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RESEARCH ARTICLE

Exploring the pedagogical use of thematic fresks in education for sustainability

[version 1; peer review: awaiting peer review]

Pauline de Montpellier[1], Coline Ruwet[1], Charlotte Mikolajczak[2], Laurent Lahaye[3], Benoît Galand[1], Valérie Swaen[1]

[1]UCLouvain (Université catholique de Louvain), Louvain-la-Neuve, 1348, Belgium
[2]EPHEC, Bruxelles, 1200, Belgium
[3]ICHEC Brussels Management School, Bruxelles, 1150, Belgium

v1 **First published:** 24 Jul 2026, **6**:259
https://doi.org/10.12688/openreseurope.23002.1
Latest published: 24 Jul 2026, **6**:259
https://doi.org/10.12688/openreseurope.23002.1

Abstract

Background

Thematic fresks – collaborative, card-based workshops designed to foster systemic understanding of sustainability issues – have rapidly gained traction in higher education. Despite their growing popularity, little is known about how these tools are pedagogically integrated into university curricula, particularly in relation to the development of sustainability competencies. This study addresses this gap through an exploratory investigation conducted within the Wallonia-Brussels Federation (FWB), Belgium.

Methods

Drawing on a mixed-method design, the research combines a systematic mapping of fresk usage across 24 higher education institutions with qualitative insights from 20 educators in economics and management.

Results

The mapping reveals that thematic fresks are widely adopted, especially at the bachelor level in management and engineering programs, and are implemented in diverse formats ranging from transversal activities to formal coursework. The Climate Fresk emerges as the most frequently used tool, followed by fresks on planetary boundaries, circular economy, and digital technologies.

Open Peer Review

Approval Status *AWAITING PEER REVIEW*

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Qualitative findings highlight a broad spectrum of pedagogical intentions, including the promotion of systems thinking, emotional engagement, and collective intelligence. However, educators also report significant challenges, such as addressing emotional responses, and adapting content to heterogeneous student backgrounds.

Conclusions

The study identifies tensions between the standardized format of fresks and the transformative ambitions of Education for Sustainability (EfS), raising questions about tool design, facilitator autonomy, and curricular integration. By documenting current practices and educator experiences, this research contributes to a more nuanced understanding of thematic fresks as pedagogical tools. It emphasizes the importance of contextual and institutional factors in shaping their effectiveness and responds to a growing demand for empirical evaluation. The study invites future research on the long-term impacts of fresk-based activities on student learning, engagement and behaviors, and encourages the professional development of educators to make EfS more impactful, inclusive, and transformative.

Keywords
Education for sustainability, thematic fresks, higher education, cartography, systems thinking, sustainability competencies, pedagogical innovation

This article is included in the COST Actions gateway.

This article is included in the Universities for Sustainability collection.

Corresponding author: Pauline de Montpellier (pauline.demontpellier@uclouvain.be)

Author roles: de Montpellier P: Conceptualization, Formal Analysis, Investigation, Methodology, Project Administration, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Ruwet C**: Conceptualization, Funding Acquisition, Methodology, Project Administration, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing; **Mikolajczak C**: Conceptualization, Funding Acquisition, Methodology, Project Administration, Supervision, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Lahaye L**: Project Administration, Writing – Review & Editing; **Galand B**: Funding Acquisition, Project Administration, Writing – Review & Editing; **Swaen V**: Funding Acquisition, Project Administration, Writing – Original Draft Preparation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: This work was supported by the Walloon Region (Belgium) through the Chaire de recherche en éducation au développement durable dans l'enseignement supérieur (Convention PRW65) of the Académie de Recherche et d'Enseignement Supérieur (ARES). The authors are affiliated with The SHIFT COST Action for the purpose of this publication; however, no funding was received from this COST Action for the present work.
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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How to cite this article: de Montpellier P, Ruwet C, Mikolajczak C *et al.* **Exploring the pedagogical use of thematic fresks in education for sustainability [version 1; peer review: awaiting peer review]** Open Research Europe 2026, **6**:259 https://doi.org/10.12688/openreseurope.23002.1

First published: 24 Jul 2026, **6**:259 https://doi.org/10.12688/openreseurope.23002.1

Introduction

Education for sustainability (EfS) has become a strategic priority for higher education institutions (HEIs), underscoring their pivotal role in equipping future generations to address complex societal and environmental challenges (Findler et al., 2019, UNESCO, 2017). Building on the legacy of Environmental Education – which since the 1950s, has championed the development of critical and engaged eco-citizenship – EfS promotes awareness of the intricate interdependencies between human societies and natural systems, and seeks to cultivate ethical, responsible, and inclusive societies (Sauvé, 2024).

To meet these ambitions, HEIs have embraced a variety of pedagogical approaches. Active and experiential learning methods – such as problem-based learning, game-based learning, cooperative learning, and outdoor education – are widely advocated for EfS (Martin & Padula, 2018; Monroe et al., 2019; Kaya & Elster, 2019). These approaches aim to engage learners holistically – cognitively, emotionally, and behaviorally – thereby hoping to foster deeper understanding and long-term commitment.

Among these approaches, thematic fresks have gained significant traction. Since the launch of the Climate Fresk in 2015, over a hundred similar tools have been developed, each addressing specific dimensions of socio-ecological transitions – from biodiversity and digital technologies to circular economy and mobility. Typically structured as short, collaborative workshops, fresks blend scientific knowledge with creative and reflective activities. They are designed to be accessible and engaging, trying to promote systems thinking, critical reflection, and collective action (Béhar, 2024).

Despite their rapid diffusion, the pedagogical use of fresks in HEIs remains underexplored. Preliminary insights highlight both their potential and limitations (De Bouver & Ruwet, 2024), yet no comprehensive mapping of their use in higher education nor systematic analysis of educators' motivations and practices has been conducted. Key questions remain: What drives educators to adopt fresks? How are these tools integrated into teaching? What impacts do they have on student learning, engagement, and behavior?

While these gaps are numerous and multifaceted, this article focuses on a subset of them. Our research addresses the following questions: How are fresks used across HEIs? What are the pedagogical motivations of educators who integrate them into their teaching, and what challenges do they face?

To explore these questions, we adopt a dual approach: a mapping of fresk usage across HEIs in Wallonia-Brussels Federation (FWB), Belgium, and an exploratory analysis of the motivations and practices of 20 educators in economics and management – disciplines increasingly engaged in sustainability-oriented curricular reforms. Through this exploratory research, we offer a critical perspective on thematic fresks as pedagogical tools and open the discussion to broader questions about the role and future of EfS in higher education.

Literature review

Education for sustainability in higher education

EfS has gained prominence in higher education as a response to the multifaceted challenges of our time, including ecological degradation, social inequality, and economic instability. HEIs – and business schools in particular – are increasingly seen as key actors in preparing future leaders to address these issues in ethical, responsible, and sustainable ways (Figueiró & Raufflet, 2015; Stubbs & Cocklin, 2008). The transformative potential of education is widely acknowledged (Mezirow, 2000), with scholars emphasizing its capacity to foster critical thinking, systemic understanding, and value-based decision-making (Saravanamuthu, 2015).

However, the integration of sustainability into higher education curricula is far from straightforward. The concept itself is contested and multidimensional, encompassing overlapping notions such as ethics responsibility, and environmental stewardship. Its interpretation varies across disciplines and stakeholders, shaped by ecological imperatives, developmental goals, cultural norms, and societal expectations (Bansal & Song, 2017; Setó-Pamies & Papaoikonomou, 2016). These conceptual tensions often translate into pedagogical challenges, particularly in how sustainability is framed and conveyed to students (Akrivou & Bradbury-Huang, 2015; Lourenço, 2013).

Curricular integration strategies can be broadly categorized along a continuum from vertical to horizontal approaches. Vertical integration typically involves standalone sustainability courses inserted into existing programs, often without challenging prevailing paradigms. In contrast, horizontal integration embeds sustainability themes across disciplinary courses, promoting more systemic and transformative reform (Ceulemans & Prins, 2010).

Importantly, the effectiveness of EfS depends not only on content but also on pedagogy. Transformative learning approaches – which encourage students to critically examine and revise their assumptions and worldviews – and

pluralistic engagement – which fosters dialogue among diverse perspectives – are considered essential for developing sustainability competencies (Saravanamuthu, 2015). These pedagogies are supposed to support learners in navigating the complexity and contested nature of sustainability, while also challenging dominant paradigms and enabling collaborative exploration of solutions (Stough, 2020).

Sustainability competencies

A growing body of literature has sought to define the competencies required for EfS. Influential frameworks include UNESCO's eight key competencies (UNESCO, 2017), the six competencies outlined in the Manuel de la Grande Transition by the FORTES collective (Renouard et al., 2020), and the European Commission's "GreenComp" framework (2022). Despite differences in emphasis, these frameworks converge around five transversal competencies (Clark et al., 2020): systems thinking, critical thinking, futures literacy, adaptability, and self-awareness in relation to the living world. Systems thinking is the ability to recognize and understand relationships, to think about how systems are embedded within different domains and different scales, and to deal with uncertainty including feedback loops and unintended consequences. Critical thinking refers to the ability to question dominant systems, evaluate alternatives, and reflect on the implications of actions. Futures literacy combines three approaches to understanding the future: the predicted future (predictions based on careful observation of an unchanged present), the alternative future(s) (what could happen if action is taken) and the best possible future (imagining and organizing a desirable future). Adaptability is defined as the ability to respond constructively to rapid and abrupt environmental and societal changes. Finally, self-awareness and reconnection with the living world involve transforming mental models through ethical reflection and a renewed relationship with nature.

While these competences offer a compelling vision for sustainability education, their operationalization remains challenging. The broad and ambitious nature of these goals often contrasts with the practical need to assess whether students have actually acquired them through specific courses or programs. The absence of clear indicators and robust assessment tools makes it difficult to translate these competences into comprehensive and measurable learning outcomes.

To support the development of these competencies, active, participatory, and experiential pedagogies are widely recommended. Approaches such as problem-based learning, gamification and serious game, cooperative learning, and immersive outdoor education are frequently cited as promising strategies (Kaya & Elster, 2019; Martin & Padula, 2018, Monroe et al., 2019). These methods aim to make learning personally meaningful and action-oriented, thereby fostering deeper engagement with sustainability challenges.

Thematic fresks as gamified tools in EfS

Thematic fresks are presented as a prominent example of gamification and serious games within EfS. Gamification refers to the integration of game design elements – such as rules, objectives, feedback systems, rewards, and narrative structures – into non-game contexts, to enhance learner engagement, motivation, and participation (Brassier & Ralet, 2021; Deterding et al., 2011). While often associated with digital tools like virtual reality, simulations, and web-based applications, gamification also encompasses serious games that promote interaction, experimentation, and social participation. These approaches aim to foster active learning and make complex topics more accessible (de Salas et al., 2022; Fernández Galeote et al., 2021). Recent literature reviews highlight gamification as an emerging pedagogical strategy for teaching sustainability, particularly in business schools (Ar et al., 2023; Ligorio et al., 2025; Sharma, 2025).

Thematic fresks originates in France in April 2015 with the creation of the Climate Fresk by energy consultant Cédric Ringenbach, then director of the Shift Project (2010–2016). Following the milestone of 2,000 participants, the association "La Fresque du Climat" was founded in December 2018 to accelerate dissemination through a growing community of trained facilitators, known as "fresqueurs". Initially aimed to reach one million participants, the movement has expanded rapidly: As of 2025, it counted 98,000 facilitators and 2,2 million participants, with France remaining the primary hub (Fresque du Climat, 2025). Notably, 44.8% of workshops were conducted in corporate settings and 27.4% in educational institutions. Belgium ranks fourth in terms of both participants and facilitators, after Germany and the United Kingdom.

The success of the Climate Fresk has inspired the development of over 160 similar tools since 2020, each addressing specific dimensions of the socio-ecological transition – from biodiversity and digital technologies to circular economy and mobility ("Inventaire des fresques et ateliers amis", 2025). Each fresk articulates specific thematic objectives. For instance, the Climate Fresk focuses on climate mechanisms, systemic interconnections, and mobilization for action. The Circular Economy Fresk emphasizes the limitations of the linear model and principles of circularity. The Digital Fresk raises awareness of the environmental and social impacts of digital technologies, encouraging ethical and responsible use. The Planetary Boundaries Fresk introduces the nine boundaries, promoting systemic thinking and action planning. The Biodiversity Fresk reframes perspectives on the living world, highlights ecosystem services, and encourages multi-scale

action (Béhar, 2024). While none have matched the reach of the original Climate Fresk, they collectively reflect a growing interest in participatory, systems-oriented education. Their creators – consultants, grassroots associations, and public institutions like ADEME – bring diverse perspectives and expertise to the design process.

Despite their thematic diversity, fresks share a common pedagogical foundation. They are grounded in scientific expertise and claim epistemic neutrality, relying on peer-reviewed data and integrating authoritative sources such as IPCC reports. This scientific anchoring aims to ensure credibility and avoid ideological bias. Accessibility is another cornerstone: fresks are designed to be adaptable across audiences and contexts – public and private sectors, for-profit and non-profit organizations, activism, training, events, and team building. Their visual and schematic format facilitates intuitive understanding, and most fresks aim for large-scale dissemination, both in-person and online.

Gamification and collective intelligence are central to the methodology, though not always clearly defined. Workshops typically involve small groups (4–10 participants) who collaboratively reconstruct causal chains using cards (as illustrated in Appendix 1, de Montpellier et al., 2026). This fosters a systemic thinking and encourages reflection on individual and collective responsibilities. Emotional engagement is deliberately integrated during the debriefing phase, serving both pedagogical and motivational purposes. Rather than prescribing solutions, the final phase of most fresks invites participants to explore meaningful actions.

The stated objectives of thematic fresks converge around transversal goals and theme-specific aims. Based on official sources and Behar's (2025) overview, transversal goals include: developing scientific and systemic understanding; stimulating individual and collective awareness; promoting collective intelligence as a basis for informed decision-making; fostering emotional engagement and ethical reflection; translating knowledge into concrete, responsible practices. Together, these tools aim to interweave knowledge acquisition, systems thinking, emotional and ethical engagement, and pathways toward sustainable action. The overarching ambition of fresk-based initiatives is to catalyze a societal tipping point, where systemic transformation becomes self-reinforcing. However, despite these aspirations, no systematic scientific studies have yet systematically evaluated their impact on learning outcomes or behavioral change.

Photographs of a fresk activity conducted during the welcome week at EPHEC in September 2025 are provided in Appendix 1 to illustrate implementation in educational settings.

Critical perspectives on thematic fresks

De Bouver and Ruwet (2024) conducted a qualitative study of the Climate Fresk, combining participatory observation, two seminars with educators and facilitators, a survey of 50 Belgian facilitators, and four thematic focus groups. Their analysis reveals tensions between the tool's intended neutrality and the need for pedagogical adaptability. While the Fresk effectively conveys scientific knowledge in an accessible and visually engaging format, it remains largely informative and lacks depth in fostering critical thinking, emotional engagement, and collective empowerment.

Drawing on transformative learning theory, the authors identify several limitations: a narrow focus on physical sciences, implicit reliance on information deficit and social tipping point theories, limited integration of socio-political dimensions, a standardized format that restricts contextual adaptation, and superficial engagement with emotions and action. They argue that transformative education should holistically integrate emotions, empower learners as change agents, and support long-term, systemic reflection.

Facilitators play a crucial role in adapting the tool to diverse audiences and contexts. Many modify the structure, tone, and framing to align with institutional constraints and pedagogical goals. The authors advocate for greater contextualization, enhanced facilitator autonomy, and integration of fresks into broader educational trajectories.

Chalak and Delplancke (2024) examined the Climate Fresk through an educational sciences lens, combining content analysis of its 42 cards with two field experiments involving high school students and master's students training to become science teachers. Their study included filmed workshops, group productions, and observations of facilitator practices.

Their analysis reveals that thematic fresks promote a mechanistic and linear understanding of climate change, emphasizing physico-chemical processes while naturalizing its causes and downplaying political and economic structures. Ecological issues are framed anthropocentrically, and socio-economic impacts – such as inequality and migration – are presented with limited political context. Emotional and narrative framings, including catastrophic language and vague formulations, may trigger anxiety and fatalism.

The authors identify a didactic tension between reductionist and holistic approaches. High school students often struggle with cognitive overload and linear reasoning, while future teachers show more systemic thinking but face challenges in critically engaging with the tool. Facilitator adaptations, shaped by institutional constraints and audience expectations, can lead to simplifications and depoliticized framings. The authors call for a more critical and politically engaged educational approach that integrates ethical, social, and ideological dimensions of climate change.

Complementing these perspectives, Hognon et al. (2025) offer a structured review of the Climate Fresk's potential cognitive, emotional, attitudinal, and behavioral impacts. Their findings suggest that the workshop enhances factual knowledge and causal reasoning, elicits diverse emotional responses (e.g., concern, hope, eco-anger), reinforces climate-related beliefs, and stimulates short-term behavioral intentions. However, they caution that intense emotional responses, if unsupported, may lead to disengagement or eco-anxiety (Jalin et al., 2024). Long-term behavioral change, they argue, requires structural support and complementary interventions. Moderating factors – such as prior knowledge, emotional sensitivity, facilitator style, and institutional context – significantly influence outcomes. While the authors call for more rigorous evaluation of gamified climate education tools, others question whether fresks should be categorized as gamification or collaborative tools (e.g., De Bouver & Ruwet, 2024), suggesting that this assumption merits further scrutiny.

Despite the growing popularity of thematic fresks in EfS, empirical research on their pedagogical use and impact remains limited. Existing studies (De Bouver & Ruwet, 2024; Chalak & Delplancke, 2024; Hognon et al., 2025) have begun to explore their design and implementation, yet their contribution to the development of sustainability competencies – particularly systems thinking, critical thinking and adaptability – is often assumed rather than critically assessed. Moreover, these studies rarely draw on robust theoretical frameworks from educational psychology or behavior change science, making it difficult to evaluate whether the mechanisms activated by fresks align with their intended educational outcomes (Hognon et al., 2025). This lack of theoretical anchoring limits the ability to assess long-term learning outcomes or behavioral transformations.

This gap reflects broader methodological challenges in EfS research. As highlighted by Stern et al. (2014) and confirmed by recent meta-analyses (Świątkowski et al., 2024; Van De Wetering et al., 2022), studies in this field often relies on self-reported data, lacks control groups, and rarely includes longitudinal follow-up. Furthermore, there is no consistent evidence that specific pedagogical approaches – such as experiential versus traditional methods – systematically lead to superior outcomes (Świątkowski et al., 2024; Van De Wetering et al., 2022). Instead, contextual and structural factors (e.g., quality of preparation, presence of follow-up activities, integration into broader educational trajectories) appear to play a more decisive role (Bransford et al., 2000; Kirschner & Hendrick, 2020).

In light of these gaps, it becomes essential to examine how fresks are actually implemented in higher education settings – by whom, with what motivations and under what constraints. Studies conducted in other settings have shown that educators' characteristics, such as their intentions, motivation, and passion, are also likely to play a critical role in shaping the impact of sustainability training (Pratson et al., 2021; Stern & Powell, 2013), yet educators' motivations remain largely unexplored.

Research methodology

To address this gap, we conducted an exploratory study focused on the pedagogical use of fresks across HEIs in the Wallonia-Brussels Federation (FWB), Belgium, with a mixed-method design. Although fresks are increasingly used across various sectors, the decision to limit the scope to HEIs in the French-speaking FWB allows for a coherent and comparable analysis. This focus is particularly relevant given the intrinsic link between pedagogical reflection and academic settings. The study concentrates primarily on Economics and Management, based on the hypothesis – later confirmed – that fresks are especially prevalent in these disciplines.

The research was conducted in two complementary phases.

Phase 1: Mapping Fresk Usage in HEIs. The first phase consisted of a systematic mapping of fresk adoption across the 24 HEIs in the FWB, which includes five universities and nineteen university colleges. Mapping is understood here as a dynamic and participatory process aimed at documenting an emerging phenomenon at a specific moment in time, while also laying the groundwork for potential longitudinal follow-up.

This phase aimed to identify the types of fresks used, their pedagogical formats, the disciplinary contexts in which they are implemented, the number of students involved and the frequency and timing of workshops. Data were collected through informal exchanges with educators and sustainability coordinators, supplemented by publicly available

information from institutional websites and reports. The first author contacted 67 individuals identified as either responsible for EfS initiatives or actively using fresks. These individuals were invited to complete a structured questionnaire (Appendix 2, de Montpellier et al., 2026), and additional data were gathered through follow-up communications via email or phone. Informed consent was sought by email, with a clear explanation of the study objectives and the information being requested, allowing participants to freely decide whether or not to respond. This data collection process enabled the compilation of an inventory of fresk workshops offered during the 2024–2025 academic year. Data collected (available on OSF, de Montpellier et al., 2026) offers a rich foundation for understanding the current state of fresk implementation and informs the selection of case studies for the second phase.

Phase 2: Exploratory Discussions with Educators in Economics and Management. The second phase of the study focuses on the economics and management disciplines, where fresks are increasingly integrated into sustainability-oriented curricular reforms. This disciplinary focus is justified by three factors. First, preliminary findings from the mapping phase revealed that nearly half (48%) of students participating in fresks were enrolled in economics and management programs. Second, economics and management education is undergoing significant transformation, with growing emphasis on preparing future professionals to address sustainability challenges. Finally, it provides a coherent scope for comparison across institutions.

This phase involved a series of exploratory, theme-based conversations with 20 educators from three institutions: UCLouvain, ICHEC Brussels Management School, and EPHEC. Informed consent was first sought by email when participants were invited to take part in the discussions, with a clear explanation of the study objectives and the information being requested, and was confirmed verbally at the beginning of each discussion. Rather than following a formal interview guide, discussions were structured around key pedagogical themes such as pedagogical motivations, implementation strategies, perceived benefits and limitations, and reflections on student engagement and learning outcomes. Detailed profiles of the educators and their use of fresks are provided in Appendix 3 (de Montpellier et al., 2026). To enrich these insights, the first author also conducted classroom observations of fresk sessions, interacted with pedagogical advisors and experienced facilitators, and participated in workshops designed specifically for educators. This qualitative phase aimed to uncover motivations, challenges, and emerging practices, while also documenting the formation of a nascent community of practice among educators experimenting with fresks in higher education.

Findings

Fresk usage in HEIs

During the 2024–2025 academic year, 16 out of 24 HEIs in the FWB integrated fresks into their pedagogical activities, reaching an estimated 5,952 students through 60 documented activities (see Table 1). Among the remaining institutions, four explicitly reported no fresk-related activities, while four others did not provide any information. It is important to note that most institutions lack centralized tracking systems for fresk initiatives, which complicates efforts to obtain a comprehensive overview. Consequently, this mapping exercise offers a pragmatic snapshot of the situation at a specific moment in time. A summary of this cartography is provided in Appendix 4 (de Montpellier et al., 2026).

The data reveal a diverse range of fresks currently in use. The Climate Fresk stands out as the most widely implemented, involving 3,172 students across 32 activities. It is followed by the Planetary Boundaries Fresk (980 students, 2 activities) and the 2tonnes Workshop (728 students, 9 activities). Other fresks – such as those focused on circular economy, digital transition, mobility, biodiversity, environmental health, and water – were used on a more limited scale (see Table 1). The predominance of the Climate Fresk, the oldest and most widely disseminated tool with the largest pool of trained facilitators, raises important questions regarding the drivers of its adoption. Is its popularity primarily due to pedagogical preference, or does it reflect more pragmatic factors such as ease of access and facilitator availability?

A clear disciplinary pattern emerges from the data. Nearly half of all participants (2,860 students or 48%) are enrolled in economics and management programs, followed by engineering and technology (1,802 students or 30%). This confirms the relevance of the disciplinary focus adopted in the qualitative phase of the study. Other fields, such as human movement sciences (450 students, 8%), political and social sciences (210 students, 4%), and psychological and educational sciences (160 students, 3%) are less represented. Health-related disciplines – including medicine, public health, and physical education – accounted for only a marginal share of participants (see Table 2). This distribution suggests that pedagogical innovation in sustainability is currently most prominent in disciplines perceived as closely linked to economic and technological transitions. This engagement may be driven by external pressures (e.g., accreditation standards, market expectations), internal curricular reforms, or the recognition that these disciplines bear responsibility for sustainability challenges – both through their roles in extractive and polluting models and their capacity to influence future transformations. Furthermore, the relative openness of economics and management education to innovative and interdisciplinary approaches, compared to more siloed disciplinary traditions, may also

Table 1. Number of students and activities per type of Fresk (2024–2025).

Workshop	Number of students involved	Number of activities
Climate Fresk	3.172	32
Planetary Boundaries Fresk	980	2
2tonnes Workshop	728	9
Not specified	545	3
Circular Economy Fresk	230	2
Mobility Fresk	85	2
Digital Fresk	84	5
Biodiversity Fresk	55	2
Environmental Health Fresk	35	1
Water Fresk	30	1
Inventing Our Low-Carbon Lives	8	1
Total	**5.952**	**60**

account for the strong interest these institutions show in fresks as a tool for exploring complex sustainability issues. This disciplinary disparity invites further investigation: to what extent is it shaped by the format and content of the fresks themselves, or by broader institutional and curricular dynamics?

In terms of study level, fresks are predominantly implemented at the Bachelor level, with 4,892 students (82% of all participants), compared to 720 at the Master level (12%) and 58 in university certificate programs (1%). Within the Bachelor group, 3,725 students participated during their first year (Bac 1), indicating a strong emphasis on early engagement in sustainability education (see Table 3). Group sizes vary considerably, ranging from small seminars of 10–20 students to large cohorts exceeding 100 students, with exceptional cases reaching up to 960 participants. Facilitation formats are adapted accordingly to accommodate this diversity.

Fresks are implemented in various pedagogical contexts, including compulsory courses, elective workshops, ad hoc events, and institutional sustainability campaigns. Course-based activities account for 3,808 students (64%), while transversal activities reach 2,144 students (36%), suggesting that while transversal fresks play a key role in raising general awareness, integration into formal curricula currently represents the dominant format in terms of student reach. A common approach is to introduce them as welcome activities at the beginning of the academic year or semester. For example, ICHEC organised a Planetary Boundaries Fresk for 960 first-year students, while ECAM ran a Climate Fresk

Table 2. Number of students involved per discipline (2024–2025).

Department/Discipline	Number of students involved	Percentage
Economics and Management Sciences	2860	48,1%
Engineering and Technology	1802	30,3%
Human Movement Sciences	450	7,6%
Not specified	310	5,2%
Political and Social Sciences	210	3,5%
Psychological and Educational Sciences	160	2,7%
Philosophy	48	0,8%
Medical Sciences	40	0,7%
Sciences	32	0,5%
Public Health Sciences	30	0,5%
Agricultural Sciences and Biological Engineering	10	0,2%
Total	**5952**	**100%**

Table 3. Number of students involved by study level and type of activity (2024–2025).

Study level	Transversal activity	Course	Total
Bachelor	1.922	2.970	4.892
Master	200	520	720
Not specified	22	260	282
University Certificate	—	58	58
Total	**2.144**	**3.808**	**5.952**

for 600 engineering students across different levels. Other institutions have used fresks to launch specific programs or options, such as EPHEC's Climate Fresk for 500 international business students and UCLouvain's Climate Fresk for 300 engineering students.

Several institutions reported a steady increase in fresk usage in recent years, often linked to broader sustainability strategies or the initiative of motivated faculty members. Among the 60 documented activities, 26 had already been organized in previous years, while 34 were first-time initiatives. When asked about future intentions, 41 organizers expressed plans to repeat or expand fresk activities, 6 indicated no intention to do so, 11 were undecided, and 2 did not answer. These findings suggest a clear positive trajectory, supported by the organization of new training sessions for educators and growing interest in fresks as pedagogical tools.

Nevertheless, several limitations must be considered when interpreting these figures. First, participation numbers are often approximate, based on estimates provided by institutional contacts rather than exact attendance records. Second, some groups are flagged as "Not specified" in terms of format (see Table 1), reflecting cases where students could choose among several sustainability-related workshops, potentially leading to overestimation. Third, because data collection relied primarily on sustainability units, underreporting is possible, especially in larger institutions where these units may not be aware of all ongoing initiatives. Taken together, these limitations suggest that the figures should be interpreted as indicative rather than exact: they may underestimate the number of distinct activities while overestimating total student participation.

In conclusion, fresks are predominantly reaching Bachelor-level students and are most commonly implemented in economics, management and engineering programs. They are used both within formal course structures and through transversal initiatives. These patterns underscore the growing presence of thematic fresks as innovative pedagogical tools for sustainability education in HEIs across the Wallonia-Brussels Federation (FWB).

Educators' motivations and challenges

The use of fresks varies significantly across these institutions, reflecting broader patterns observed in higher education. At ICHEC Brussels Management School, the initiative was driven by a top-down institutional decision to organize the Planetary Boundaries Fresk for all incoming students at the start of the academic year. To support this large-scale implementation, approximately forty educators were trained in facilitation, and three full days – comprising six half-day sessions – were dedicated to the activity. ICHEC also developed a customized version of the fresk, incorporating tailored solution-oriented action cards. This coordinated approach illustrates a top-down approach with strong institutional commitment to sustainability education.

At UCLouvain, fresks are typically integrated into courses at the initiative of individual educators. Facilitation is provided by teaching assistants or trained staff, and sessions are organized for both small and large student groups. The university supports these efforts through the creation of a facilitation "ecosystem" and collaboration with the "Maison du Développement Durable" (House of Sustainable Development), which coordinates workshops and training sessions for students, staff, and local residents. This model reflects a hybrid approach, combining bottom-up initiatives with top-down institutional support, and aligns with UCLouvain's broader Transition Plan.

EPHEC presents a more decentralized model, where fresks are organized both as welcome activities for specific programs and as components of regular coursework. Although the initiative is primarily bottom-up, it is supported by a team of educational advisors and committed faculty members trained in facilitation. These educators often rely on a network of volunteer facilitators from outside the academic sphere to ensure the feasibility of the workshops. This approach highlights the importance of individual commitment and external collaboration in sustaining fresk-based activities.

Across all three institutions, the organization of fresks requires substantial coordination and voluntary engagement from members of the teaching community.

Discussions with educators revealed a wide range of pedagogical motivations for using fresks. First, educators mobilize fresks to achieve cognitive and conceptual objectives: They use fresks to communicate scientific facts and climate mechanisms in a clear and accessible way. They also aim to promote systems thinking by helping students visualize interconnections and grasp the complexity of socio-environmental issues. A second category of motivations related to engagement and learning dynamics: Fresks are valued for their gamified and interactive format, which enhances student engagement and participation. Many educators see them as a way to diversify pedagogical approaches, introduce active learning, and break away from traditional lecture-based formats. Third, fresks are used for their relational and emotional dimensions: Several educators emphasized the role of fresks in fostering group cohesion and collective intelligence. The workshops create space for emotional expression – an aspect often absent from academic settings – and encourage open dialogue among students. This shift also redefines the educator's role from knowledge transmitter to facilitator of learning experiences. The fourth category of motivations for using fresks refers to curricular and institutional integration: Fresks are used to bridge disciplinary silos and support more integrated learning. They help connect course content to real-world socio-environmental challenges, raise awareness, and inspire action. In some cases, they are strategically embedded within formal curricula; in others, they are deployed transversally across programs or as part of extracurricular initiatives. These motivations shared by educators are mainly personal, although in some cases they are encouraged by the motivations of their institution.

However, several challenges were identified. Managing large groups with limited facilitation resources remains a significant constraint, as does the difficulty of recruiting and training qualified facilitators – often influencing the choice of fresk. Time constraints, particularly in short sessions, limit opportunities for emotional processing and meaningful debriefing. Educators also expressed uncertainty around how to address eco-anxiety and emotional discomfort, citing a lack of training and guidance. The heterogeneity of student backgrounds, prior knowledge, and socio-economic contexts requires tailored approaches, which can be difficult to implement. For example, discussions around voluntary simplicity may be inappropriate or alienating for students facing economic hardship, and some students may experience emotional shock when exposed to sustainability content for the first time, especially during welcome weeks. Additional concerns include the need to connect fresks with other course content and follow-up activities, the risk of repetition and student fatigue when fresks are used in multiple contexts, and criticism of the lack of political and structural dimensions in fresk content. While the scientific framing of the workshops is appreciated, the solutions phase is often perceived as overly political and highly dependent on the facilitator's approach. Some educators also questioned the appropriateness of gamification for addressing serious topics such as climate change.

Finally, educators expressed a strong demand for empirical research on the impacts of fresks. They called for studies that account for student diversity – including age, background, prior knowledge, and motivation – as well as contextual factors such as curricular integration and complementary pedagogical practices. There is a shared interest in understanding how students perceive fresks, what they retain, and what they learn. Desired outcomes include increased knowledge, systemic understanding, heightened awareness, and motivation to act. Educators also expressed a willingness to critically reflect on their own practices, identify best practices, and improve their use of fresks through peer exchange and collaborative learning.

Discussion

This study offers a multi-dimensional contribution to the literature on EfS in higher education. Empirically, it provides the first systematic mapping of thematic fresks across institutions in the Wallonia-Brussels Federation (FWB), Belgium. By documenting the type of fresks used, their disciplinary distribution, formats of implementation, and student reach, the study captures the contours of an emerging pedagogical phenomenon and highlights the institutional dynamics that shape its diffusion.

First, the study reveals a dynamic yet uneven landscape. Fresks are widely adopted across institutions, but their use is concentrated in specific disciplines – particularly economics, management and engineering. This disciplinary pattern reflects broader trends in EfS, where sustainability initiatives often emerge in fields perceived as central to socio-economic and technological transitions (Figueiró & Raufflet, 2015). However, this concentration may marginalize contributions from the social sciences, which are essential for addressing the historical, political, and ethical dimensions of climate and environmental issues. As a result, students may be exposed to technocratic or depoliticized framings of sustainability, limiting the development of critical and systemic thinking.

Second, implementation strategies vary significantly across institutions. Some fresks are embedded in formal curricula, others are deployed transversally or during welcome events. These different levels of implementation exemplify the various approaches to integrating sustainability in education (e.g., vertical and horizontal integration, Ceulemans & Prins, 2010). These differences also reflect the influence of institutional context, facilitator training, and external support. Our findings are consistent with the fact that EfS effectiveness seems less dependent on the format of the tool than on these structural and contextual factors (Świątkowski et al., 2024; Van De Wetering et al., 2022). However, such dynamics can also create path dependencies: once educators are trained in a specific fresk, they may be less inclined to explore alternative tools, potentially narrowing the pedagogical repertoire available for EfS.

Third, the predominance of the Climate Fresk raises questions about the mechanisms driving its adoption. Its accessibility and large pool of facilitators partly explain its success, but educators also cite its ability to convey scientific knowledge and foster systems thinking. Yet, as highlighted by De Bouver and Ruwet (2024) and Chalak and Delplancke (2024), the pedagogical depth of fresks is constrained by their standardized format and narrow disciplinary framing. Our findings echo these critiques: while educators appreciate the tool's visual and interactive qualities, they also report difficulties with its rigidity, limited political and structural analysis, and the emotional complexity it can provoke among students.

Qualitatively, the research sheds light on the motivations and practices of educators who integrate fresks into their teaching. Educators express a wide range of pedagogical motivations, including promoting engagement, interactivity, emotional expression, and collective reflection – objectives aligned with transformative learning theory (Mezirow, 2000; Sterling, 2011). However, the challenges they face – such as managing large groups, addressing eco-anxiety, and adapting content to heterogeneous student backgrounds – underscore the need for more context-sensitive and inclusive approaches. These findings resonate with critiques in the literature that call for moving beyond knowledge transmission toward holistic pedagogies that integrate emotional, ethical, and political dimensions (Ardoin et al., 2018; Sharma, 2025).

A central issue emerging from the study is the potential misalignment between educators' motivations, the design of fresks, and the sustainability competencies they aim to foster. In several cases, the choice to use fresks appears driven more by practical considerations – such as facilitator availability or institutional support – than by deliberate pedagogical strategy. Yet, the few studies, in other contexts and settings, that have examined the influence of educators' motivations on their target audiences suggest that such motivations play a significant role (Pratson et al., 2021; Stern & Powell, 2013). The absence of clearly defined competency frameworks and assessment tools further complicates efforts to evaluate learning outcomes and long-term impacts. Educators themselves express a strong demand for empirical research on the effects of fresks, particularly studies that account for learner diversity and contextual variables. This aligns with calls in the literature for more rigorous evaluation of EfS tools, which often rely on self-reported data and lack longitudinal follow-up (Stern et al., 2014).

Finally, the study highlights the fragility of fresk initiatives over time. While many institutions report growing interest and future intentions to continue using fresks, others treat them as one-off events, often concentrated at the beginning of the academic year. Factors such as voluntary participation, logistical constraints, and student absenteeism influence recurrence and integration. These findings point to the need for stronger pedagogical anchoring and institutional commitment to assess if fresks actually meet their objectives and ensure that they contribute meaningfully to sustainability education.

Taken together, these results contribute to a more grounded understanding of how fresks function in practice. They invite reflection on the pedagogical mechanisms activated by fresks and their alignment with sustainability competencies. They also contribute to ongoing debates about the role of gamification in EfS (Fernández Galeote et al., 2021), a categorization that remains contested. By documenting both the scope of fresk use and the lived experiences of educators, this study lays the groundwork for future research and pedagogical innovation.

Ultimately, this research highlights the role of universities and social sciences in sustainability education. It encourages critical consideration of the use of educational tools, thereby promoting inclusive, reflective, and transformative learning environments. Beyond academic, the findings may inform EfS strategies in other sectors, including NGOs, businesses, and public institutions, where fresks are increasingly used.

Limitations and future research directions

This study presents several limitations that must be acknowledged when interpreting its findings. First, the empirical investigation is geographically confined to the French-speaking community of Belgium, whereas thematic fresks originated and are most extensively used in France. The institutional frameworks of higher education differ between these two contexts, particularly in terms of governance, curricular autonomy, and sustainability strategies. While certain

patterns identified in this study – such as disciplinary concentration or pedagogical motivations – may be transferable to other settings, the generalizability of the results remains limited.

Second, the use of thematic fresks as tools for EfS is still largely concentrated in a few countries and remains relatively unknown in many parts of Europe and beyond. This uneven diffusion raises important questions about the cultural, institutional, and linguistic factors that shape the adoption of specific pedagogical tools. As highlighted in recent literature (Świątkowski et al., 2024; Van De Wetering et al., 2022), the effectiveness of EfS interventions is highly context-dependent, and the choice of tools may reflect broader educational cultures and policy environments.

Third, while the mapping provides a valuable overview of the scope and diversity of fresk usage in higher education, it is not without methodological limitations. Temporal bias is inherent in the approach, as it captures a snapshot rather than the evolution of practices. Participation bias may also affect the results, as a limited number of institutions did not respond to the survey, and educators who chose to participate may be more engaged or favorable toward fresks than the broader population.

Despite these limitations, the study offers a valuable case study of the growing trend toward "ready-to-use" tools in sustainability education. It provides empirical grounding for future comparative research on the use, adaptation, and impact of such tools across different national and institutional contexts. Further investigations could explore whether the selection of EfS tools is culturally influenced, how they are integrated into diverse curricular frameworks, and to what extent they contribute to the development of sustainability competencies in varied educational ecosystems.

In particular, longitudinal studies are needed to assess the long-term effects of fresk-based activities on student learning, engagement, and behavior. Comparative research could also examine the pedagogical framing of fresks in different disciplines and institutional settings, and how educators' motivations align – or misalign – with observed student outcomes. This perspective responds to two pressing demands in higher education: the need for pedagogical training that supports sustainability-oriented teaching, and the requirement to demonstrate measurable learning outcomes through concrete instructional designs and evaluation strategies.

Finally, future research could contribute to the professional development of educators by identifying effective facilitation practices, exploring the emotional and ethical dimensions of fresk-based learning, and developing competency-based assessment frameworks. In doing so, it would support the broader reflection on how to make sustainability education more impactful, inclusive, and transformative.

Ethics and consent

The research protocols were reviewed and approved by the Ethics Committee of the research institute LouRIM at UCLouvain, confirming their compliance with the ethical standards applicable within the Institute.

Informed consent was obtained from all participants. Rather than through a signed consent form, consent was indicated by participants' voluntary agreement to the email invitation after receiving clear information about the study and was sought again verbally at the beginning of each discussion. This was a low-risk study involving neither sensitive personal data nor vulnerable populations, but rather a survey of educational activities and discussions on pedagogical practices. All study procedures, including the informed consent process, were approved by the Ethics Committee.

Data and software availability

Underlying data

The data underlying this article are available in the Open Science Framework (OSF) at osf.io/fma3g (Dataset).

This project contains the following underlying data:

- Cartography dataset, anonymized by removal of all personal information.

- Informal discussions with educators: not publicly available due to ethical and confidentiality constraints.

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

Link to Dataset on OSF: https://doi.org/10.17605/OSF.IO/FMA3G [de Montpellier et al., 2026].

Extended data

The extended data associated with this article are available in the Open Science Framework (OSF) at osf.io/fma3g (Appendices).

This project contains the following extended files:

- Appendix 1: Illustration of a fresk activity in higher education
- Appendix 2: Questionnaire sent to HEIs in the FWB for the cartography of fresks
- Appendix 3: Information on the profiles of the 20 educators and their use of fresks
- Appendix 4: Summary table of the cartography of fresk use

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

Link to Appendices on OSF: https://doi.org/10.17605/OSF.IO/FMA3G [de Montpellier et al., 2026].

Acknowledgements

We thank the sustainable development coordinators from higher education institutions of the Wallonia-Brussels Federation of Belgium, as well as the members of the *Profs en Transition* network, for completing and disseminating our survey on the use of fresks for the cartography. We are also grateful to the 20 educators from UCLouvain, ICHEC, and EPHEC for the valuable discussions regarding their pedagogical practices related to fresks and ESD. Finally, we thank the reviewers and participants of *The Shift "Universities for Sustainability"* conference for their insightful comments, which helped improve the manuscript for publication.

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