

# European higher education

## Alternative forms of learning and teaching during and after the COVID-19 pandemic

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### ABSTRACT

The shift to remote learning during the pandemic posed significant challenges for lecturers and higher education institutions in maintaining student engagement. In this research, two interconnected aspects are explored: first, what were the pre-existing conditions that either facilitated or hindered the integration of technology in European higher education during the pandemic. Second, how did these conditions shape Portuguese students' perceptions of the flipped classroom model prior to, during, and following the pandemic. The article uses a multi-method research design. The findings underscore the critical influence of pre-existing conditions on the capacity of higher education institutions to implement digital transformation effectively. Within this broader framework, the analysis of the effectiveness of the flipped classroom model reveals that students often value the flexibility, self-directed learning opportunities, and increased interaction afforded by this approach.

### KEYWORDS

COVID-19, contextual factors, flipped classroom, pre-existing conditions, research on pedagogies, student engagement, teaching and learning in higher education

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The global COVID-19 pandemic, which began in 2019 and persisted into 2020 and beyond, significantly influenced higher education. It compelled institutions to embrace remote learning and work models quickly, accelerating their digital transformation efforts (Times Higher Education 2020). The pandemic demonstrated the significance of technology in ensuring educational continuity (Almaiah et al. 2020; Bryson 2020). Concomitantly, the pandemic underscored the dependence of teaching practices on digital technology while altering teaching practices by shifting face-to-face teaching and



learning to online platforms. This shift accelerated the digital transformation of education, as the necessity for physical distancing and lockdowns meant that digital solutions became essential for continuing educational activities.

Furthermore, the shift also highlighted the importance of student-centred approaches in digital learning environments. The transition to remote learning highlighted and intensified several pre-existing conditions in higher education. Lecturers and higher education institutions faced outdated or inadequate technology infrastructure, insufficient institutional support, inadequate teacher training and concerns over security and privacy. These gaps, along with individual factors, contributed to a decrease in student motivation and engagement.

Given the challenges faced by lecturers and higher education institutions in maintaining student engagement during the shift to remote learning, the aim of this research is, on the one hand, to examine and identify the pre-existing conditions that facilitated or hindered the integration of technology into the creation of engaging educational experiences during the pandemic. On the other hand, in this article, using the flipped classroom as an illustration of how technology can be incorporated into pedagogical frameworks, we seek to analyse how the pre-existing conditions shaping the changes in teaching and learning in European higher education influenced students' perceptions of the flipped classroom model before, during and after the pandemic in Portugal. This research contributes to learning the lessons from the pandemic to improve alternative forms of teaching and learning in education and enhance student engagement.

This article starts with an overview of digital technologies and their adoption in education contexts. Next, the concepts of student-centred approaches, student engagement and active learning are revisited. It continues by presenting the multi-method design of the research. The results show that pre-existing conditions such as national policies, technology infrastructure and teachers' and students' preparedness for remote working shaped the changes in teaching and learning in European higher education. The article ends with an analysis of students' perceptions of the flipped classroom across different stages of the pandemic in Portugal.

## **Digital transformation in higher education and challenges in remote learning**

Digital transformation is the key feature of the way in which higher education institutions in Europe reacted during the pandemic. However, digital transformation had begun to gain significant momentum in the late 1990s



and early 2000s with the widespread adoption of the Internet and the availability of digital technologies. The timeline and pace of digital transformation varied across institutions and regions; some higher education institutions were early adopters and began their digital transformation initiatives in the early 2000s, while others started their efforts more recently. Higher education institutions began exploring technology for instructional purposes, administrative processes and communication during the early stages of digital transformation.

Interestingly, one of the first papers referenced in the Web of Science, focusing on digital transformation in higher education, refers to the behavioural synthesis support system for undergraduate teaching in educational computing (Ainscough et al. 1992). Such a support system can enhance student interaction with course material and with each other through tools like discussion forums, quizzes and video lectures. Additionally, by providing insights into student engagement, the system might enable educators to tailor their teaching strategies for improved participation and learning outcomes. Complementing this, learning management systems (LMS) emerged as centralised platforms for managing course content, assessments and communication, streamlining the administrative aspects of teaching and student interaction. While LMS focus on the logistical and content-related aspects of course delivery, a behavioural synthesis support system can significantly enrich the educational experience by adapting teaching approaches to promote student engagement. Although proponents of these systems advocated for their use as supplements to face-to-face teaching and learning rather than replacements, their development paved the way for a potential shift from traditional in-person instruction to online learning.

In the following years, the pace of digital transformation in higher education is being accelerated by key technological developments. The proliferation of mobile devices, the growth of cloud computing, and the emergence of data analytics empowered institutions to collect and analyse large volumes of learning data, allegedly facilitating data-driven decision-making, for example, identifying students at risk, tailoring interventions, and improving course design based on real-time feedback. These tools might induce collaboration between students and lecturers as the tools might favour more interactive, participatory learning environments through shared digital workspaces, discussion forums and collaborative assignments.

In the 2000s, the rise of massive open online courses (MOOCs) was a significant milestone in digital transformation. MOOCs allowed higher education institutions to offer online courses to a global audience, showcasing the potential of technology to provide access to learning experiences. Online collaboration tools, virtual reality and artificial intelligence illustrate the

rapid acceleration of technologies and provide many solutions for issues (e.g., geographical barriers, engagement and interaction, accessibility, time management and flexibility), raising questions about alternative and effective ways to teach and learn with technologies. Digital transformation is ongoing and ever-evolving, continually challenging higher education institutions to adopt technology, with the aim of enhancing teaching, learning and administrative processes.

However, depending on each institution's unique context, available resources, and level of preparation to embrace digital transformation, the effectiveness of the rapid changes prompted by the pandemic in promoting access to education and favouring equal opportunities among people of all backgrounds remains to be seen (Goudeau et al. 2021). The research questions addressed in this article are: How can higher education institutions effectively adapt to alternative forms of teaching and learning that were accelerated by the COVID-19 pandemic? How can we manage these alternatives in a way that promotes the achievement of intended learning outcomes?

### **Student-centred approaches and student engagement**

The engagement of students in digital transitions during the COVID-19 pandemic showed and accelerated a broader shift already underway in higher education towards student-centred approaches driven by political frameworks like the Bologna Process and by the pedagogical need to address increasingly diverse student populations due to massification. In the literature, the concept of student-centred teaching and learning (O'Neill and McMahon 2005) can refer to student participation in the design of their academic path, active learning (e.g., Higgs and McCarthy 2005), which involves students in their learning through more interactive and dynamic environments, or more egalitarian relationships between students and academic staff (e.g., Stephenson and Troy 2003).

From the perspective of student-centred approaches that emphasise active learning, the pandemic brought forward the importance of key elements such as student autonomy, collaboration, and the development of critical thinking. These elements align closely with the notion of student engagement, which, as Hamish Coates (2007) outlines, is grounded in seven core principles: encouraging student-faculty contact, encouraging cooperation among students, promoting active learning, providing prompt feedback, emphasising the amount of time students actively spend engaged in learning activities that are directly related to instructional goals, communicating high expectations, and respecting diverse students. In this light,

the challenges and priorities brought to the surface during the pandemic reaffirmed the central role of student engagement in effective education. Engagement, in this sense, encompasses pedagogical practices, active learning, collaborative work between students, meaningful teacher–student interaction, content and practical application of knowledge, and both academic and social interaction (Coates 2007). Therefore, as Lee Shulman (2002) argues, student engagement is not merely a proxy for learning outcomes, it is a fundamental aim of education itself.

Although remote learning during COVID-19 highlighted the transformative potential of technology in higher education, in a broader context, this impact has implications for the future of work and for how we prepare people to live in a more technologically hybrid world (Harwood and Eaves 2020). For higher education to achieve its goal of ‘bringing students into a transformational relationship to knowledge that changes their sense of who they are and what they can do in the world’ (Ashwin 2020), an understanding is needed of the extent to which digital transformation fosters the students’ transformational relationships by engaging them in teaching and learning.

By looking at the flipped classroom as a model of hybrid teaching and learning as it blends online and in-person teaching, this model exemplifies how the challenges of student engagement highlighted by the pandemic may be mitigated by hybrid approaches driven by flexibility. In the flipped classroom, traditional in-class activities and homework assignments are reversed or ‘flipped’. Students are introduced to new concepts or content outside of class, typically through pre-recorded video lectures, readings or other multimedia resources that they can access online at their own pace and then use for active learning activities such as group discussions, problem-solving exercises, collaborative projects and interactions with the lecturer.

Flipped classrooms have been popularised by the idea of inverting the objectives of the face-to-face class, not promoting expository activities, but rather the consolidation of knowledge, skills and attitudes acquired by students in a pre-class context through the viewing of videos and mandatory readings (e.g., Tucker 2012). The analysis of research findings (Veiga et al. 2019) showed that, as a didactic and pedagogical device (Bernstein 2000), the flipped classroom not only facilitated the dissemination and acquisition of knowledge but also created space for critical reflection. This space allows students to develop a necessary distance between learning and the application of knowledge in concrete situations.

This is a fascinating point because the flipped classroom approach prompts awareness of how knowledge is taught and what knowledge should be applied in in-class activities, which helps to improve academics’

reflexive capacity in dealing with the academic development and support. Furthermore, face-to-face classes, in the context of flipped classroom, elicited greater student participation leading them to take a more active role in the learning process (Gallagher 2007) and promote deeper knowledge of certain concepts, since there is more time for debate, discussion and solving tasks or applying knowledge in assessments such as exams or tests (Kellogg 2009).

During the pandemic, the results of the implementation of flipped classrooms in pharmaceutical sciences (Remião and Veiga 2021) highlighted the benefits of applying collaborative work between students as a learning strategy, enhancing social and academic relationships between students (McCollum et al. 2017) and valorisation of group work as one of the factors that enhances learning during flipped classes (Huang and Lin 2017). These findings highlight the need for higher education institutions to foster academic development and support strategies such that access to technology encourages challenging learning settings that actively contribute to student engagement.

Recognising the importance of student cooperation and the role of challenging group tasks is crucial to understanding how collaborative work impact student learning and motivation both key dimensions of student engagement. Notably, even students who felt they had a less active role in group discussions tended to report positive experience with flipped classes. This flexibility can enhance by accommodating diverse students' needs, yet it also underscores the need to take account of socioeconomic and cultural factors when designing and implementing alternative teaching and learning methods. As the pandemic revealed, these factors play a critical role in shaping how students engage with and benefit from such approaches.

A different study (Veiga and Remião 2021) identified the characteristics of autonomous study based on experiences with flipped classrooms. The analysis revealed that the two groups of students differed in their perception of the relevance of recorded content as pharmaceutical sciences students gave more importance to recorded content to support their studies than education sciences students but agreed on the importance of flipped classrooms for developing skills in organising autonomous study time. Based on thematic analysis, these themes provided insights into the characteristics of autonomous study such as access to recorded lectures valuing the relevance of the content in terms of accurate knowledge, flexibility in organising study time and space, the benefits of reviewing material outside the classroom, and the positive impact of flipped classrooms on knowledge consolidation, application, academic performance, and the development of skills such as time management and critical thinking.



Further research in pharmaceutical sciences (Remião and Veiga 2021) highlighted the importance of collaborative practices and pedagogical strategies in promoting student engagement in flipped classrooms as the collaborative work among students was identified as a relevant factor for their involvement in the teaching and learning process. The study concluded that the development of pedagogical practices and collaborative work are crucial for promoting student engagement in the teaching and learning process through flipped classrooms and for enhancing cooperation as an academic competence (Barnett 1994). All in all, the dimensions of autonomous study as well as the emphasis on higher education as a competence while promoting student agency form part of student readiness and expectations – a sub-theme that was mentioned before apropos of the dynamics shaping the emergency response of higher education institutions to the pandemic.

The sudden shift to online and distance learning triggered by the pandemic dramatically altered the educational landscape, highlighting critical challenges and opportunities. This shift means that alternatives to high-quality, inclusive digital education must be found (Mok 2022) to navigate the demands of education in a digital age. Issues such as student engagement, the diverse learning needs of students, and the integration of technology in education have come to the forefront.

Under this framework, the combination of multiple factors that shaped teaching and learning in higher education in Europe during the pandemic can be seen as pre-existing conditions (Veiga and Seidenschur 2022). These conditions include institutional elements associated with the technological infrastructure, institutional support and preparedness of lecturers and students, but also structural problems which Europe was already facing (Wright 2020), associated, for instance, with economic conditions, student demand and social inequalities. As such, these conditions were affecting teaching and learning in higher education before the pandemic and have also influenced higher education institutions' capacity and ability to provide resources and assistance to academics and students during the pandemic.

Integrating digital technologies in education presents both challenges and opportunities. To deliver meaningful and engaging educational experiences, these technologies must be thoughtfully incorporated into the planning, creation, and organisation of courses, as well as content, learning outcomes and students' assessment. To ensure that the use of technology truly benefits the educational process, it is also crucial to evaluate whether this integration effectively enhances student engagement while promoting the achievement of intended learning outcomes.

## Research design: Multi-method design

In this article, a multi-method design is applied, as illustrated in Table 1, to explore how pre-existing conditions may influence the Portuguese students' perceptions of the flipped classroom model prior to, during, and following the pandemic.

The multi-method design of this study draws firstly on the analysis of the pre-existing conditions shaping remote education during COVID-19 in Denmark, England, Finland, France, Germany, Hungary, Ireland, and Portugal (Veiga and Seidenschnur 2022). Researchers in each participating country studied at least two higher education institutions, conducting a total of 130 semi-structured interviews with national and institutional leaders, academics, and support staff in 2021. To examine and identify the pre-existing conditions that facilitate/hinder adaptations to alternative forms of teaching and learning accelerated by the COVID-19 pandemic, thematic analysis (Braun and Clarke 2006) involved identifying and analysing patterns or themes within a dataset. Initial coding started by assigning codes to relevant segments of the data, allowing preliminary themes to be formed. These themes capture the main ideas emerging from the analysis of the qualitative data about pre-existing conditions influencing the changes of the educational response to COVID-19 (Veiga and Seidenschnur 2022).

Secondly, to explore and analyse how to manage alternative ways of teaching and learning in a way that promotes effective learning outcomes, this article draws on cross-sectional data generated to evaluate the effectiveness of a flipped classroom approach in degree programmes of education sciences and pharmaceutical sciences, both before and during the pandemic in Portugal. The Institutional Ethics Commission approved the study to ensure full compliance with European research ethics, standards, regulations and practices. The students were informed about the study at the beginning of each semester and responded to the survey once the assessment of their learning outcomes was completed.

The evaluation strategy of pedagogical practice employed mixed data analysis techniques. To analyse the contribution of the flipped classes to student engagement, a questionnaire survey was constructed, asking students to use a five-point Likert scale to indicate: (1) the relevance of the recorded content; and (2) their satisfaction with the flipped class experiences for the achievement of specific learning outcomes. The survey was conducted at the end of the second semester, after the students' assessment, in the following academic years: 2018–2019 (N 204) (paper), 2019–2020 (N 88) (Google Form), 2020–2021 (N 147) (Google Form) and 2021–2022 (N54) (Google Form).

**Table 1.** Multi-method design

Data source	Data analysis approach	Research interest	Outcome
Analysis of the impact of the COVID-19 pandemic on higher education in Denmark, England, Finland, France, Germany, Hungary, Ireland and Portugal (Veiga and Seidenschur 2022)	Thematic analysis (Braun & Clarke, 2006)	Analyses of pre-existing conditions related to specific dimensions associated with digital transformation and impacting teaching and learning before and during the pandemic	The ideas covered in the country reports can be broken up into the following themes: national policies, technological infrastructure, student and academic staff readiness, and socioeconomic factors influencing the changes in teaching and learning prompted by the pandemic.
Cross-sectional data was generated to evaluate the effectiveness of a flipped classroom approach for student engagement in Portugal.	Descriptive and covariance statistical analysis	Comparative analysis of the perceptions of students before, during and after the COVID-19 pandemic	Identify the influence of pre-existing conditions in experiencing the implementation of flipped classrooms.

The quantitative analysis of the data was performed using SPSS 25 software. Descriptive statistics was employed to explore perceptions of the relevance of recorded content and experiences of the flipped classroom approach, taking the intended learning outcomes for the course into account. The internal consistency analysis showed that the scales of relevance of the recorded content (nine items) were good (Cronbach's alpha = 0.795) and that the scale of satisfaction on the experience with the flipped classes (seven items) was very good (Cronbach's alpha = 0.925). To analyse the differences between pre-pandemic perceptions and those during the pandemic and in the post-pandemic academic years, we used the Kruskal–Wallis statistical test to compare the students' perceptions according to their rating of the experiences with the flipped classes, comparing them with the other classes of the semester. A significance value of less than 0.05 was used as a reference for signalling differences.

### **Pre-existing conditions shaping the changes in teaching and learning in European higher education**

The analysis of the themes reflects the issues that emerged across the surveyed countries in order to explore the relationship between pre-existing

conditions and student engagement. The analysis is cross-theme, with national specificities highlighted to demonstrate the importance of each theme in teaching and learning in higher education in the perception of policy/decision-makers, academics and support staff.

### *National policies, external influences and socioeconomic and cultural factors*

In the surveyed countries, national policies and external influences addressing pre-existing conditions highlighted several issues affecting the financial sustainability of higher education systems, the role of the state in regulating institutions, and the integration of further and vocational education into higher education.

#### *Financial sustainability of higher education systems*

The pandemic exacerbated existing challenges related to the financial sustainability of higher education. For instance, in Portugal, the pandemic intensified problems such as the massification of higher education and the ageing of academic staff. National policies failed to address the chronic underfunding of the sector, leading to a lack of prioritisation for sustainability (Veiga et al. 2022). This situation revealed how uneven preparedness among lecturers and variations in the way in which academic disciplines adapted to distance learning created disparities in student engagement. Similarly, in Finland, austerity measures since 2012, including staff reductions and tuition fees for non-EU students, strained higher education institutions (Aarnikoivu and Saarinen 2022). In England, financial sustainability was affected by economic slowdowns and the departure of the UK from the European Union, which influenced institutional responses to the pandemic. Increased teaching staff workload was noted as a significant issue (Dang et al. 2022). Germany's situation also underscored the need for additional funding for digital transformation to support active learning and pedagogical practices (Seidenschnur and Pineda 2022).

#### *Socioeconomic and cultural factors influencing the reaction of higher education institutions*

Financial constraints impacted the readiness of academic staff and the adaptability of pedagogic practices to remote learning, leading to increased inequalities among students. The German and Portuguese participants highlighted how socioeconomic and cultural factors influenced institutions' responses to COVID-19. In Germany, disparities in students' digital readiness and expectations challenged efforts to provide equitable access to technology and support active learning (Seidenschnur and Pineda 2022).



Conversely, opportunities emerged for certain groups, such as disabled persons and those living remotely, who found online learning beneficial (Seidenschnur and Pineda 2022). Similarly, recording classes during the pandemic supported student engagement and learning outcomes, as observed in Ireland (Gibson et al. 2022), and research is demonstrating the increased value of recording classes for students' attainment and achievement of learning outcomes (Remião et al. 2022).

#### *The changing role of the state*

The role of the state in regulating higher education systems has evolved, impacting institutional autonomy and pedagogical practices. In France and Hungary, financial and institutional autonomy were reduced by increased state regulation. France's dependence on fees and foreign students strained public institutions (Dakowska 2022), while Hungary experienced reduced autonomy due to recentralisation and heightened state control (Géring et al. 2022). Despite these constraints, Hungarian institutions benefited from pedagogical autonomy, allowing experimentation with hybrid education models (Géring et al. 2022). However, given a pre-existing condition associated with recentralisation, the Hungarian research (Géring et al. 2022) draws attention to the expectation that institutional control mechanisms for digital learning will become stronger and more standardised within higher education's daily operations.

#### *National and institutional policies*

The integration of further and vocational education into higher education reflects a broader European trend towards the Skills Agenda. In Denmark and France, national policies have emphasised the importance of practical skills and alignment with internships, affecting institutional priorities and responses to emergency education (Dakowska 2022; Harsbo et al. 2022). In Ireland, the emergence of technological universities (TUs), a new type of institution in Ireland's historically binary higher education sector, demonstrate how pre-existing conditions and financial sustainability issues shaped institutional responses to the pandemic (Gibson et al. 2022).

Governance reforms in Europe and beyond (see, for example, McLendon 2003) have been closely connected with funding of higher education institutions as debates have been focusing on the extent to which higher education institutions rely on government funding or can draw on other sources (for example, OECD 2003). Related to this, debates on institutional autonomy and self-governing, reducing the reliance of higher education institutions on state funding and control, have also influenced the relationship between the state and higher education institutions (Varghese 2013).

The analysis of the articulation between national policies and socio-economic and cultural factors highlights the role of the former in shaping how higher education institutions in various countries responded to the pandemic. These factors influenced student inequalities and digital readiness, impacting the ability of institutions to provide access to technology and support for learning.

### *Technological infrastructure and institutional culture embracing innovation*

In the surveyed countries, the pre-existing technological infrastructure played a crucial role in facilitating the adoption of digital tools and platforms in higher education during the pandemic. This infrastructure, combined with the efforts of IT staff to promote digital literacy, supported the transition to online education. However, the challenges of rethinking digital pedagogies became apparent, highlighting the need for innovation in educational practices driven by the ongoing digitalisation of education.

#### *Technological infrastructure as a facilitator*

The role of technological infrastructure as a facilitator is evident in the Danish and Finnish cases. The Danish report (Harsbo et al. 2022) illustrates how digital transformation can act as a self-reinforcing factor; institutions with advanced technological infrastructures were better equipped to integrate digital tools into teaching and learning. This advantage stems from a national coordination strategy focused on digital transformation, which emphasised enhancing technological infrastructure to support active learning and improve pedagogic practices.

In Denmark, changes in teaching and learning during the pandemic were closely linked to pre-existing national policies, such as the university college merger strategy aiming at reforming its higher education and vocational sectors in response to technological change, labour market demands, and expansion of digital learning. These changes enabled the development of academic staff's digital teaching skills, thereby potentially enhancing the quality of student engagement and learning experiences.

#### *Openness regarding the collaboration between academics and support staff*

The Danish report (Harsbo et al. 2022) highlighted the positive impact of collaboration between academics and support staff. This collaboration fostered a sense of unity and equality, bolstering the relationship between digital technology and pedagogy. In Finland, support from IT staff and peer networks facilitated experimentation with and adaptation



to digital technologies, which was crucial for aligning teaching practices with specific learning objectives and outcomes (Aarnikoivu and Saarinen 2022).

Similarly, the Hungarian study (Géring et al. 2022) emphasised the importance of centres supporting teaching and learning in the transition to digital education. These centres provided counselling and advice on using digital tools, helping to foster an institutional culture that embraces innovation and supports active learning. In Finland, the technological infrastructure contributed to a 'digitally-oriented' mentality among higher education actors, reflecting favourable views on digitalisation among both lecturers and students.

Favourable attitudes towards adopting digital tools and platforms in higher education were also noted in the English report (Dang et al. 2022). The complementarity of campus-based learning with digital platforms enhanced the well-being of various members of the academic community. Additionally, hybrid possibilities for meetings, webinars and other events were well received, signalling a potential expansion of traditional learning environments into hybrid forms. The Irish study further emphasised the role of hybrid options in facilitating student interactions, particularly in practical sessions (Gibson et al. 2022). The Portuguese report echoed this sentiment, suggesting that some pandemic-driven changes, such as the predominance of online meetings and the adoption of hybrid formats, could be maintained in the future (Veiga et al. 2022).

### *Digital pedagogies*

Despite the advantages of technological infrastructure, the shift to online education highlighted the need to rethink digital pedagogies to ensure alignment with learning objectives and outcomes. The Finnish report (Aarnikoivu and Saarinen 2022) emphasised the challenge of adapting pedagogical practices to the ongoing digital leap, pointing out difficulties related to both teaching and learning. The Danish report (Harsbo et al. 2022) noted a lack of experience in evaluating educational experiments, indicating that technological infrastructure alone is insufficient without an institutional culture committed to continuous improvement and innovation in pedagogy. This culture is vital for promoting digital transformation and significant teaching and learning experiences for academic teaching staff and students.

In Hungary, the pandemic prompted a shift in focus towards pedagogical concerns, such as course design, planning skills, and the need for curricular revisions in online education (Géring et al. 2022). Similarly, the German report (Seidenschnur and Pineda 2022) documented the development of

novel teaching strategies in response to the increased workload and the transition to online environments, particularly in the social sciences.

The Irish report (Gibson et al. 2022) revealed that the internationalisation of the curriculum might increase as online education facilitates access and communication with international partners. The Portuguese research (Veiga et al. 2022) noted that online education broadened opportunities for internationalisation, particularly for students who might not have engaged in physical mobility. This suggests that the pandemic established virtual synchrony routines, offering a different perspective on virtual mobility and furthering the need to rethink digital pedagogies in higher education.

### *The digital and pedagogic readiness of academic staff*

The varied experiences across countries like Portugal, Hungary, France, Germany, and England highlight the different levels of digital and pedagogical readiness, which has significant consequences for adapting to the rapid changes in teaching and learning necessitated by the pandemic. These variations also underscore the importance of active learning, effective pedagogic practices, and meaningful interactions in the digital education landscape.

#### *Piecemeal experience with digital education*

In England, global competition for students has driven new educational models, yet the experience with online learning has been piecemeal. This lack of readiness among students and academic staff became apparent during the pandemic, revealing a gap in digital skills and pedagogical preparedness. The English report (Dang et al. 2022) emphasises the need for further support in developing digital capabilities, which may become a growth area in the future. Integrating digital competencies into professional frameworks highlights the importance of academic staff being prepared to address digital education challenges while fostering active student engagement and interactions that are essential for effective learning.

Similarly, in France, digital teaching was not widespread across most universities before the pandemic, except in highly internationalised institutions like the Grandes Écoles. The French report (Dakowska 2022) notes that the apparent lack of preparedness among academics to teach online raised doubts and concerns from academics, including issues of data protection and the ethical use of course content. This lack of readiness also impacted the ability to maintain student engagement and active learning in an online environment, where pedagogic practices had to be quickly adapted without sufficient preparation.

*From excitement to boredom*

The German response to remote education revealed a more nuanced experience, with the transition to online teaching sparking debates about how knowledge is taught and what types of knowledge are most effectively conveyed online. The German report (Seidenschnur and Pineda 2022) identified three phases in the adoption of online teaching during the pandemic: enthusiasm, revolution, and boredom. Initially, the shift to online education was met with excitement and innovation, as academics and students explored new ways to engage in learning. However, as time went on, this excitement gave way to boredom, and the limitations of online learning became more apparent, particularly in terms of sustaining active learning and student engagement. In keeping with this, it was revealed in the Portuguese report (Veiga et al. 2022) that after the first momentum with many experiments, which were innovative and even rewarding and were working, it then began to slow down.

The German report (Seidenschnur and Pineda 2022) also noted improvements in relationships between academics and administrators, suggesting that the crisis may have helped bridge gaps between different groups within institutions. This collaborative spirit could be crucial in shaping future pedagogic practices that support active learning and effective student interactions. The ability to experiment with synchronous and asynchronous digital teaching technologies during the pandemic is likely to influence future teaching and learning alternatives, with a continued focus on fostering engagement and interaction.

*A strategic anticipation gap*

In Hungary, despite having the technological infrastructure to support the transition to online education, there was a lack of strategic anticipation and preparedness for such a shift. The Hungarian report (Géring et al. 2022) highlights the absence of policy decisions based on evidence and the lack of professional development opportunities before the pandemic, which affected the technical and pedagogical readiness of academics. This lack of readiness also impacted the ability to implement active learning strategies and engage students effectively in the online environment.

Similarly, in Portugal, the transition to emergency remote teaching was hindered by a lack of technical and pedagogical readiness among academics, largely due to the absence of national policies and strategies promoting digital transformation in higher education. The Portuguese report (Veiga et al. 2022) emphasises that rather than relying solely on technology as a solution, there is a need for a comprehensive debate that increases awareness of the complexities of learning, didactics, and andragogy. This debate is

essential for developing pedagogic practices that not only utilise technology effectively but also prioritise student engagement and active learning.

In Finland, the level of digital skills and experience with digital tools varied greatly among academics, even with the digital leap prompted by the pandemic. The Finnish report (Aarnikoivu and Saarinen 2022) points out that this variability posed challenges, particularly in scientific fields like medicine and healthcare.

These challenges underscore the importance of aligning digital skills with pedagogical practices that support active learning and foster meaningful student interactions, ensuring that educational outcomes are met even in a digital environment. The analysis of digital and pedagogical readiness across these countries underscores the significance of readiness in terms of digital skills, pedagogical approaches, and a willingness to adapt to digital education. The disparities in readiness levels reflect the influence of pre-existing conditions, such as technological infrastructure and national policies, while underscoring the need to critically evaluate the outcomes of pragmatic approaches that inform decisions about how and when technology is used.

### *Students' readiness and expectations*

The analysis of changes in teaching and learning during the pandemic revealed several challenges that significantly impacted students' readiness and expectations. These challenges, which include the quality of the student experience, the benefits of online learning, support for a student-centred approach, and mental health issues, played a crucial role in shaping students' ability to engage with instructional materials and methods. Additionally, students' expectations influenced their motivation and attitudes toward learning, highlighting the importance of fostering student engagement through active learning, pedagogic practices, and meaningful interactions.

### *Quality and assessment of students' learning*

In Denmark, changes in teaching and learning during the pandemic did not alleviate students' feelings of a chaotic transition in 2020 or their sense of lost learning. However, by January 2021, online working-group arrangements had received positive feedback from students, exceeding the expectations of supporting staff (Harsbo et al. 2022). This shift underscores the importance of creating learning environments where students can actively engage with new materials and pedagogic practices. Such environments not only enhance student motivation but also support their readiness to learn. Higher education institutions must therefore ensure fair access to technology and resources, enabling the integration of appropriate digital tools into



teaching and learning while maintaining a focus on student engagement as a cornerstone of effective education.

Student readiness and expectations were further influenced by issues surrounding assessment during the pandemic. For example, in Portugal, inequities in student evaluation became a major public concern, particularly regarding the fairness of online assessments and the privacy implications of surveillance mechanisms. The Portuguese case highlights how insufficient or unfair assessment practices can undermine students' academic achievement and expectations, leading to distrust and demotivation. If students perceive their assessments as unjust or unreflective of their knowledge and skills, they may lose motivation to engage actively in their studies.

Similarly, in Finland, changes to entry regulations for higher education, such as the varying weights assigned to matriculation and entrance exam results, also impacted student readiness and expectations (Aarnikoivu and Saarinen 2022). These challenges underscore the need for fair and transparent assessment practices that are aligned with students' expectations and support their engagement in learning. In contrast, the Irish report noted that student assessment practices, such as open-book exams, could enhance accessibility and flexibility, particularly for underrepresented groups, thereby promoting social justice and student engagement (Gibson et al. 2022).

The English (Dang et al. 2022) and German (Seidenschnur and Pineda 2022) reports also raised concerns about how the pandemic negatively impacted students, particularly through increased workload and a heightened risk of dropout due to disengagement. These challenges underscore the importance of adopting pedagogical practices that actively support student engagement and learning, helping students stay motivated, connected, and supported in digital environments.

#### *Online learning and support*

The pandemic also brought socioeconomic and cultural issues to the forefront, influencing the benefits and drawbacks of online learning. The Irish study (Gibson et al. 2022) noted that while online education offers flexibility, it also presents challenges for students who may lack quiet workplaces at home where they can fully engage with learning materials. This highlights the need for a balanced approach to online education, one that combines the convenience of digital learning with the essential face-to-face interactions that support student engagement and learning outcomes.

In Portugal (Veiga et al. 2022), unforeseen successes in the use of pedagogic devices, such as remote laboratories in engineering, demonstrated how certain tools could actively promote student autonomy and engagement. This finding illustrates the importance of leveraging technology in

ways that enhance pedagogic practices and support active learning, enabling students to take ownership of their educational experiences.

#### *Mental health and well-being*

Mental health and well-being emerged as critical concerns during the pandemic, as highlighted in the Finnish report (Aarnikoivu and Saarinen 2022). Higher education institutions must address these concerns to create supportive learning environments that promote student engagement and well-being. The French study (Dakowska 2022) also noted the increased workload for academics associated with student assistance and care, emphasising the need for evaluation tools that consider the well-being of all members of the academic community.

These findings underscore the importance of fostering an institutional culture that values mental health and well-being, as these factors are closely linked to student engagement and the overall quality of the educational experience. However, the global rise in individualism partly driven by increases in educational attainment, which have been associated with more individualist practices (Santos et al. 2017), poses a significant challenge to building collaborative learning environments and supportive academic communities. The various challenges faced by students during this period, from assessment inequities to mental health concerns, highlight the need for pedagogic practices that prioritise active learning, student-centred approaches, and meaningful interactions.

In the following section, students' perceptions within the flipped classroom model, will be explored and analysed considering the influence of pre-existing conditions shaping teaching and learning in European higher education. It will also underline the role of student engagement in framing educational experiences before, during and after the pandemic.

### **Student engagement with the flipped classroom before, during and after the pandemic in Portugal**

The two experiments under consideration began with one flipped classroom session to organised in 2018–2019 in the bachelor's programme in education sciences and the integrated master's programme in pharmaceutical sciences, and they were expanded to three sessions in succeeding academic years. The aim of the flipped classroom strategy, which was put into action by providing the programme content of the curricular unit ahead of the corresponding scheduled contact hours, was to encourage the adoption of theoretical frameworks, the application of knowledge, while creating tasks focused on the accomplishment of a particular goal. The flipped classroom

in the two experiments complemented other lectures where the time, place, and pace of learning remained constant, and practical and lab classes were provided in the respective curricular unit.

The flipped classroom was based on viewing a recording of a presentation by a lecturer (and the respective slides of the presentation) and subsequently bringing discussions, problem-solving proposals or challenges promoted by the teachers to the classroom (all face-to-face except for one session online in the first lockdown). The implementation of the flipped classroom strategy is based on constructive alignment, and it incorporates specific goals to promote the appropriation and comprehension of theoretical frameworks (integrated master's in pharmaceutical sciences) and to apply knowledge in developing tasks oriented towards the realisation of a specific activity (bachelor's programme in education sciences). The objectives of teaching are linked to the intended learning outcomes, and student engagement factors were also considered for the flipped classroom strategy (Coates 2007) in the planning and evaluation of the effectiveness of the pedagogical and didactical tactics used in the course units under review.

Flipped classes have been implemented since the 2018–2019 academic year and are based on the provision of videos recorded by the lecturer. The videos were recorded in a real classroom context in the 2017–2018 academic year using the Explain Everything application. The videos were made available to students using the 'Panopto' tool, which is part of the Moodle learning platform. The integration of technology within this model required access to the Internet. Both learning systems provide interactive tools such as scrolling, note-taking and the ability to change the speed of the videos that so students can view them at their own pace. The platforms also provided information on the minutes watched, enabling lecturers to identify which segments of the videos were replayed or viewed most frequently by students; this information was then used to prepare in-class activities that addressed areas of higher interest, difficulty, or engagement. These in-class activities were implemented using technological collaborative learning tools such as Google documents, Padlet, and Poll Everywhere, ensuring that students have access and digital skills to work with them.

#### *Impact of recorded classes and flipped classroom on student learning: A comparative analysis*

In this study, student perceptions were analysed across various stages – pre-pandemic, during the first and second lockdowns, and post-pandemic – to evaluate the effectiveness of flipped classroom in fulfilling intended learning outcomes. The findings, drawn from a Kruskal–Wallis test and

subsequent pairwise comparisons, reveal critical insights into how different periods influenced student engagement and learning. The Kruskal–Wallis test evaluates whether there are statistically significant differences between the distributions of multiple independent groups (pre-pandemic, during the first and second lockdowns, and post-pandemic). The test operates on ranks, where all observations across groups are pooled and ranked from lowest to highest. Each value is assigned a rank, and the test then compares the mean ranks of each group. Differences in these average ranks suggest whether one group tends to have higher or lower values than the others, indicating potential group-level effects. In this context, a higher average rank means that the group's data tend to have larger values, while a lower average rank indicates smaller values. As indicated by the results of the Kruskal–Wallis test, all  $p$ -values are less than 0.05, with most being less than 0.001, suggesting that students' perceptions varied significantly depending on the period in which they were surveyed.

*Knowledge acquisition, understanding, and study support*

Prior to the pandemic, students demonstrated a high level of satisfaction with recorded classes for acquiring knowledge, understanding the topics covered, and supporting study, with ranks of 272.83, 282.27, 303.12, respectively. This trend remained relatively stable during the lockdowns, with only minor fluctuations. However, post-pandemic data shows a significant drop in satisfaction for acquiring knowledge, with ranks dropping to 42.59, while understanding the topics saw a partial increase (rank: 266.72) as did supporting study (rank: 205.18). This suggests that while the immediate transition back to traditional classroom settings may have been disruptive, students prior to the pandemic and during lockdown perceived the effectiveness of recorded content for knowledge acquisition.

*Curiosity, training and development*

During the second lockdown, students perceived recorded classes as particularly effective for fostering student curiosity and training and development. The rank for arousing curiosity during this time peaked at 316.81, considerably higher than in the pre-pandemic period (rank: 203.00) and post-pandemic (rank: 294.24), while the rank for training and development during the second lockdown increased to 286.53, significantly higher than the pre-pandemic (rank: 230.39) and post-pandemic (rank: 223.81). These findings suggest that the strategies employed during the lockdowns—were more engaging, stimulated greater intellectual curiosity among students, and enhanced their individual growth.

*Practical applications and skills development and assessment*

The study also highlights the differential impact of recorded classes on practical skills and problem-solving abilities. While in the first lockdown, recorded classes were moderately effective in helping students to *solve practical problems* (rank: 164.77), there was a noticeable decline during the second lockdown (rank: 132.98). However, perceptions slightly improved post-pandemic (rank: 145.51). In contrast, perceptions decreased post-pandemic on the impact of recorded classes on *assessment in the course unit* (rank: 164.44). The highest peak (rank: 266.44) was achieved in the second lockdown and pre-pandemic (rank: 263.55). This underlines the value of recordings for practical *application of knowledge and assessment*.

*Motivation and interaction*

Motivation to *learn beyond the content covered* and *interaction with colleagues* are crucial elements of student engagement. The data reveals a steady increase in motivation, particularly in the post-pandemic period (rank: 192.78), reflecting a positive long-term impact of the recordings. Similarly, interaction with peers improved progressively, with the post-pandemic period showing the highest rank (165.76). These results underscore the importance of continued use of collaborative and interactive elements in teaching such as Poll Everywhere and Google documents, even as educational settings return to routine.

The findings associated with the students' satisfaction with using videos supporting flipped classrooms and recorded classes offer insights for lecturers and higher education institutions aiming to develop institutional policies in a post-pandemic era. However, the significant post-pandemic drop in satisfaction with knowledge acquisition suggests a need for better integration of recorded classes and videos supporting learning with in-person teaching to maintain their effectiveness. Furthermore, the perceptions reported during the second lockdown, which indicate that curiosity was aroused, suggest that flexible remote learning strategies may yield positive outcomes if integrated into curriculum design.

*Acquiring knowledge and developing comprehension skills*

In turn, the transition to flipped classrooms significantly influenced students' perceptions of their learning outcomes, particularly during the pandemic. Actually, the analysis of student perceptions of flipped classrooms and learning outcomes revealed that the flipped classrooms approach was key for *acquiring knowledge and developing comprehension skills* during the pandemic. Pre-pandemic, students had a moderate (rank: 208.42)

perception of the consistency with which they could acquire knowledge in flipped classrooms. This perception saw a notable improvement during the first lockdown, reaching its peak (rank: 278.77), and remained high post-pandemic. The significant satisfaction during the first lockdown indicates that the structure of flipped classrooms was particularly effective in this period. Interestingly, students also reported that flipped classrooms became increasingly effective in helping them *apply knowledge to new contexts* as time progressed. The highest levels of satisfaction were observed post-pandemic (rank: 281.00), demonstrating the method's growing effectiveness in developing *comprehension skills*.

*Mobilising arguments and ability to reflect critically*

The influence of flipped classrooms in *mobilising arguments for problem-solving, ability to reflect critically and engagement* was also relevant. Before the pandemic, students had a lower perception of the effectiveness of flipped classrooms in aiding *problem-solving* (rank: 169.46). However, this perception improved markedly during the lockdowns, with the second lockdown showing the highest effectiveness (rank: 247.22). Similarly, *students' ability to reflect critically on course topics* was significantly enhanced during the lockdowns. The perception of support for critical reflection was lower pre-pandemic (rank: 167.95) but improved during the second lockdown (rank: 231.16) and remained high post-pandemic (rank: 232.68). *Engagement in classroom discussions and debates* also improved steadily, with students reporting the highest involvement post-pandemic (rank: 277.55). This progression underscores the effectiveness of the flipped classroom in fostering active student participation over time, suggesting that flipped classrooms during the pandemic succeeded in achieving critical thinking, problem-solving, communication, and collaborative learning outcomes. This achievement is aligned with the idea that digital transformation may enhance students' transformational relationships as a purpose of education by itself. To that end, student participation requires expansive, self-reflective and transformative learning processes (Zepke 2014). These processes involve encouraging students to reflect on their learning strategies and learning outcomes. Such an environment fosters students' ability to reconsider their attitudes toward learning and their capability to synthesise and apply knowledge meaningfully.

The more favourable perceptions during and after the pandemic suggest that flipped classrooms became increasingly effective as students and educators adapted to diverse learning environments. Lecturers should continue refining and utilising flipped classroom models, particularly focusing on activities that enhance comprehension, problem-solving, and independent



study skills. The high ranks during lockdown periods indicate that students benefited from the structured environment of flipped classrooms during uncertain times. Ensuring that such resources remain available and accessible can help maintain student engagement and learning outcomes in future blended or fully online learning environments. The strong post-pandemic rankings for reflection and discussion indicate that flipped classrooms can effectively foster critical thinking and collaborative skills. Lecturers should incorporate more opportunities for reflection and peer interaction in flipped classroom designs to continue leveraging these strengths.

These findings suggest that flipped classrooms, when effectively implemented, can significantly enhance student engagement and learning outcomes, especially in times of disruption or transition. Continued focus on refining these methods and adapting them to changing student needs will be key to maintaining their effectiveness.

## **Conclusion**

This article offers a comprehensive picture of the changing conditions associated with digital transformation sparked by the pandemic and their influence on the perceptions of students regarding one alternative form of learning and teaching. It provides an in-depth analysis of pre-existing conditions faced by academics, support staff, national and institutional leadership in Denmark, England, Finland, France, Germany, Hungary, Ireland, and Portugal, while underlining the effectiveness of flipped classrooms before, during, and after the pandemic in Portugal, as seen in Table 2.

This research addresses how higher education institutions can adapt to alternative forms of teaching and learning accelerated by the COVID-19 pandemic by emphasising the importance of flexible and innovative pedagogical approaches. The analysis of the flipped classroom model in Portugal illustrates how adaptable teaching methods, focused on student engagement and active learning, can successfully respond to the challenges of digital transformation. Furthermore, the research highlights the significance of national and institutional policies in supporting this transition, noting that regulatory frameworks and financial sustainability play a critical role in enabling European higher education institutions to implement effective digital strategies. These findings show that adaptability, both in teaching methods and institutional policies, is key to navigating crises like the pandemic while maintaining educational quality and inclusivity. The example of the integration of technology into pedagogical models before and after COVID in Portugal, framed by the broader context in which higher education institutions evolve, highlights the need for higher education institutions

**Table 2.** Summary of key research findings

<b>Pre-existing conditions influencing the digital transformation in European higher education</b>	<b>The example of the flipped classroom: before, during and after COVID-19 in Portugal</b>
<p><b>National and institutional policies, external influences and socioeconomic and cultural factors</b></p> <ul style="list-style-type: none"> <li>Financial sustainability of the higher education system</li> <li>The changing role of the state in regulating the system and institutions</li> </ul>	<p>The research on the effectiveness of flipped classrooms during and after the pandemic shows the broader need for higher education institutions to adopt flexible teaching approaches that can be adapted to changing circumstances. This suggests that regulatory and institutional support is crucial for successful adaptation to crises and for enhancing student engagement and learning outcomes.</p>
<p><b>Technological infrastructure, institutional culture and innovation</b></p> <ul style="list-style-type: none"> <li>Openness regarding the collaboration between academics and support staff</li> <li>Digital pedagogies</li> </ul>	<p>The need for reliable technological infrastructure and innovative pedagogical approaches like flipped classrooms is key to fostering effective, adaptable, and student-centred learning environments.</p>
<p><b>Digital and pedagogic readiness of academic staff</b></p> <ul style="list-style-type: none"> <li>Piecemeal experience with digital regarding digital education</li> <li>From excitement to boredom</li> <li>A strategic anticipation gap</li> </ul>	<p>The analysis of the flipped classroom model during the pandemic illustrates the effectiveness of the need for a contextualised and informed approach to employing technology and pedagogy in education, particularly when it is focused on active learning and adaptability.</p>
<p><b>Students' readiness and expectations</b></p> <ul style="list-style-type: none"> <li>Quality and assessment of students' learning</li> <li>Online learning and support</li> <li>Mental health and well-being</li> </ul>	<p>Flipped classrooms showed the importance of adapting educational strategies to improve student experiences and outcomes during and after the pandemic to promote student-centred approaches and active learning.</p>

to encourage the design of pedagogical models that diverse students can navigate and benefit from, rather than imposing a dominant model of teaching and learning.

In managing alternative forms of teaching to promote effective learning outcomes, the article underscores the need for collaboration among stakeholders and robust technological infrastructure. It emphasises that successful digital transformation requires the readiness of academic staff and students alike, ensuring they are equipped with the necessary skills and resources to thrive in a digital learning environment. The example of the flipped classroom model demonstrates the value of fostering student-centred learning environments that prioritise engagement and adaptability.



As the perceptions of the students in the flipped classroom showed, the shift brought about by the pandemic demands not only careful pedagogical planning and sustained support but also a meaningful integration of technology that aligns with the *situatedness of practice* (Suchman 1987). This alignment involves adapting technological tools to the specific teaching and learning contexts in which they are used, ensuring that technology enhances the established dynamics of educational practice. As Stephen Harwood and Sally Eaves (2020) suggest, it is not only the technical aspects of technology that matter but also how it is employed in broader socio-economic and cultural contexts.

The limitations of this research are associated with generalising research findings due to contextual national and institutional differences. Lack of control over the data collection process was mitigated by the fact that data collection processes focusing on pre-existing conditions influencing education during the pandemic were built in partnership with national team members, and the national reports were written based on a common template that was also agreed upon and shared among all the national teams. However, the original research interpretation and assumptions may differ from the research-specific objectives of this article.

To mitigate this limitation, secondary data analysis based on thematic analysis and the literature review ensured that the interpretations in this article were aligned with its objectives. The findings regarding the analysis of flipped classrooms may also have limited generalisability beyond the specific context and sample used. However, the analysis allows the research findings to contribute to the pedagogical discussions on the incorporation of educational technology beyond the pandemic.

Leveraging the pandemic's momentum and lessons to stimulate research on pedagogies in higher education is vital for the future conception and planning of alternative education models within higher education institutions (Rapanta et al. 2021). This momentum is not only timely but essential for informing the design of alternative educational practices within institutions.

Research into pedagogies offers valuable insights into anticipatory practices (Robertson 2020) that help manage students' expectations and improve educational effectiveness. This research, thus, supports the reflexive practice of academics, enabling them to critically examine and improve their own teaching. At the same time, it contributes to the consolidation of pedagogy as a field of knowledge, providing academics with frameworks that enhance their professional practice and reinforce the legitimacy of teaching and learning research.

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