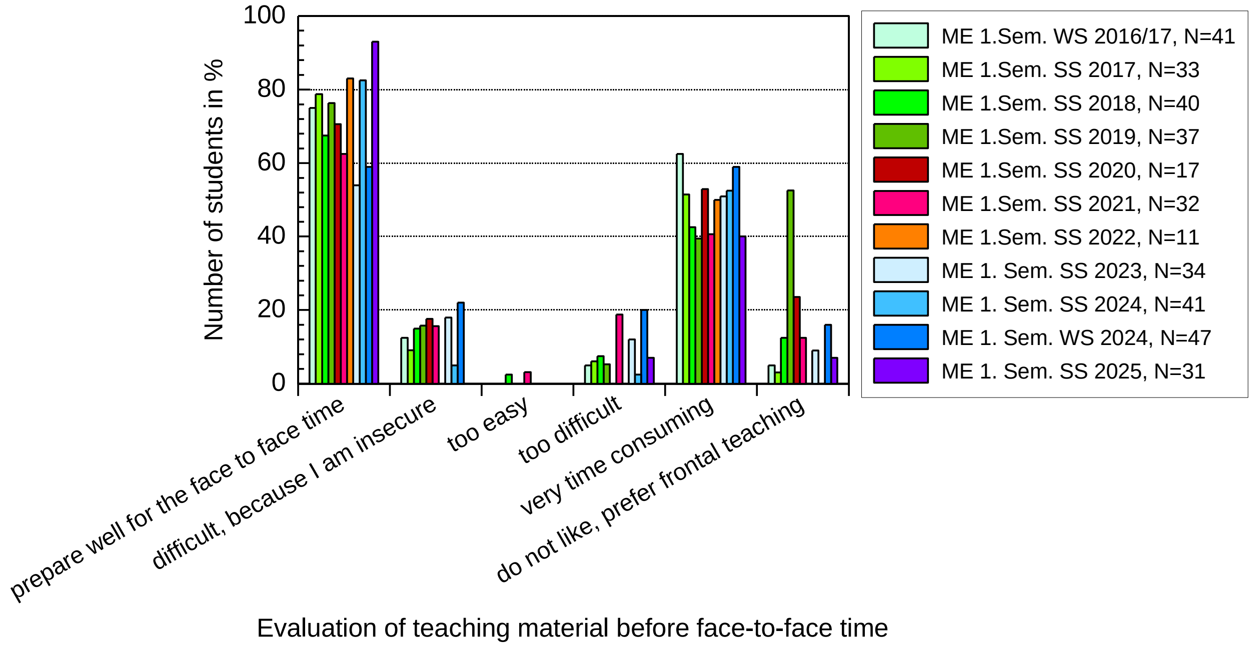

Figure. 4. *Student evaluation of teaching material (red, COVID-19 pandemic)*

Figure 5 reveals a variety of opinions regarding the preference for face-to-face teaching compared to lecture videos. While a significant portion of students (ranging from 26.83% to 83%) prefer face-to-face teaching, a smaller but notable group (17.07% to 52%) believes that face-to-face teaching is as effective as lecture videos. The preference for using lecture videos before lectures shows less variability, with percentages ranging from 29.41% to 45.45%, but the use of lecture videos after lectures is quite prevalent, with a majority (57.89% to 78.05%) utilizing them to reinforce learning. Interestingly, there is a substantial group of the summer semester 2023 (up to 90.9%) that prefers no lecture videos at all, suggesting a strong inclination towards other forms of learning or perhaps an aversion to video-based learning. Additionally, a fair number of students perceive lecture videos and therefore the inverted classroom lecture scenarios at HTW Berlin as offering study freedom, highlighting appreciation for the flexibility and autonomy they provide in managing their learning.

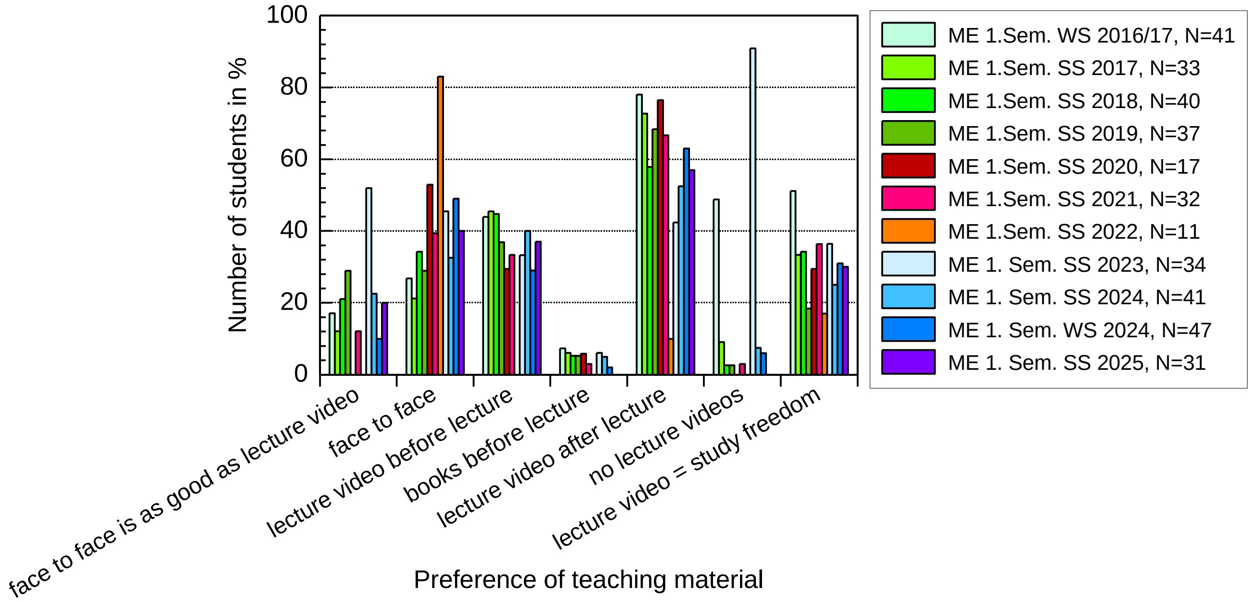

Figure. 5. *Student Preference of Teaching Material (Red, COVID-19 Pandemic)*

In parallel with assessment feedback, evaluations of the overall course structure have been mixed. While "excellent" ratings peaked at 46.34% in WS 2016/17, they diminished over time. However, "good" ratings showed strength, particularly in SS 2019 when they represented 63.63% of responses and approximately 50% after the COVID-19 pandemic. This suggests that the course has evolved to meet student needs better, maintaining an overall positive reception. Negative feedback has remained minimal, indicating broad acceptance of the course's structural design.

Regarding learning outcomes and strategies, the course consistently delivered a strong foundational understanding of materials science, with over 60% of students across semesters acknowledging its introductory value (figure 6). The course's innovative structure necessitates continuous student engagement, although some students continue to prioritize exam performance over intrinsic learning goals – the main focus of inverted classroom teaching methods. This reveals an area for potential development to promote deeper intellectual engagement and motivation among students.

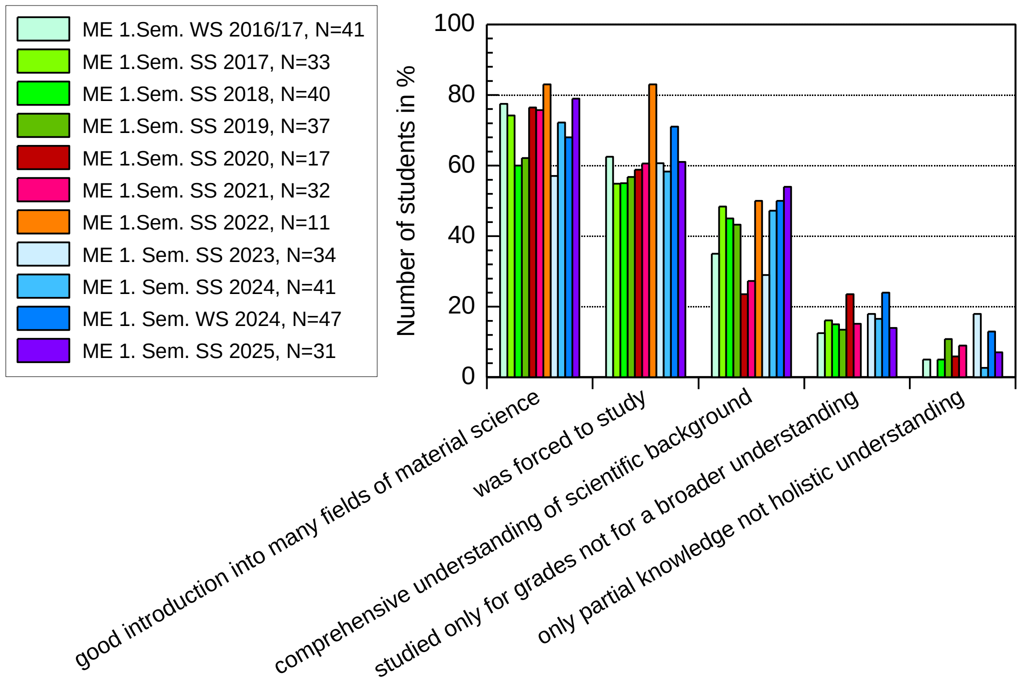

Figure. 6. *Student Evaluation on Learning Strategies (Red, COVID-19 Pandemic)*

In summary, while student satisfaction was initially high, variations in feedback over time reveal key areas for improvement. Ensuring assessments align with learning objectives, maintaining structural flexibility, and encouraging intrinsic motivation are crucial for sustaining the course's educational excellence. Overall, the data highlights diverse student preferences and experiences with different learning approaches. It emphasizes the need for adaptable teaching methods with respect to a range of learning preferences, recognizing that while some students thrive with flexibility and autonomy, others may require more structured and traditional methods of instruction.

3.1 Unprepared Students

The study by Gulley et al. (2016) and subsequent practical experiences underscore the challenge of addressing unprepared students in higher education courses. Initially, the expectation that students will independently prepare during self-study periods is largely ineffective. Despite having reached university-level education, around 40% of students remain unprepared for class discussions or activities. This lack of preparation arises from a variety of understandable personal reasons, such as time constraints, familial responsibilities, and technical difficulties with course management systems. As a result, relying solely on student self-motivation is insufficient, and alternative strategies must be employed (Pfennig, 2024):

One approach to improving student preparation involves providing clear external guidance and conducting formative assessments. Detailed guidance on weekly workloads and learning objectives can help, but it tends to add undue stress. Although formative assessments push students to engage with the material, the pressure and insecurity regarding content can lead to a gradual aversion to the subject.

A more effective strategy observed involves the integration of formative assessments paired with a clear routine during class sessions. By announcing self-study expectations and assessment details from the outset, students can better manage their workload and focus on incremental learning goals. The introduction of frequent testing helps break down the material into manageable segments, facilitating continuous engagement and understanding. Students appreciate this structured approach as it allows them to allocate their study time according to personal schedules, thereby minimizing end-of-term stress.

Another successful tactic is the use of extra assignments and embracing collaborative tools like templates, padlet, and miro boards. Unprepared students benefit from their involvement in specifically tailored activities that help them catch up with their peers. These interactions empower students to contribute positively during class discussions, fostering a supportive learning environment. Involving students in peer-modulated sessions or small groups, where they can ask questions and receive feedback without embarrassment, helps build confidence over time.

Pfennig, 2024 found that despite the potential for added pressure, formative assessments combined with structured guidance significantly enhance learning outcomes. Particularly in a challenging context like the COVID-19 impacted semesters, these measures proved vital in driving engagement and comprehension. By integrating both prepared and unprepared students into group activities and assessments, the approach encourages active participation and lifts overall class performance.

In conclusion, addressing unprepared students effectively requires a multifaceted strategy. Combining formative assessments with clear guidance, collaborative activities, and positive reinforcement helps students of varying levels to integrate into the learning process, ultimately improving both motivation and performance. While additional preparation time for instructors is necessary, the resultant improvements in student engagement and understanding make it a worthwhile investment.

3.2 Advantages and Disadvantages of Inverted Classroom Teaching Scenarios

The "inverted classroom" approach offers several advantages and challenges in the educational landscape, particularly within material science courses. One of the key benefits is the reusability of peer-to-peer lecture films, which provide a flexible and adaptable learning resource. These films, once created, can be utilized repeatedly, aligning well with contemporary students' learning preferences. Students appreciate the flexibility in time and location for accessing lectures, as well as the ability to revisit entire lectures or specific sections, allowing them to learn at their own pace. This method encourages motivation during self-study, fosters collaborative learning in class, and supports problem-solving in a conducive classroom atmosphere. Small group interactions further enhance the individual learning experience.

However, the inverted classroom approach is not without its drawbacks. The initial preparation of lecture materials and films requires substantial time and effort, far exceeding that of traditional lectures. There is a risk of losing students unwilling or unable to engage in independent study, potentially hindering their ability to contribute to group work or develop necessary background knowledge. This necessitates additional teaching resources to support these students, which increases the workload for educators and may discourage well-prepared students. Although the course workload remains unchanged, the distribution requires students to consistently engage throughout the semester rather than only before exams.

Based on experience, it is recommended to implement the inverted classroom model for foundational scientific knowledge that remains stable over time. Educators must possess comprehensive knowledge of the subject to address a wide range of student inquiries effectively. The preparation and upkeep of lecture materials are central to the method's success. Initial applications of this approach should avoid excessive innovation, focusing on established routines for optimal outcomes. Transparency and clear communication of course objectives are crucial from the outset. New adopters are advised to start with a single theme, using templates and consistent contact-time routines for discussing results and tackling practical problems. When executed well, this approach leads to dynamic discussions and innovative problem-solving, yielding positive results even with first-year students.

Overall, while the initial phases of the course saw remarkable student satisfaction, the subsequent variations in perception highlight critical areas for continuous improvement. Enhancing the alignment of assessments with student learning objectives, preserving structural adaptability, and nurturing intrinsic academic motivation are pivotal for sustaining and elevating the pedagogical effectiveness of the course.

3. Reflecting on the Role of the Lecturer

In the context of higher education, the of a lecturer in an inverted classroom setting undergoes a significant transformation from the traditional "sage on the stage" to a "guide on the side." This shift emphasizes the facilitator of lecturers, focusing on promoting active learning and critical engagement with course material (Brame, 2015; Berrett, 2012).

In traditional classroom settings, lecturers are typically the primary source of knowledge, directly delivering information during lectures while students passively receive it. However, in an inverted classroom, the initial content delivery is moved outside of class time, often through video lectures or assigned readings. This change empowers students to engage with new material at their own pace, allowing class time to be dedicated to activities that reinforce and apply their understanding (Pierce et al., 2012; Cui et al., 2017).

As facilitators, lecturers in flipped classrooms focus on creating an environment conducive to active learning. They design and activities such as guided discussions, collaborative group work, and engineering problem-solving scenarios that encourage students to apply their knowledge (Pfennig, 2016, Pfennig, 2018). This approach helps students develop higher-order thinking skills, such as analysis and synthesis, which are essential in higher education (Lord, 2012; Horn et al., 2013).

Additionally, lecturers play a critical in providing feedback and support during classroom activities. They monitor student progress, address misconceptions, and guide discussions to deepen understanding (Setren et al., 2019; O'Brien et al., 2020). This shift from direct instruction to facilitation requires lecturers to employ different teaching strategies and possess strong pedagogical skills to adapt to the dynamic nature of student-centered learning environments.

Furthermore, lecturers must ensure that preparatory materials are engaging and aligned with course objectives, as these resources are crucial for setting the foundation for in-class activities (Pfennig, 2018). Effective communication about the importance and expectations of the flipped model is also essential, as students may initially be resistant to the increased responsibility for their own learning (Spannagel et al., 2012; Thai et al., 2017).

Still, due to the more collaborative nature of the teaching environment students might attach to lecturers more than in traditional lectures. Facilitators need to be aware of their emotional influence and responsibility as guiding person to the newly academic word with its uncertainties for undergraduate students in their first study year.

Also, the lecturer needs to be more patient because learning seems to be slower as students prioritize different content during self-study periods. Lecturers have to endure a new pace of learning on the other hand earning a surprising variety of content transforming individual strategies.

In summary, the lecturer's in an inverted classroom is multifaceted, involving careful planning, effective facilitation of active learning, and providing ongoing support and feedback as well as patience and a sensitivity towards social dependence and influence. This paradigm shift is believed to enhance student engagement and learning outcomes but also to prepare students for the complexity and demands of higher education (Haynes and Currie, 2020; Pfennig, 2021, Pfennig, 2024).

5. Conclusion

The paper examines the implementation and effects of the inverted (flipped) classroom model in higher education, focusing particularly on material science courses at HTW Berlin. This pedagogical approach shifts content delivery to outside the classroom, freeing up in-class time for active learning through discussions and problem-solving. The model is praised for fostering critical thinking and self-paced learning, particularly in STEM fields. The inverted classroom at HTW Berlin utilizes digital resources and diverse teaching methods to accommodate the varied backgrounds of students, promoting interaction and collaborative learning.

Although it has shown success in improving learning outcomes and student engagement, the model also faces challenges. Some students may struggle with the increased demands of self-study or become dissatisfied with the shift from traditional methods. Possible strategies to support students are to include structured guidance, formative assessments, and collaboration-enhancing tools.

The role of lecturers in this setting shifts from direct knowledge delivery to that of a facilitator, promoting active learning while patiently providing essential support and feedback. This transformation requires educators to adapt their strategies to the dynamic –yet often slower in pace, but student-centered environment of the inverted classroom.

Despite mixed feedback over time, the course at HTW Berlin has been generally well-received, offering insights into areas for improvement such as aligning assessments with learning objectives and maintaining structural flexibility.

References

Ashby, M., Shercliff, H., Cebon, D. (2013). Materials Engineering, Science, Processing and Design (3rd edition). Elsevier, Butterworth & Heineman.

Berrett, D. (2012). How 'flipping' the classroom can improve the traditional lecture, The Cronicle of Higher Education.

Brame, C.J. (2015) Flipping the Classroom, http://cft.vanderbilt.edu/files/Flipping-the-classroom.pdf, call: 09/2015.

Braun, I. et al. (2012). Inverted Classroom an der Hochschule Karlsruhe - ein nicht quantisierter Flip, Beitrag zu „Das Inverted Classroom Model: Begleitband zur ersten deutschen ICM-Konferenz", Jürgen Handke, Alexander Sperl (Hrsg.), erschienen im Oldenbourg Verlag.

Carberry, A.R., Siniawski, M.T., Dionisio J.D.N. (2012). Standards-based grading: Preliminary studies to quantify changes in affective and cognitive student behaviors. IEEE Frontiers in education conference, Seattle, WA.

CSU Colorado State University, Using Peer Teaching in the Classroom (2015). Retrieved 07/2021 from https://tilt.colostate.edu/TipsAndGuides/Tip/180.

Cui T., Wei-Gang Y., Fu Y. (2017). Effectiveness of flipped classrooms in nursing education: Systematic review and meta-analysis. Chinese Nursing Research, 4, 192-200.

Educause Learning initiative (2016). 7 THINGS YOU SHOULD KNOW ABOU FLIPPED CLASSROOMS. Retrieved 07/2021 from https://library.educause.edu/resources/ 2012/2/7-things-you-should-know-about-flipped-classrooms.

Eryilmaz, M. (2015). The effectiveness of blended learning environments. Contemporary Issues in Education Research (CIER), 8(4), 251-6.

Fischer, M und Spannagel, C. (2012). Lernen mit Vorlesungsvideos in der umgedrehten Mathematikvorlesung, in Desel, J., Haake, J.M. und Spannagel, C. (Hrsg.), DELFI 2012, Die 10. E-Learning Fachtagung Informatik der Gesellschaft für Informatik e.V., S. 225-236, Bonn: Köllen Druck + Verlag, Copyright © Gesellschaft für Informatik.

Galindo-Dominguez, H. (2021). Flipped Classroom in the Educational System: Trend or Effective Pedagogical Model Compared to Other Methodologies? International Forum of Educational Technology & Society Educational Technology & Society, 24 (3), 44-60.

Geist, M.J., Larimore, D., Rawiszer, H., Al, S., Abdellatif, W. (2015). Flipped versus traditional instruction and achievement in a baccalaureate nursing pharmacology course. Nurses Education Perspective, 26, 114-115.

Goto, K. and Schneider, J. (2010). Learning through teaching: Challenges and opportunities in facilitating student learning in food science and nutrition by using the interteaching approach. J. of Food Sci. Education, 9(1), 31-35.

Guskey T. R. and Pollio H. R. (2012). Grading Systems - SCHOOL, HIGHER EDUCATION - Students, Grades, Teachers, and Learning, Education Encyclopedia. StateUniversity.com.

Harrington, S.A., Bosc,h M.V., Schoofs, N., Beel-Bates, C., Anderson, K. (2015). Quantitative outcomes for nursing students in a flipped classroom. Nurses Education Perspective, 36, 179-181.

Haynes, B.J., Currie, N.G. (2020). Outcomes from applying the inverted classroom to a first year structures module. The Structural Engineer, 98(5), 8-15.

Horn, M.B. (2013). The transformational potential of flipped classrooms. Education Next. 13, 78-79.
http://invote.de/, call 01/2016.

Kamo, C., Zvereva, E. (2017). Methodology of Flipped Classroom as a Learning Technology in Foreign Language Teaching. Procedia - Social and Behavioral Sciences, 237,1500-1504.
https://doi.org/10.1016/j.sbspro.2017.02.236.

Lord, T. (2012). 101 reasons for using cooperative learning in biology teaching. The American Biology Teacher, 63(1), 30-38.

Marbouti F., Diefes-Dux H. A., Madhavan K. (2016). Models for early prediction of at-risk students in a course using standards-based grading, Computers & Education 103, 1-15.

O'Brien, S., Clancy, S., Berthould, M., Hayes. L. (2020). Performing Trinity. In Garnett, V. Trinity Spaces: International Spatial Humanities Sprint Camp (iSHCamp), Trinity College Dublin.
https://sway.office.com/SViZyVxQ7Ab5wiXL?ref=Link

Pfennig A. (2016). Inverting the Classroom in an Introductory Material Science Course, Procedia - Social and Behavioral Sciences, 228, 32-38

Pfennig A. (2018). Improvement of learning outcome in material science through inverted classroom techniques and alternative course assessment. JFLET Journal of Foreign Language Education and Technology, 3(1), 148-162.

Pfennig, A. (2021) Improving Learning Outcome for GSL (German as a Second Language) Students in a Blended Learning Cumulative Assessment Material Science Course. Intern. J. of e-Education, e-Business, e-Management and e-Learning (IJEEEE) 11(3):93-100.

Pfennig, A. (2021). How flipped classroom teaching methods in first year studying succeed, Proceedings of the 7th International Conference on Higher Education Advances HEAd`21, 1211-1218.

Pfennig, A. (2024). The challenge of unprepared students in inverted classroom teaching scenarios. In: 10th International Conference on Higher Education Advances (HEAd'24), 1007-1015. Valencia, 18-21 June 2024. https://doi.org/10.4995/HEAd24.2024.17067.

Pierce, R., Fox, J. (2012). Vodcasts and active-learning exercises in a "flipped classroom" model of a renal pharmacotherapy module. American Journal of Pharmaceutical Education, 76, 196.

Sadler D.R. (2005). Interpretations of criteria-based assessment and grading in higher education, Assessment & Evaluation in Higher Education, 30 (2), 175-194, online 2010.

Setren, E., K., Moore, O., Yankovich, M. (2019). Effects of the Flipped Classroom: Evidence from a Randomized Trial, SEII Discussion Paper #2019.07, MIT Department of Economics, National Bureau of Economic Research.

Simon, B., Kohanfars, M., Lee, J., Tamayo, K, & Cutts, Q., Experience report: peer instruction in introductory computing. Proceedings of the 41st ACM Technical Symposium on Computer Science Education (2010) 341-345.

Simpson, V., Richards, E. (2015). Flipping the classroom to teach population health: increasing the relevance. Nurses Education Practice, 15, 162-167.

Stockwell M.S., Cennamo, M., Jiang, E., Brent, R. (2015). Blended Learning Improves Science Education. Cell, 162(5), 933-936.

Szpunar, K.K., Jing, H.G., Schacter, D.L. (2014). Overcoming overconfidence in learning from video-recorded lectures:Implications of interpolated testing for online education, Journal of Applied Research in Memory and Cognition 3, 161–164.

Thai, N.T.T., De Wever, B., Valcke, M. (2017). The impact of a flipped classroom design on learning performance in higher education: Looking for the best “blend” of lectures and guiding questions with feedback, Computers & Education, 107, 113-126.

Walsh J., O'Brien M., Costin Y. (2021). Investigating student engagement with intentional content: An exploratory study of instructional videos. The International Journal of Management Education, 19(2), 100505.

Zheng, L., Bhagat, K.K., Zhen, Y, Zhang, X. (2020). The Effectiveness of the Flipped Classroom on Students' Learning Achievement and Learning Motivation: A Meta-Analysis. International Forum of Educational Technology ＆ Society Educational Technology ＆ Society, 23(1), 1-15.