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Article

System-level educational leadership as a resilience building mechanism: The case of Greece

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Abstract: This paper explores the resilience of education systems in the face of the challenges that have arisen in the wake of the Covid-19 pandemic and emphasizes the urgent need for educational institutions to prepare for uncertainties and unforeseen challenges. The paper highlights the shortcomings of education systems in ensuring educational equity for disadvantaged students during the pandemic, emphasizes the limitations of current research on the resilience of education systems, and argues for the need to consider the resilience of the education system alongside the resilience of students and teachers. Drawing on the insights of the organizational and social-ecological approaches to resilience, this paper argues that the resilience of schools ultimately depends on their ability to ensure organizational learning. This study examines the barriers to organizational learning (OL) in Greek secondary schools using quantitative data from teachers. The research findings reveal structural, systemic and cultural barriers that hinder the promotion of OL and thus the resilience of schools. Building on previous research on nested systems and system leadership, the paper argues that schools are at the forefront of promoting resilience in the education system. It emphasizes the need for system-level educational leadership (SLEL) as a mediating governance mechanism that promotes interaction between schools and the wider education system to ensure the establishment of a meta-capability of learning at all levels. This research contributes to the discourse on educational leadership by emphasizing the importance of schools as resilience pillars capable of strengthening resilience across the education system.

Keywords: education system’s resilience; organizational learning; social-ecological resilience; system leadership; meta-capability; systems thinking; feedback loops

1. Introduction

We live today in uncertain and fast-moving times [1] in which the future is beyond human prediction and control [2]. This heightened sense of uncertainty, unpredictability and rapid environmental and societal changes has highlighted the need for resilient educational systems that are able to accommodate uncertainty, adversity and reinvent themselves to protect the most vulnerable.

However, the health and subsequent health and learning crises of Covid-19 are a vivid example of the difficulties educational systems face in the resilience front. In fact, the pandemic has exposed the limits of education systems to protect the most vulnerable populations, highlighted inequalities between schools, families and students [3], and triggered an unprecedented global challenge to educational equity [4]. In the same vein, the OECD [5] emphasized that “the economic losses caused by learning losses due to the worldwide school closures in early 2020 will be more deeply felt by disadvantaged students”, and the UN [6] pointed out that the learning crisis ‘is exacerbating pre-existing educational inequalities by reducing the opportunities for many of the most vulnerable children and young people”. Additionally, UNESCO [7] emphasized that currently ‘education is failing millions of children, youth and adults, increasing their exposure to poverty, violence and exploitation”.

During this emergency, schools became fundamental organizational units in overcoming the learning and equity crisis both during and after the pandemic [8–10]. However, the difficulties encountered on the ground in uncovering the inequitable pressures on school leaders have highlighted two imperatives: The need for system-level leadership to support school leaders in addressing challenges beyond the capacity and control of individual schools and the need to build resilient education systems that are prepared and able to ensure equity and resilience at the societal level during crises or emergencies.

Indeed, coping with the pandemic at the individual school level has placed uneven pressure on school leaders, who experienced an abrupt shift in their roles due to the unprecedented uncertainty and concurrent health and learning crises [11–14]. In addition to the challenges mentioned above, school leaders faced pressures related to compliance and accountability, a lack of resources and capacity, and centralized educational management that limited their autonomy [15]. Furthermore, the above-mentioned pressures were compounded by the lack of crisis management training for school leaders, as they had never faced a crisis of this magnitude and duration before [16]. This situation led to personal costs for the school leaders that negatively impacted their well-being and mental health [17–19].

However, the pandemic has also highlighted gaps in research in the areas of education and societal resilience. In the field of education, the fact that the resilience of educational organizations and other parts of the education system is still under-researched should be mentioned [20]. Furthermore, the term “education system resilience” is not commonly used, and there is no consensus on its definition in international development, education literature, and education policy and planning [21]. Most importantly, the pandemic has shown that ‘coping’, ‘adapting’ and ‘recovering’ are well suited to building societal resilience when the problem is external to the systems and processes involved, but not when they are part of the problem [22].

This paper argues that the normalization of crises and emergencies in the glocalized context [15,21] requires education systems to develop their learning capacities as a proactive measure before a crisis or emergency occurs. To ensure that schools operate at their best capacity, resilience research in education needs to shift its current dominant focus on students and teachers also to the education system itself. In this context, organizational and social-ecological perspectives that focus on the learning loops of systems and organizations for building resilience can provide important insights. Based on the above positioning, this paper utilizes quantitative data from Greek secondary school teachers to examine the conditions present in Greek secondary schools that facilitate organizational learning (OL).

This article is organized as follows. In the Materials section, we present a synthesis of previous research on resilience and highlight the contributions that organizational and social-ecological perspectives can offer to the field of education. In the Methods section, we report on the results of the quantitative research conducted in Greece. The concluding section examines the significance and contribution of these findings for strengthening resilience in education and argues for system-level educational leadership (SLEL) as a mediating governance mechanism that promotes organizational learning across the education system. The study contributes to resilience research in education by emphasizing the role of individual schools as leaders in building resilience and promoting an understanding of resilience as an ongoing process of meta-capability development across the education system.

2. Materials and methods

This section begins with the latest resilience research in education, followed by earlier research on organizational and social-ecological resilience. Although the chronological order of resilience research is reversed, we have chosen this method to better support the substantive basis of our argument.

2.1. Resilience in education

Resilience in education is based on two main pillars: Educational resilience as student's academic resilience and students' resilience against educational disruptions.

2.1.1. Educational resilience as academic resilience

The term educational resilience was originally used to describe students' academic resilience, i.e., the increased likelihood of academic success despite contextual adversities such as poverty, health and other social conditions that can have a significant impact on students' educational outcomes and trajectories. In their review of research on educational resilience (1979–2003), Waxman et al. [23] highlighted four 'alterable factors' that may help in this direction: (a) Increased teacher support and high teacher expectations of students; (b) promotion of school resilience as a critical arena for the development of protective factors related to individual resilience; (c) professional development for teachers to help them understand their instructional strengths and weaknesses; and (d) instructional change. Moreover, the 2009–2016 longitudinal study by Sanders et al. [24] complemented Waxman's research by conceptualizing educational resilience as a mediator of risk for student academic achievement against contextual factors. The study by Sanders et al. [24] focused on high- and low-risk students and emphasized that a positive teacher-student relationship in at-risk youth can significantly enhance student resilience and lead to better educational outcomes.

2.1.2. Educational resilience as resilience to education disruptions

Over the last decade, there has been a growing body of literature that addresses the topic of resilience in education under the prism of disruptions in schooling due to unforeseen circumstances. Under this prism, educational resilience refers to schools and education systems' capacity to ensure the continuity of education during emergencies and crises caused by natural disasters, communicable diseases, political conflicts or a combination of the above. In this approach, resilience is defined as "the capacity of an education system to absorb, withstand and adapt to disturbances while ensuring the continuity of its vital actions" [25] and is considered interdependent with community or societal resilience [21,25–27].

Under this approach, the prevention and minimization of these disruptions is a high-priority issue, as discontinuities in education not only represent a significant violation of children’s right to education [25] but also have been found to have a significantly disparate impact on children who are particularly vulnerable to disasters (girls, children in low SES households, children with disabilities, refugees, asylum seekers, and internally displaced persons) as the consequences of these disruptions are not evenly distributed [28].

In this branch of research, we find undercurrents such as the Education in Emergencies (EiE) approach [21,28], the Disaster Risk Reduction (DRR) approach [21,25], and Climate-Resilient Education (CRE) [21], all of which show the increasing focus on the resilience of the education system to disruptions caused by emergencies and crises. This resilience approach emphasizes adaptive strategies that enable individuals to thrive in the midst of adversity and promotes a sense of agency and self-confidence in learners [29]. The goal is to cultivate a new, desirable subjectivity in young people that enables them to make positive adaptations to overcome adversity and bounce back from challenges, while also contributing to their communities in this regard [30].

Based on the premise that resilience in education is the product of “grit” [31], but also a product of design [32], for schools to fulfill a stabilizing function, conscious efforts are made to:

1) Ensure structural (school buildings and infrastructures, etc.), support system (psychological and mental health of teachers and students, etc.), and complex system resilience (critical infrastructures, political bodies, etc.) [25] to guarantee the continuity of educational provision despite emergencies and crises [26].
2) Develop students’ skills and competencies through appropriate learning activities that could promote the reshaping and reframing of identities and subjectivities to overcome uncertainty and crisis [27]; equip students with the necessary social-emotional and cognitive skills to withstand these events by adapting teachers’ curricula and pedagogical practices [26]; identify a desirable subjectivity in which individual students can make positive adjustments to overcome adversity and bounce back in the face of obstacles [30].
3) Equip teachers with the skills to promote resilience in students by updating teaching and learning pedagogies [26], implementing autonomy-supportive intervention programs [20], and developing teachers’ psychological resilience and well-being based on reflective engagement and reflective practices as a means of developing students’ psychological resilience and well-being [25,29]. The acquisition of strategies to teach emotional intelligence, coping mechanisms, and proactive responses to crises [30] as well as training in practical emergency response and familiarization with responses and common risks in the school setting [28] are also among the main tools proposed to promote teacher and student resilience.

Under this approach, if we leave the structural support factors aside, resilience is considered a learned capability that can be achieved through specialized training promoting ‘individual sustainability competences’ [33], with the aim for students to ‘learn to bounce back’, ‘learn resourcefulness’, and ‘learn from past disasters for better future protection” [34].

2.2. Organizational resilience

The reason we refer to organizational resilience is that schools have long been considered learning organizations [35–37]. Organizational resilience is defined as the ability of the entire organization to anticipate and effectively manage potential threats and adapt to changing conditions [38,39]. We can identify three main streams in organizational resilience research. The first stream examines organizational resilience as an outcome and focuses on the resources, strategies, and routines that influence an organization's effectiveness [40–42]. In this framework, the goal of resilience is the predetermined goal of homeostatic regulation through the externally supported empowerment and capacity building of the organization. The second stream examines organizational resilience as a process that emerges through the dynamic interaction of different stages, phases, and pathways of organizational response before, during, and after disruptions and is therefore temporally defined [39,43,44]. The second stream of resilience, in contrast to the first, which assumes a stable world, assumes that the world is more dynamic, sees resilience not only as the ability to regain stability but also as the ability to reduce exposure to risk, and combines preventive and reactive measures as part of the decision-making processes of organizations. As Duchek et al. [39] note, this temporal structuring of the resilience process follows similar approaches in the crisis management literature.

The third and most recent stream of organizational resilience adopts a holistic perspective that incorporates the two previous streams. Here, organizational resilience is conceptualized as a dynamic cycle based on the continuous improvement, adaptation, and implementation of an organization's capabilities [45], operationalized through the reconfiguration and optimization of organizational resources, the reconfiguration of organizational relationships, and finally the recovery and achievement of growth that counteracts the trend when a crisis occurs [46]. In this latest conceptualization, organizational resilience is seen as a meta-capability [39] based on a set of facilitators that occur at different times during a crisis and are categorized according to their content and temporal dimension [47]. Based on their content, Hollands et al. [47] identify three categories of facilitators: Assets and resourcefulness, dynamic competitiveness, and learning and culture.

Table 1 presents the resilience capabilities, type and categories identified under the third stream. What we observed is the facilitators related to learning and culture are mentioned directly or indirectly in all four typologies. They are explicitly mentioned in the typologies of Hollands et al. [47] and Chen et al. [46]; learning is directly mentioned in the typology of Duchek et al. [39], whereas culture is inferred through the whole spectrum of the anticipation, coping and adaptation capabilities. The same applies in the typology of Conz and Mangani [45], in which, although there is no direct reference to learning and culture, they are inferred through the subcomponents of proactive, absorptive and adaptive resilience.

Table 1. Holistic perspectives of resilience.

	Categories	Subcategories
DUCHEK ET AL. [39]	1. Anticipation capabilities	a) ability to observe internal and external developments, b) ability to identify critical elements and potential threats, as far as possible, to prepare for unexpected events.
	2. Coping capabilities	a) ability to accept a problem, b) ability to develop and implement solutions. These capabilities imply immediate or short-term action in response to unexpected events.
	3. Adaptation capabilities	a) reflection and learning, and b) organizational change capabilities.
CONZ & MAGNANI [45]	1. Proactive Resilience	a) Ability of alertness, readiness and preparedness through redundancy, resourcefulness, and collectiveness.
	2. Absorptive and adaptive Resilience	a) Ability to persist and withstand for the absorptive attribute. b) Ability to change, sustain, and adapt for the adaptive attribute.
	3. Reactive Resilience	a) Ability to respond, survive, return and bounce back.
CHEN ET AL. [46]	1. Capital resilience	a) Ability to operate normally and to recapitalize against risk in a crisis.
	2. Strategic resilience	a) Ability to identify and eliminate consistently factors of adversity.
	3. Relational resilience	a) Ability to build mutually beneficial relationships across the spectrum of stakeholders.
	4. Cultural resilience	a) Ability to shape organizational culture. b) Ability to foster employee commitment.
	5. Learning resilience	a) Ability to cope with stressful situations and disruptions. b) Ability to learn in response to crisis.
HOLLANDS ET AL. [47]	1. Facilitators in relation to their content	a) Assets and Resourcefulness b) Dynamic competitiveness c) Learning & Culture
	2. Facilitators in respect to their temporal properties	a) General Readiness Facilitators (t − 1) b) Robustness Facilitators (t) c) Reaction Facilitators (t + 1)

2.3. Social-ecological resilience

The reason we refer to the social-ecological approach of resilience [48] is that this approach was the first to shed light on the issues of uncertainty and risk due to anthropogenic and natural factors. The social-ecological approach is based on earlier ecological theories and emerged from the need to understand the dynamic interaction between human societies and ecological systems in the context of rapid change, increasing uncertainties, and challenges from ecological and anthropogenic factors. The social-ecological approach emphasizes the importance of flexibility, adaptability and the ability to change through learning within social-ecological systems in response to changing conditions and disturbances. Social-ecological resilience is defined as the capacity of a system to absorb disturbances while maintaining its basic function, structure, identity and feedback. It is based on three main premises: (a) The extent of disturbance a system can absorb while remaining within the same domain of attraction; (b) the extent to which a system is capable of self-organization as opposed to being organized by external factors; and (c) the extent to which a system can build and improve its capacity to learn and adapt [49,50]. In other words, social-ecological systems are integrated systems that include both ecological and social components and emphasize their interconnectedness and feedback loops. Social-ecological resilience is the ability of these systems to absorb disturbances and reorganize themselves while changing and maintaining the same function, structure, identity and feedbacks [50].

This notion of adaptability is a cornerstone for the development of social-ecological resilience, as traditional management focusing on stability, predictability and control was thought to create vulnerabilities and work against the development of system resilience. In fact, Holling [48,51] was the first to introduce the terms adaptive cycles, panarchy and adaptive management as central concepts in his framework. For Holling [51], the adaptive cycle describes the phases of ecosystem development using a four-phase model: Exploitation (growth), conservation (stability), release (decline) and reorganization (renewal). The interplay of these four phases creates a dynamic cycle in which the system can either return to a previous state or transition to a new, potentially more desirable configuration. The concept of the adaptive cycle can help us to understand how systems transition through different states. This cyclical nature of cycles illustrates that resilience is not only about maintaining stability but also about enabling transformation and adaptation in the face of change [52,53].

Drawing on the concept of the adaptive cycle, Holling [51] defined panarchy as a hierarchical structure of adaptive cycles that enables systems to renew themselves while being protected from disruptive change. In this sense, adaptive management is a systematic, integrative approach to the management of ecosystems and institutions that emphasizes the need for institutions to evolve to accommodate the dynamic and complex nature of ecosystems and advocates flexibility and learning from experience [51]. As Folke et al. [54] emphasized, adaptive management is a necessary strategy for effective governance in the face of uncertainty and the need for sustainable development. Conversely, systems and institutions are not adaptive because, due to their rigidity and lack of responsiveness, they do not consider the variability of the ecosystem and consequently do not meet the needs of the context [54]. The goal of adaptive management is to identify barriers and bridges in ecological and institutional renewal in order to increase fitness [55,56]. The concept of adaptability is also reflected in Holling's [51] distinction between engineering and ecological resilience. Engineering resilience (efficiency) focuses on stability near an equilibrium state and measures resistance to disturbances and the speed of return to equilibrium. Ecological resilience (persistence) emphasizes the ability of systems to absorb disturbances and maintain their structure. This distinction is crucial as it shifts the focus from a static view of stability to a more dynamic understanding of disturbances as opportunities for innovation and development across the system.

2.4. Resilience as learning meta-capability

What research on organizational resilience, and in particular the third stream of resilience, has to offer the education sector is the recognition of resilience as an organizational metacapability based on learning. Indeed, research on organizational resilience recognizes that the problems in achieving resilience depend not only on the scale and impact of the problem itself but also on the ability of the organization to put in place the mechanisms and strategies that would enable it to 'bounce back', which ultimately depends on the learning culture within the organization. In fact, the three streams of resilience follow and correspond to the three loops of organizational learning.

According to Argyris [57], learning takes place in a single loop when matches are created or when undesirable developments are corrected by changing actions. In contrast, second-loop learning describes "…those sorts of organizational inquiry that resolve incompatible organizational norms by setting new priorities and weightings of norms or by restructuring the norms themselves together with associated priorities and assumptions" [58]. Triple-loop learning, inspired by Argyris' single and double loops, goes even deeper, as it "opens up an examination of the underlying 'why's'" … that permits insight into the nature of the paradigm itself [59]. Triple-loop learning challenges the founding principles of the organization to develop new ones so that the organization can move to a subsequent phase [60], questions the mission of the organization to produce new structures and strategies for learning [61], and requires "continuous reflection on the learning process, the contexts in which learning takes place, and the assumptions and values that motivate learning and influence its outcomes" [62]. Triple-loop learning is about the development of a learning meta-capability at the organizational level.

On the other hand, what the social-ecological approach is offering to the educational resilience is the explicit reference to resilience loops and their direct association with hierarchical adaptive cycles of learning throughout nested sub-systems. The social-ecological approach emphasizes the systems approach in order to do justice to the non-linear dynamics, uncertainty and surprises of social and ecological problems, challenges the simplistic notion that every problem has a single cause or a direct solution, and emphasizes the need for adaptive management to achieve sustainability, where sustainability is defined as "the capacity to create, test, and maintain adaptive capability" throughout the system [51].

In sum, recognizing that the adaptive capacity of a system depends on its ability to learn [49,63–66] and that learning is a core element in building resilience [67–69], this paper argues that the resilience of the education system ultimately depends on its meta-capability to learn, reorganize, and transform itself at the micro, meso, and macro levels.

2.5. Quantitative research in Greek secondary education schools

To explore our working hypothesis and understand the building of resilience in education, we made the following three methodological choices. First, we have chosen Greece as a case study because the country has faced and is still facing the impact of overlapping and acute crises: An acute austerity crisis (from 2009), an unprecedented refugee crisis (2015), and the Covid-19 pandemic. In fact, Greece is one of the countries most economically affected by the pandemic [70] but has also suffered from the legacies of the previous economic [71,72] and refugee crises [73]. As all of these crises have had a significant impact on education, Greece is a suitable case study to investigate whether there are the conditions in Greek secondary education schools to ensure organizational learning.

Second, the sample consisted of 234 public secondary education teachers selected through stratified random sampling from three administrative areas in Greece. Of the respondents, 59.83% were women and 40.17% were men. A total of 58.5% had a bachelor's degree, 4.3% had a second bachelor's degree, 32.5% had a master's degree, and 4.7% had a PhD. **Table 2** shows that 56.5% of the teachers were more than 50 years old, and 45.6% had more than 20 years of service. In terms of school size, the sample was almost equally divided into schools with 100–250 students and schools with over 250 students. The data were anonymized to protect teachers' confidentiality.

Table 2. Demographics.

Teachers				**Schools**	
Age	**%**	**Years in service**	**%**	**No of Students**	**%**
< 34	3.4	< 4	8.6	< 50	2.6
35–39	8.6	5–9	6.5	50–100	9.0
40–44	14.7	10–14	20.7	100–250	42.7
45–49	16.8	15–19	18.5	> 250	45.7
50–54	22.0	20–24	11.6	**Total**	100
55–59	22.4	25–29	14.2		
> 60	12.1	> 30	19.8		
Total	100.0		100		

Third, the questionnaire we used consisted of 66 questions on a Likert scale designed to explore a) the extent to which Greek secondary schools function as learning organizations; b) the obstacles that hinder OL; and c) the perceived opportunities to overcome these obstacles. The reliability analysis revealed that the Cronbach's alpha for the questionnaire was 0.924. This study focused on analyzing the results of the fifteen questions on factors that hinder the creation of OL. The fifteen questions exploring barriers to OL were categorized into three main categories: (a) Structural barriers; (b) barriers due to a lack of systemic thinking; and (c) cultural barriers (attitudes, beliefs, and mindsets). This categorization was based on the typologies of barriers proposed by Seo [74], Zarei-Matin and Akhawan Alavi [75], and Williams et al. [76].

3. Results

This section presents the descriptive statistics as well as the correlations and factor analysis of our findings.

3.1. Descriptive statistics

Table 3 presents the teachers' responses to the structural barriers inhibiting OL, such as the centralized nature of the educational system (A1, A2, A3, and A4) and the lack of professional development programs (A5). The lack of professional development programs (A5) was considered the most important barrier in this category (mean: 3.93 and predominant mode: 5), with 36.1% of respondents fully agreeing with this statement. The second most important barrier is centralized decision-making. 36.7% of the teachers agreed and 38% strongly agreed that centralized decision-making without careful data analysis had a negative impact on OL (predominant mode: 4). The predominant mode was 4 for the other three questions in this category, with mean scores ranging from 3.44 to 3.65.

Table 3. Structural factors inhibiting school's transformation in LO.

Obstacles	Mean	Mode	SD
A1. Centralized decision making and school's lack of autonomy.	3.44	4	1.026
A2. Centralized formation of curriculum and tight timeframe for its implementation.	3.65	4	1.105
A3. Students' evaluation methods are decided centrally.	3.55	4	1.078
A4. Centralized decision making without careful analysis of data.	3.98	4	1.045
A5. Lack of professional development programs for teachers.	3.93	5	1.027

Table 4 shows the mean, predominant mode, and standard deviation for the second category, which explores the barriers to OL in the context of systemic thinking. The results are quite similar to the results on structural barriers. In fact, **Table 3** shows that mode 4 prevails for all four questions in this category, with mean scores ranging from 3.52 to 3.7 on a five-point Likert scale.

Table 4. Obstacles related to the absence of systemic thinking.

Obstacles related to the lack of systemic thinking	Mean	Mode	SD
B1. Lack of holistic view on the parameters affecting conditions of learning at school.	3.65	4	0.90
B2. Allocation of responsibility to external factors.	3.70	4	0.94
B3. Difficulty perceiving the self as part of the whole.	3.52	4	1.01
B4. Consideration of teachers' professional development as an individual and not collective endeavor.	3.66	4	0.94
B5. Focus is on the satisfaction of individual ambitions without caring for the whole.	3.67	4	1.03

Table 5. Obstacles related to attitudes, beliefs, and mentalities.

Obstacles	Mean	Mode	SD
C1. Teachers have difficulty acknowledging their weaknesses and seeking help from their peers	3.44	4	0.99
C2. Absence of open and honest dialogue in teachers' meetings	3.44	4	1.14
C3. Teachers' defensive thinking and fear toward change	3.63	4	0.98
C4. Distance between the applied teaching methods and students' potential and real needs	3.96	4	0.93
C5. Teachers' disappointment about the degradation of their role	4.09	5	0.94

Finally, **Table 5** presents the cultural barriers related to attitudes, beliefs, and behaviors. Results in this category indicated teachers' negative emotions and signs of fragmentation on their boards (C1, C2, C3, C4, and C5). Of the five questions in this category, questions C4 and C5 had the highest percentages of agreement among teachers. 35% of the respondents agreed, and 40.6% strongly agreed with Question C5, whereas 35% agreed and 32.2% strongly agreed with Question C4.

3.2. Correlation analysis

Table 6 presents the correlation analysis (Spearman's rho) for the 15 obstacles. If we focus on the correlations between the categories, three observations can be made: a) Structural barriers are weakly correlated with the barriers related to the other two categories of barriers (barriers of systemic thinking and cultural barriers); b) the vast majority of barriers related to systemic thinking are in most cases moderately correlated with the cultural barriers but only weakly correlated with the structural barriers to OL.

Table 6. Correlation analysis between obstacles (Spearman's rho).

	A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**C5**
A1	1														
A2	0.597	1													
A3	0.393	0.527	1												
A4	0.444	0.644	0.551	1											
A5	0.321	0.368	0.314	0.326	1										
B1	0.243	0.221	0.318	0.275	0.382	1									
B2	0.307	0.225	0.323	0.326	0.308	0.544	1								
B3	0.252	0.245	0.391	0.273	0.252	0.442	0.667	1							
B4	0.274	0.291	0.323	0.256	0.251	0.387	0.500	0.668	1						
B5	0.257	0.262	0.318	0.286	0.253	0.390	0.566	0.620	0.653	1					
C1	0.235	0.266	0.165	0.152	0.195	0.375	0.450	0.432	0.381	0.508	1				
C2	0.154	0.310	0.210	0.162	0.239	0.406	0.494	0.412	0.413	0.514	0.731	1			
C3	0.275	0.197	0.223	0.178	0.286	0.375	0.482	0.412	0.358	0.426	0.580	0.667	1		
C4	0.150	0.266	0.271	0.317	0.232	0.352	0.346	0.265	0.330	0.350	0.407	0.462	0.411	1	
C5	0.238	0.310	0.208	322	285	0.307	0.279	0.236	0.240	0.309	0.328	0.332	0.403	0.517	1

If we focus on the correlations within the categories/intra-category correlations, we find that the correlations are moderate or strong in most cases. In particular, we find that the highest correlations within categories (0.731) are a) between C1 and C2 (0.731); b) between B3 and B4 (0.668); c) between B3 and B5 (0.620); d) between B2 and B3 (0.667); e) between B4 and B5 (0.653); and f) between A2 and A4 (0.644). Thus, while most of the barriers related to systemic thinking are strongly correlated, the category of structural barriers shows a strong correlation only between the questions related to the centralized nature of the education system (A2 and A4). The same applies to the category of cultural barriers, where the only strong correlation (C1 and C2) concerns the relationships between teachers.

Finally, if we focus on the cross-category correlations between specific questions, we find that: a) Although question A5 ("lack of professional development programs for teachers") correlates only weakly with the barriers in all categories, its highest correlation (0.382) is with B1 ("lack of holistic view of parameters affecting learning conditions in schools"); b) questions C4 (distance between teaching methods and students' needs) and C5 (teachers' disappointment) correlate (moderately or weakly) only with the barriers in the same category.

3.3. Factor analysis

The factor analysis confirmed our initial categorization of barriers: a) Structural barriers; b) barriers due to a lack of systemic thinking; and c) cultural barriers. In fact, the factor analysis showed that the three main factors cumulatively explained 63.082% of the variation in the 15 questions (**Table 7**).

Table 7. Factor analysis.

Total Variance Explained							
Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loading**
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**
1	6.118	40.785	40.785	6.118	40.785	40.785	4.788
2	2.004	13.362	54.147	2.004	13.362	54.147	3.898
3	1.340	8.934	63.082	1.340	8.934	63.082	4.440
4	0.852	5.682	68.763				
5	0.769	5.129	73.892				
6	0.660	4.400	78.293				
7	0.560	3.736	82.029				
8	0.547	3.648	85.677				
9	0.421	2.803	88.480				
10	0.378	2.522	91.002				
11	0.341	2.275	93.277				
12	0.295	1.964	95.241				
13	0.283	1.885	97.126				
14	0.232	1.547	98.673				
15	0.199	1.327	100.000				

Extraction method: Principal component analysis. a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

The factor analysis has shown that the most significant factor explaining 40.785% of the variation in the teachers' responses was the category of barriers related to the lack of systemic thinking (B1, B2, B3 and B4). The second most important factor, explaining 13.362% of the variation in teachers' responses, consists of three structural barriers (A1, A2, A5), all related to the centralized nature of the education system and the lack of centralized provision for teachers' professional development. The third most important factor, which explains 8.934% of the variation in teachers' responses, consists of three barriers (C1, C2 and C4), and it is related to relationships between teachers on the one hand and the distance between students' needs and teaching methods on the other. Therefore, although the categories of barriers remained the same, questions A3, A4, B5, C3, and C5 were omitted as they had a loading < 0.4 (**Table 8**). The five questions that had a loading < 0.40 are those questions that investigate unilateral factors related either to the centralized nature of the Greek education system (A3, A4) or to teachers' individual attitudes (B5, C3, C5) and which are not interacting in their formulation with other systemic actors. **Table 8** shows the loadings of the individual questions with the factor to which they belong (Pattern matrix with values above 0.40).

Table 8. Questions and loadings per component.

Pattern Matrix[a]			
	Component		
	1	**2**	**3**
B3	0.749		
B4	0.850		
B2	0.708		
B1	0.444		
A2		0.638	
A1		0.744	
A5		0.531	
C2			0.672
C4			0.759
C1			0.742

Extraction method: Principal component analysis. Rotation method: Promax with Kaiser normalization.
[a]. Rotation converged in 6 iterations.

The component correlation matrix (**Table 9**) also confirmed the correlation analysis, showing a correlation between obstacles related to the absence of systemic thinking and those related to values, beliefs, and mentalities (0.515). Finally, a value of 0.876 in the Kaiser-Meyer-Olkin (KMO) test (**Table 10**) confirmed the validity of the factor analysis.

Table 9. Component correlation matrix.

Component Correlation Matrix			
Component	**1**	**2**	**3**
1	1.000	0.364	0.515
2	0.364	1.000	0.325
3	0.515	0.325	1.000

Extraction method: Principal component analysis. Rotation method: Promax with Kaiser normalization.

Table 10. KMO and bartlett's test.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.876
Bartlett's Test of Sphericity	Approx. Chi-Square	1,586,283
	Df	105
	Sig.	0.000

4. Discussion

Findings indicate barriers hindering the emergence of organizational learning in Greek secondary schools and point to the need for system-level leadership to act as a resilience tool.

4.1. Barriers to OL in Greek secondary education schools

Research findings have shown that the conditions that would enable OL at the micro level of schools are not met. First, descriptive statistics showed that most teachers agree and strongly agree with the existence of barriers to OL in all three categories. Second, the factor analysis confirmed previous typologies of obstacles in structural, systemic, and cultural barriers. Indeed, the factor analysis revealed that barriers related to the lack of systems thinking were the most significant factor in teachers' responses. This finding is important if we consider that systemic thinking is a key requirement for OL [37]. Moreover, the factor analysis showed that structural barriers are the second most significant factor to OL. This finding indicates an important barrier to OL, as the centralized nature of education is at odds with the call for democratic governance across the whole school system [36]. This centralized decision-making also points to the absence of the structural conditions that could enable individual, group, and collective learning [37]. It is also important to note that question A5, which had the third highest mean score among the 15 barriers mentioned in the questionnaire, represents an important structural barrier, considering that facilitation and prioritization of learning for all members" [36] and 'the creation and support of continuous learning opportunities for all staff' [37] are core values in OL. The lack of professional development programs for teachers (A5) is crucial when considering the importance of external support for achieving OL. External support can act as a protective factor by mitigating the negative effects of stress on teachers and increasing internal motivation. This support is especially important for novice teachers who may feel overwhelmed by their new tasks or experience various forms of maladaptation in the early stages of their careers [77].

In addition, the factor analysis confirmed that the third category of barriers is related to attitudes, beliefs, and mindsets that are counterproductive for OL. Indeed, the research findings have revealed a culture of fragmentation and mistrust among teachers as well as a mismatch between students' needs and teachers' teaching methods. These findings suggest that the conditions for a culture of inquiry, innovation, and exploration [37] and for teacher self-realization [36] are not present in schools. Furthermore, this finding is of paramount importance, especially for novice teachers, as peer support and a sense of belonging are important mediating factors for improving teachers' reflective practice and professional development [77].

Furthermore, the correlation analysis results, which indicated a moderate link between barriers related to systems thinking and cultural barriers, while exhibiting only a weak correlation with structural barriers to organizational learning, remind us of the combination of culture and learning as facilitators in Holland' et al.'s [47] holistic approach to resilience. In sum, the above findings, examined both concurrently and separately, show the lack of a learning culture that would promote the development of resilience at the micro-level of individual schools.

4.2. System-level educational leadership: A meta-capability for resilience building

Two observations can be derived from the above findings. These findings indicate that there are obstacles that hinder organizational learning in Greek secondary education. These obstacles stem from a lack of systemic thinking, the centralized structure of the Greek education system and the prevailing attitudes, beliefs and mindsets characterized by fragmentation and mistrust. Second, these findings are consistent with the limitations of the Greek education system identified in previous OECD reports. Indeed, the OECD [78] report emphasized a) the need for constructive accountability and improvement-oriented feedback in the system; b) the centralized nature of the education system, which limits the ability of schools to respond to the needs of students and the community; and c) the important role that education leaders must play in transforming schools into learning organizations. Previous reports also indicate that Greek governments face challenges in implementing reforms and modernizing systems, primarily due to a lack of trust between different stakeholders [79]. In addition, both teacher morale and trust in the education system are reported to be low [79], while citizen satisfaction with education and schools in Greece is among the lowest [80]. The aforementioned second observation by emphasizing Chandler's [22] contention that building resilience is only possible if the relevant systems and processes are not implicated in the problem, we argue for a system-level educational leadership (SLEL) that could serve as a valuable governance tool to mitigate these challenges.

The notion of system-level leadership in education is not new and points to two main focal points in the relevant literature. The first focal point sheds light more on the horizontal interactions among clusters of schools, and system leadership is described as inter-school collaboration that improves the quality of individual schools and benefits the educational system as a whole [81–83]. In the second category, we find research that focuses on and describes in more detail the vertical interaction between the micro, meso and macro levels of the education system. Hopkins [84,85] recognizes three levels of system leadership that are required and must work together: (a) School-level system leadership, which requires school leaders to care about the success of their own and other schools; (b) local/regional-level system leadership, in which practicing school leaders participate in local/regional programs to ensure local alignment and implementation; and (c) national/state-level system leadership, in which social justice, moral purpose, and commitment to every learner are key areas for transformation and collaboration across the system [85]. Similar to Hopkins [84,85], Boylan [86] also considered system leadership as leadership that goes beyond a single school or organization and extends to three different levels: (a) School-wide leadership through collaborations and partnerships with other schools; (b) systemic leadership orientation that emphasizes the interconnectedness of different educational entities and the importance of moral purpose in leadership action; and (c) leadership of the school system as a whole. In the same vein, Gurr and Drysdale [87] place system leadership in the context of educational administration, focusing on the regional level of schools and emphasizing that system and school leadership must work in a synergistic relationship to achieve the greatest impact. More recently, Mowat [88] has emphasized the importance of system leadership as collaboration between different levels of the education system with the moral goal of achieving equity and promoting social justice within the educational framework.

What the above conceptualizations of system leadership have in common is that they all agree that system leadership is underpinned by the moral goal of ensuring equity and social justice for the most vulnerable students. This is enabled through localized change that promotes system-wide improvement [83,86–88]. What they also have in common is the lack of focus on the resilience of the education system. In fact, the concept of resilience is only mentioned by Dimmock [82] as one of the personal qualities that effective leaders need to overcome challenges and bounce back from difficulties, and not under the system's perspective.

Our concept of system leadership emphasizes the resilience of the educational system and prioritizes the analysis of how learning and resilience loops are created throughout the education system, starting from the micro-level of individual schools. This theorization posits that successful school and system transformation requires building and sustaining leadership for change at all levels of the system [84,85,89] and asserts that sustainable gains can only be achieved through a comprehensive focus on whole-system improvement [90]. This conceptualization of system leadership by drawing on the model of ecological resilience [51] and panarchy theory [56,65] aligns with Butler's [91] definition of system leadership as "the ability to generate change across a system or a nested system when this involves creating, utilizing, or exploiting connections within the system" (p. 96).

What Butler's definition of resilience brings into focus and is a cornerstone for our argument is the concept of nestedness. Nestedness is fundamental if we assume that schools are complex adaptive systems populated by different rule-based agents living in multi-level and interconnected systems in the form of a network [92]. Schools are therefore nested systems, nodes in higher-level education systems that have a degree of autonomy, albeit within the constraints imposed by the education system(s) enclosing them [93]. This nested structure of schools is of particular importance when we consider the relationship of enclosing and enclosed systems to adaptation and change. Indeed, if we consider that enclosing systems change more slowly and less frequently, whereas nested systems change more quickly and more frequently [94], then we recognize that if schools were resilient as nested structures, this would indirectly benefit the resilience of the education system. Our argument for the necessity of SLEL as a mediating governance tool also relies on Morin's [95] argument that relations between whole parts must necessarily be mediated by the middle term of interactions. This mediation is necessary because it redresses the currently identified focus of educational resilience towards individual actors and is consistent with organizational and social-ecological approaches to resilience that view resilience as an emergent collective capacity for a complex system.

From this perspective, the aim of SLEL would be to act as a governance mechanism that facilitates the interaction between the micro-level of schools and the macro-level of the education system by making visible the learning and resilience loops that take place at both the school and education system levels. The aim of SLEL would be to analyze the behavior of individual schools in order to identify patterns and challenges and improve schools' understanding of their working practices, coping strategies, response patterns, and cognitive frameworks. SLEL would act as a macro-observer to uncover the underlying patterns behind the events and details to identify the factors associated with each school's behavior, resources, and capabilities [39,96]. This mediation between the micro-level of schools and the macro-level of the education system is crucial, as the ability to withstand shocks is influenced by feedback loops between local and global components of the system. To summarize, the aim of SLEL would be to explore the modus operandi and feedback loops at both the school and education system levels [65,97] in order to improve the system's self-awareness of its cognition, competencies, and learning processes. This meta-capability would enable improved adaptability, strategic thinking, and resource management across the system.

5. Conclusion

This paper considers resilience in education as a meta-capability that depends primarily on the school's ability to achieve OL. Our findings emphasize that in an environment characterized by uncertainty and the unexpected, the challenge of educational resilience cannot be the sole responsibility of individual schools but is a collective endeavor that must be ensured at the level of the education system. The difficulties of Greek secondary schools in ensuring the above-mentioned capabilities point to the need for system-level educational leadership that acts as a macro-observer of individual schools and ensures that learning and resilience loops are in place that can ensure the adaptability of the system.

The present study has its limitations. First, we conducted a quantitative study, which limits the scope of our findings and discussion. Further studies could conduct qualitative research to gain further insight into how school and district leaders perceive barriers to OL and educational resilience. Second, further research could investigate whether there are underlying feedback loops in education policy documents and whether there are affinities with empirical data. Third, our study focused only on Greece. Further studies could focus on other EU and non-EU countries to provide a comparative perspective on building educational resilience in challenged and less challenged national contexts.

SLEL contributes to the practice and policy of educational leadership in three ways. First, SLEL recognizes the needs and limitations of the micro level of school leadership in ensuring organizational resilience and creates a mediating management level for building resilience in education. Second, SLEL's greatest contribution is that it emphasizes the role of individual schools as complex adaptive systems with nested properties, thereby highlighting the importance of schools in transforming the education system. Finally, this research and SLEL's contribution are timely, as there is a lack of research documenting the feedback loops in individual schools and how they affect the resilience of the education system. This represents a significant gap in literature. We need more research to understand the feedback loops at multiple, interconnected levels to understand the resilience of the education system as a learning meta-capability.

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