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Mapping innovation in educational contexts: drivers and barriers

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Abstract: The present demand for school transformation considers innovation a tool that operates in a triangle of strengths: leadership, school cultures, and school accountability. Considering the growth and diversification of literature on this subject, we propose discussing the factors influencing innovation. This article exposes a literature review focused on the systematisation of factors that foster or inhibit innovation, presenting a qualitative classification sustained on two main criteria: organisational capital and professional capital. The built typology harmonises criteria concerning innovation's functional, strategic, relational, behavioural, and environmental aspects. Additionally, it aims to fulfil an epistemic, phenomenological, and propositional purpose. The typology congregates a scheme of constructs that integratively systematise and organise 118 factors described in the literature that influence the school's organisation.

Keywords: innovation; typology; transformational capital; organisational capital; professional capital.

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1 Introduction

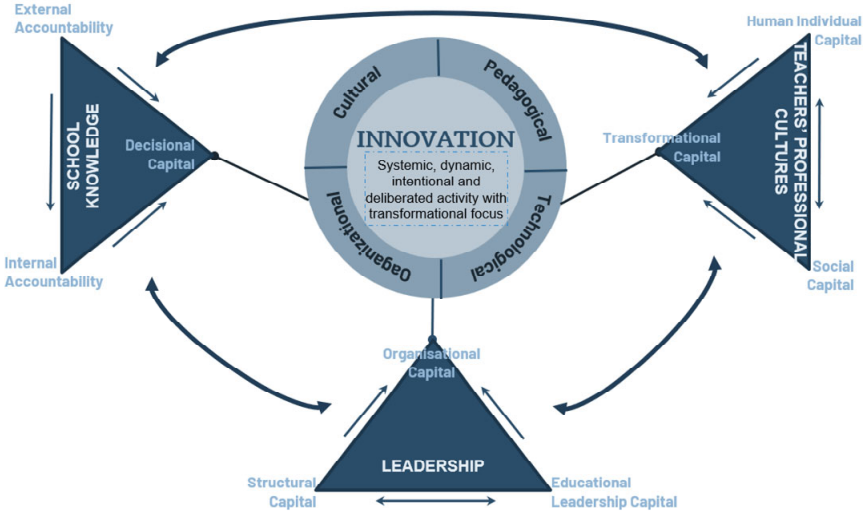
In half a century of studying innovation as an educational phenomenon, significant knowledge was generated that allowed it to be understood as multidimensional and polysemic (Lambriex-Schmitz et al., 2020; Stefenberga and Sloka, 2020). The literature on educational innovation enables us to understand it as a cultural, economic, political, and socially determined process (Arar et al., 2019) as well as a tool for school transformation, translated into improving the quality of learning and teaching processes (Cuenca et al., 2006; Serdyukov, 2017).

In the educational field, innovation can involve changes at various levels, including the organisational, cultural, digital, curricular, and pedagogical (Sotiriou et al., 2016; Woolner et al., 2018; Alves and Cabral, 2019; Pathak and Mishra, 2019; Wisetsat and Nuangchalerm, 2019; Figueiredo, 2020; Blömeke et al., 2021). The change lies in the educational institutions being an interdependence of the school cultures and of the innovative processes that are generated and spread (Hall and Rowland, 2016; Navarro-Corona, 2016; Song and Choi, 2017; Amorim et al., 2019; Mogren et al., 2019; Alves, 2021; Córdoba-Pachón et al., 2021). In biological systems, evolutionary changes are driven by genetic variations that are generated by mutations and the forces of natural selection indexed to the environment. Similarly, at schools, innovation corresponds to a mutational force that wants to change the DNA of the school itself. In education, natural selection corresponds to internal and external forces, the cultures established in schools and the societal forces of change. In nature, most mutations are deleterious and end up being eliminated, others are silent, producing no effects, and only an insignificant percentage are successful. This is mirrored in schools where most changes have also been nothing more than attempts. Therefore, the extreme resilience of natural systems has parallelism in schools. Resilience in educational systems is widely documented (Bocconi et al., 2013; Cuenca et al., 2006; Fullan, 2007; Hargreaves, 2012; Nóvoa, 2019). Eyal (2009) defines resilience as the "conservation of opportunities for renewal of the system", and in the face of "degeneracy, it loads the system with extreme resilience, enabling it to resist systemic changes" (p.488). Educational resistance is decoded into a lack of sustainability of change (Arar et al., 2019; Córdoba-Pachón et al., 2021; Fullan, 2007; Hargreaves and Shirley, 2009; Lambriex-Schmitz et al., 2020). To Smith (2018), the "acceptance of innovation comes from the kind of stability that gives a society resilience in the face of change" and "can be embraced as a force that will benefit society as a whole." Similarly, in education, innovation may act as a force that may impact schools, making them more responsive to societal demands. Hence, it is crucial not only to understand the transformational qualities of schools but also to identify factors that promote innovation and those that hinder innovation to better support change-oriented organisations. This article discusses a taxonomy for defining factors influencing innovation in the educational field. Considering that principles that underlie classification schemes improve the potential to leverage from prior research (Lambert, 2015), we propose a classification system that provides a further understanding of the innovative phenomena. We intend to systematise and synthesise the forces that prefigure promoters in the innovative process and the ones assumed as opposing forces to school transformation.

2 Materials and methods

"Classification is a necessary step for understanding a research area" [Lambert, (2015), p.50] to classify complex objects into a smaller number of categories using taxonomies, categorisation schemes, or typologies (Ahlquist and Breunig, 2012). "A typology is a hierarchical system of categories used to organize objects according to their similarities and dissimilarities" [Fonseca, (2013), p.2]. Therefore, we propose a taxonomy for systematising and synthesising factors that influence innovation in educational systems according to literature, including empirical studies. In this study, we follow a six-step methodology design proposed by Lambert (2015). The first step states the objective of classification: to systematise factors promoting and factors holding back innovation in complex institutions, namely, schools. The second step consists of defining the function and characteristics of the classification, assuming the feature of a typology. In the third step, considering the classification philosophy, we follow mainly an essentialism viewpoint to define the criteria to form categories, which are conceptually derived, and to identify objects that fit the categories. The fourth step consists in identifying the classification principles that flow from a theoretical model conceived for studying innovation in educational systems. This model highlights the main criteria for clustering (Figure 1): leadership capital interrelated with structural capital and incorporated into a broader construct, which is organisational capital; school knowledge related to school evaluation, which leads to the school's decisional capital; and teachers' professional cultures, arise from social capital and individual human capital. Cluster membership is only meaningful as an explanatory construct when we have pre-existing empirical evidence of clustering the relevant variables (Ahlquist and Breunig, 2012). Hence, this classification has an additional purpose: to identify variables (factors) that may be allocated to each field of the theoretical model for studying innovation in schools.

Figure 1 Model for studying innovation (see online version for colours)



The fifth and sixth steps consist, respectively, in choosing a procedure to establish categories through observation (a process to discover variables) and deciding the rules to

operationalise the procedure. To accomplish that, we followed the method adopted by Tyunnikov (2017), which consists in:

- Identifying and ontologisation of the rationale for classification sustained in literature. Hence, employing databases SCOPUS and WOS, it was identified and selected relevant literature using the combination of terms: [innovation, school change], [innovation, leadership], [innovative behaviour, school cultures], and [teacher's innovative behaviour; leadership]. The documents gathered also included seminal authors and secondary bibliographic resources from the revised articles. Of 138 documents considered due to the relevance of the title, keywords, and abstracts, 77 were selected after integral text reading. Therefore, the analysis included 33 articles exposing empirical studies, three literature reviews, and 37 texts, including books, articles on theoretical essays, and reports.
- Defining selection criteria and establishing a framework for classification criteria (Table 1).
- Clustering factors that promote or hinder innovation in schools.

Table 1 Domains and dimensions defined for building the classification

Structural domains			*Dimensions*	
Transformational capital A systemic, sustainable, and driven-mission process that happens in schools, leading to its transformation. It is how professional capital and organisational capital is used to transform teaching and learning.	1	*Organisational capital* The purview of leadership for devising new forms of organisational capital to produce high-leverage teaching and learning strategies, enabling its transformation. It is considered leadership for capacity building for transformation.[1]	1.1	*Educational leadership capital* Social and symbolic capital for educational leadership used to articulate a clear mission or vision for the school.[2]
			1.2	*Structural capital* Internal processes and information that belongs to the organisation.[3]
	2	*Professional capital* It is a function of an interactive and multiplicative combination of three kinds of capital: decisional, social, and individual.[4]	2.1	*Decisional capital* The wisdom and expertise to make sound judgments about learners cultivated over many years.[4]
			2.2	*Social capital* Teachers and other school professionals work together in a collaborative culture that allows them to learn from each other.[4]
			2.3	*Individual human capital* Personal attributes – knowledge, experience, and skills – of teachers that can improve the teaching-learning process.[4]

Source: [1]Dimmock (2011) and Yakavets et al. (2017), [2]Bartee (2007), [3]Sujudi et al. (2020) and [4]Hargreaves and Fullan (2012)

3 Critical analysis of literature and synthesis

3.1 Innovation for school transformation

Education is in a transitional stage, in the process of reconstruction and reset of its identity as a response to challenges imposed by globalisation. In this context, innovation emerges as a key element for school transformation, given that it is recognised that in school cultures of non-innovation, professional isolation prevails, and innovations have been assuming an episodic and fleeting character, receiving little support from leaders and colleagues (Hargreaves and Shirley, 2009). Alves and Cabral (2019) mention that discontinuity, individualism, and voluntarism shape the logic of educational actions in schools, which are mega-bureaucratic systems. Therefore, the educational change translated as the ability to spread pedagogical and educational advances (Fullan, 2007) is related to innovation, a necessary and positive instrument of change (Serdyukov, 2017).

Considering that school systems are refractors of the global forces of change, the main work is to understand the process of social refraction (Goodson, 2014) and to find a balance between internal issues, external relations, and individual determinants of change (Goodson, 2001). Because innovations adopted have been superficial and have had almost no impact on teaching practices (Pacheco, 2019), the transformation of schools will have to consist:

- in changing the school cultures instead of top-bottom policies (Fullan, 2007)
- in transforming school grammar (Cabral and Alves, 2016; Machado, 2018; Alves and Cabral, 2019, 2021; Fullan, 2020a)
- in taking into consideration and transforming the personal beliefs and missions of teachers (Goodson, 2014), using the professional capital of schools under the concept "use the group to change the group" [Fullan et al., (2015), p.6]
- in transforming leaderships considering their influence on the school's organisational climate, teachers learning and in empowering innovative behaviour (Sattayaraksa and Boon-Itt, 2012; Shirley et al., 2020; Tayag and Ayuyao, 2020; Vermeulen et al., 2020; Pan and Chen, 2021).

The resignification of the role of teachers and other educational actors is necessary (Goodson, 2014) because at the heart of school transformation settles personal and professional involvement as well as cultural, organisational, and pedagogical features of schools.

3.2 Promoters and hindrance factors in educational innovation

The school transformation is ecological, which means that innovation in the classroom is supported by systemic changes and becomes imperative in a future-oriented education (Straub and Vilsmaier, 2020). At the organisational level, innovations are an interdependence between leaders, self-knowledge generated in school, and school cultures. So, it is essential to identify the school's extrinsic factors that can promote or hinder innovation and the intrinsic factors of educational institutions, plus the individual factors allocated to each element of the educational community that influences it. This analysis logic stems from internal and external issues and personal perspectives indexed

to the agents of change that need to be addressed so that the problem of sustainability and generalisation is attempted.

3.2.1 Teachers and professional cultures

Teachers are key elements to change and scaffold students to meet educational goals and are also requirements for preparing 21st-century citizens (Wisetsat and Nuangchalerm, 2019). Considering the importance that the transformation of school has been assuming, boosting innovation and creativity in education requires the existence of a supportive environment that profiles organisational change, fosters responsibility, and impulses teachers to work collaboratively and autonomously towards organisational success (Pathak and Mishra, 2019). An environment of trust and teachers' identification with the school mission strengthens teachers' sense of belonging and innovative behaviour. Cultures of trust or active trust promote our highest collective values (Hargreaves and Shirley, 2009), and trust is a dimension of the school climate that empowers innovative behaviour (Pathak and Mishra, 2019; Tian and Zhang, 2020). On the other hand, teachers who work in closed environments feel restrictions and demotivation, which produce an inability to lead to organisational improvements (Pathak and Mishra, 2019). Hargreaves (2010) points out that teachers focus on the daily challenges and immediate and concrete rewards of their work, exhibiting a professional attitude marked by 'presentism' (focused on the short-term), 'conservatism' (concentrate on small-scale changes rather than global school changes), and 'individualism'. The prevailing professional culture drifts between isolation and superficial collaboration and between balkanisation and forced collegiality (Messina, 2001; Fullan, 2007; Alves and Cabral, 2019). In response to this modus operandi that marks the profession, transformational grammar is required to alter the organisational structures and scaffold agency in teachers (Alves and Cabral, 2021). The emergence of this new school grammar is indexed to innovation dependent on moderating forces that include professional autonomy and enhances a more autonomous, collaborative, interactive, deliberative, committed, and responsible professional teaching practice (Alves and Cabral, 2021).

3.2.2 Teachers' individual and professional factors

Teachers' professional behaviour is marked by individual features and professional structural factors that determine engagement with the school, involvement with the teaching process and commitment to their continuous development. Empirical studies have identified statistically significant effects between innovation, professional self-efficacy perception, and teaching motivation (Serdyukov, 2017; Cao et al., 2020). According to Roness (2011), motivation has an intrinsic dimension, reporting satisfaction with teaching experiences, and an extrinsic dimension due to wage benefits and other rewards. The same author appends an altruistic dimension that stems from the teacher's perception of teaching as a social good and his hope to play a role in the development of students.

Perception of self-efficacy represents an important factor that contributes to innovative behaviour, being even a measure of potential to express innovative behaviour and associated with other factors that enforce it, like positive self-assessment, favourable self-concept, flexibility, and sharing skills (Cerna, 2014; Wisetsat and Nuangchalerm, 2019; Blömeke et al., 2021; Gao et al., 2021). For Nemeržitski et al. (2013), greater

involvement and participation of teachers in professional development and decision-making generates more favourable and supportive environments for creativity and innovative behaviour. Systemic visions of creativity result from understanding it not as individual property but as something that gradually emerges from the connections and interactions between creators and other elements of the community, involving ideas, thoughts, and experiences (Cuenca et al., 2006; Tyunnikov, 2017; Córdoba-Pachón et al., 2021). Shortage of time, task overload, lack of autonomy, lack of opportunities for reflection, non-believing and lack of hope, scarce communication systems for supporting teachers' work, and lack of opportunities for face-to-face interactions impede innovation in schools (Messina, 2001; Fullan, 2007; Hargreaves and Shirley, 2009; Song and Choi, 2017; Lee et al., 2020).

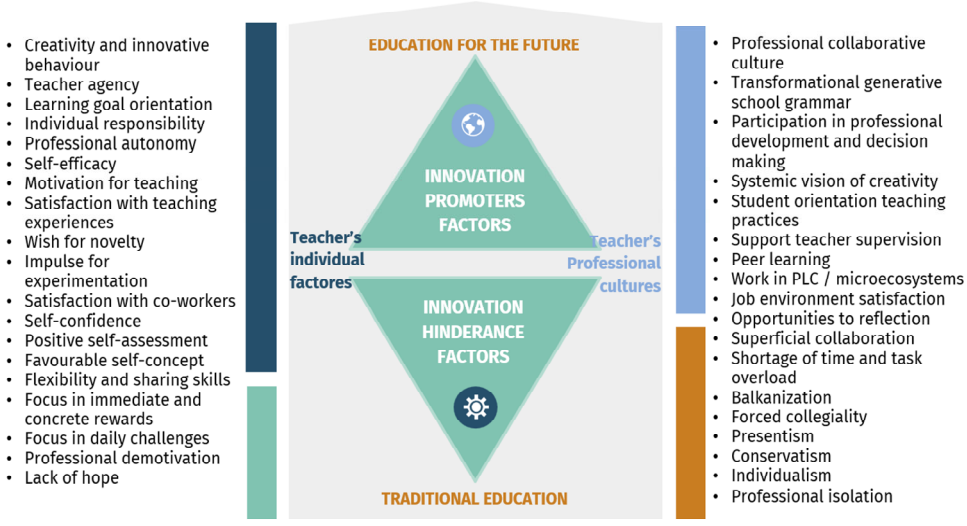
Teachers' innovative behaviour is a key factor in the process of transformation of teaching practices. It is defined by Nemeržitski et al. (2013) as teachers' ability to provide students with new, unfamiliar models and tools for classroom activities, thus, fostering students' creativity and producing new original outcomes for the learning process. Those authors define two composite factors to evaluate innovative behaviour. First, professional self-development in interaction with cognitive and motivational factors, including management of teachers' own learning, wish for novelty and impulse for experimentation. Second, innovation skills and self-efficacy are interrelated with using students' creativity to support teaching practices and student-oriented teaching practices. Innovative behaviour is also fostered by peers' and leaders' recognition, as the lack of it can negatively impact the willingness to adhere to innovative practices (Cao et al., 2020). The risk of conflicts with co-workers and reduced satisfaction with co-worker relations obstruct innovative change (Janssen, 2003). Innovative behaviour is influenced by employee characteristics (e.g., mood, self-confidence, wide interest, learning goal orientation, reflection, and openness to new experiences), job features (e.g., job complexity, job demands, and supportive supervision), and, especially, by team characteristics (Runhaar et al., 2016). Innovative behaviour is also determined by low or high job involvement attitude due to self-concept or sense of identity (Janssen, 2003).

3.2.3 Teachers' collaborative cultures

Collaborative cultures are strongly associated with school success and potential peer learning, providing support and encouragement to teachers to overcome the difficulties of change (Hargreaves and Shirley, 2009), including the ones due to acquired routines through experience and daily practice (Cuenca et al., 2006). Professional collaboration between teachers in planning and realisation of the teaching-learning as well as cooperation at the organisational level, especially participation in decision-making, favour innovation (Nemeržitski et al., 2013). On the other hand, innovations are not favoured by the high levels of discretion that characterise educational actors (Cuenca et al., 2006). Social innovations provide new forms of collaboration between people in co-working spaces (Domanski et al., 2020) that function as micro-ecosystems of innovation or professional learning communities (PLC). Teachers in a robust PLC believed that their colleagues tend to be open to innovation, respectful towards one another, and provide ample support and good advice for their instructional activities. Still, schools with weak teacher communities tend to be conservative toward change, and their teachers are markedly individualistic and have low expectations regarding student learning (Song and Choi, 2017). Innovative school environments are associated with

more frequent teacher collaboration, exchange and higher job satisfaction among teachers (Blömeke et al., 2021). Innovativeness appears as a multifaceted and complex construct that balances individual aspects, school climate and cultural characteristics of schools, to which are added the influence of leadership (Figure 2).

Figure 2 Synopses of forces for innovation centred on teachers (see online version for colours)



3.2.4 Leadership, organisational culture, and educational responsibility

Innovation is understood as a central factor for society, enabling improvements in education and promoting transformational social change (Howaldt et al., 2016; Domanski et al., 2020; Córdoba-Pachón et al., 2021). However, in organic organisations designed to facilitate innovativeness, new ideas for changing structure, culture, or strategy may challenge the consensually agreed paradigms, raising resistance to change and disagreement (Janssen, 2003). This justifies the discussion about factors related to leadership. For principals and head departments or middle leaders is important to understand the main psychological characteristics of schools' community which are, according to Hannan and Silver (2000): how community members interpret an institution's culture; the level of discord within that culture; how innovations are received; reasons provided for change and how those changes are facilitated; the status of communications between central and peripheral parts of the culture; and ideas about the past, present, and future changes throughout the culture.

School leaders need to articulate the innovation's alignment with the school's broader goals (Tan and Hung, 2020). Leadership for innovation demands special attention with ongoing community learning, receptiveness to novelty, flexibility, and continuous adaptation. So, it is essential to use "a specific construct of school leaders' learning support, rather than a generic construct of leadership support, to understand how learning-supportive school leaders may affect teachers' professional learning and work effectiveness" [Lee et al., (2020), p.2]. The leader's support is fulfilled in four main domains:

- Providing infrastructure and resources: Supplying space and structured time, allocating budgets for professional collaboration and knowledge sharing within and outside the school (Song and Choi, 2017; Lee et al., 2020); yielding technology to support teachers' work, the pedagogical process, routines and school structures (Mogren et al., 2019); reducing bureaucratic charge in teacher's work (Fullan, 2007); providing ICT supporting innovative pedagogies considered first-order barriers and purely operational obstacles (Serdyukov, 2017); managing the renovation of the schools' grammar meant as regular structures and rules that organise the work of instruction (Tyack and Tobin, 1994) by allowing a generative transformational grammar (Alves and Cabral, 2021).
- Providing professional development: Fostering professional learning communities and micro-ecosystems for innovation which are new forms of collaboration between people in co-working spaces (Domanski et al., 2020; Shirley et al., 2020); boost formal ongoing relevant formation opportunities and satisfy cognitive needs (Lee et al., 2020) that assure teacher learning support (Song and Choi, 2017); encouraging pedagogical diversity through multidisciplinary or interdisciplinary teams (Shirley et al., 2020; Straub and Vilsmaier, 2020); act intentionally on innovation's second-order barriers, which are applicational and pedagogical (Serdyukov, 2017); encourage uplifting cultural attitudes toward pedagogy (Serdyukov, 2017); fight actively against teacher isolation practices, balkanisation and artificial collegiality (Hargreaves and Fullan, 2012; Amorim et al., 2019).
- Providing knowledge of school: Giving access to relevant data about school and regular information about school evaluation, as well as improving reflection on it and stimulating sustained participation in decision making (Nemeržitski et al., 2013); providing data about monitoring actions of pedagogical, collective, and structured ongoing experiences; supporting professional knowledge creation for action following bottom-up logics (Mogren et al., 2019); to privilege internal accountability for knowledge which means to adopt responsible accountability (Fullan et al., 2015; Serdyukov, 2017).
- Providing psychological robustness among teachers: Satisfy cognitive needs, including autonomy (Lee et al., 2020); harvest engagement (Shirley et al., 2020); inspire an inclusive vision (Hargreaves and Shirley, 2009) and a common purpose to increase cognitive alignment among the innovation ecosystem members (Gomes et al., 2021); foster tolerance, flexibility, openness and diversity (Nemeržitski et al., 2013); care for job satisfaction among teachers (Blömeke et al., 2021).

3.2.5 Leadership styles for organisational leverage

Schools adopt innovations according to their needs and contexts (Tan and Hung, 2020), which is crucial to embrace a culture of internal and systemic assessment. "Policymakers will need to make a major shift from superficial structural solutions to investing in leveraging internal accountability and building the professional capital of all teachers and leaders throughout the system" [Fullan et al., (2015), pp.14–15]. This is also true for leaders once it allows them to consider better the needs and design interventions to act in each context and, according to Tan and Hung (2020), to transcend the binary between adaptation and fidelity to allow adoption and diffusion of innovation. Profound

professional knowledge and collaboration act as an indispensable platform for "not just overseeing the present" but essentially "to be accountable for the future" [Fullan et al., (2015), p.14]. Leaders must recognise school transformation as a collective phenomenon that yields on professional capital, a construct that considers three elements: professional autonomy; social capital reporting teachers learning from each other; and decisional capital considering developing judgment and expertise over time (Hargreaves and Fullan, 2012; Fullan et al., 2015). Leadership practised through professional capital allows leaders and teachers to deeply understand the teaching profession and pedagogical practices. Additionally, it contributes to scaffolding a school culture sustained in reflection and criticism.

Leaders must be ecological due to schools' growth, acting as community builders, encouraging a sense of growing together (Tan and Hung, 2020), and administrating school improvement to collectively enhance students' possibilities for learning (Mogren et al., 2019). It requires proactive, transformational, and empowering leadership that, according to Shirley et al. (2020), includes: first, set performance objectives that will close the growth gap innovation, assuring a means to an end, which is to improve long-run and top-line learning growth; second, consider the current innovation narrative and develop the desired narrative; third, pull the organisational levers to change the work environment and foster narratives that characterise a desired innovative future; fourth, change the ongoing process to accelerate innovation, assuring commitment.

Leadership style plays a prominent role in promoting innovation environments, highlighting the influences of instructional, transformational, transactional, and empowering leadership (Anthony and Hermans, 2020; Atik and Celik, 2020; Thompson, 2020; Cheong et al., 2016; Daniëls et al., 2019; Gil et al., 2018; Hargreaves and Fullan, 2012; Pellegrini et al., 2020; Vermeulen et al., 2020). Considering the influence of leadership on the capacity that organisations present to operate innovation, the study conducted by Gil et al. (2018) showed that leadership has a positive effect on the learning culture and the structure of the organisation, and these two factors influence the capacity for school innovation.

Being constructive, transactional leadership can promote the team's creativity and will bring efficient organisational information processing and knowledge sharing to support decisions (Pellegrini et al., 2020; Gao et al., 2021). Gao et al. (2021) reunited empirical evidence that supports the mediated effect due to transitional leadership on creativity related to the injection and cultivation of creative organisations. More creative schools, with the assumption of a culture of innovation, will favour the transformation of teachers' practices.

The empirical study conducted by Anthony and Hermans (2020) allowed the identification of several items as being conspicuous of transformative leaders: idealised attributes and behaviour of the leader, inspiring motivation, intellectual stimulation, and individual consideration of the leaders over the led. Transformational leaders encourage unconventional thinking, pay attention to high-level goals, can improve collective effectiveness and individual efficacy, and, in general, promote organisational creativity (Gao et al., 2021), which are determinative features of innovation.

Taking into perspective the effect of empowering leadership, Atik and Celik (2020) found interdependencies between the leadership behaviours of school principals and teachers' satisfaction at work due to the mediating effects of trust and psychological empowerment. Empowering leadership is a process that creates a supportive environment meant to improve teachers' sense of meaning, competence and self-determination,

inspiring teachers' intrinsic motivation and fostering innovative behaviour (Zhu et al., 2019). Inducing their psychological empowerment promotes teachers' agency.

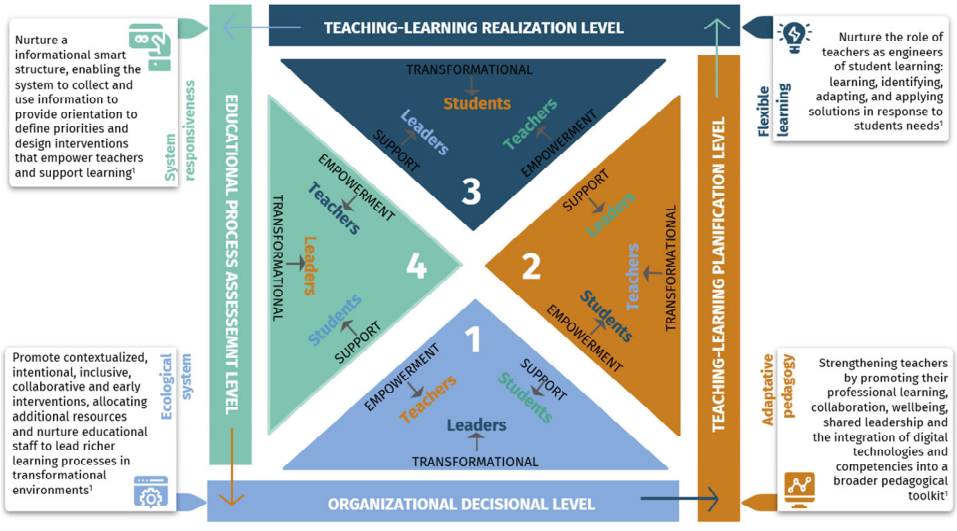
3.2.6 Leaders' and teachers' collective responsibility

Andrews and Conway (2020) understood leaders as the key to success and school improvement, along with the comprehension of collective responsibility regarding the progression of school results. Communication is basilar in an institution, and the idea of language having multiple and contested meanings must be considered because it is a mediating tool that shapes every aspect of activity (Tan and Hung, 2020). Communication is needed to improve the school, which, according to Mogren et al. (2019), means developing a shared holistic vision at the school's organisational level. Tools for effective communication include platforms for teachers' dialogical processes, leader-teacher connections, and student-teacher interactions. Communication is necessary for the whole community to embrace the school mission and achieve better pedagogical goals.

Leaders must be aware of the difficulties of the diffusion innovation process and strategically manage human resources considering that there are different individual characteristics. Rogers (2003) identifies the following: innovators, early adopters, early majority, late majority, and laggards. For laggards and average performers to grow faster is necessary to construct growth-enabling narratives to identify and address the obstacles impeding innovation. Hargreaves and Shirley (2009) defend seven principles for sustainable leadership: depth of purpose in developing student learning; breadth so this purpose and its achievement are shared; endurance over time so that improvement continues across reforms; justice in attending to all students' learning; resourcefulness in using financial resources and human energy; conservation in connecting future visions to traditions in narratives of commitment and hope; and diversity of curriculum, pedagogy, and team contributions in organisations and networks where ideas are cross-pollinated instead of being cloned.

Leadership appears as a complex and multifaceted activity blended with holism, coherence, transparency, competence, determination, resilience, knowledge, and skills. Leadership is related not only to organisational management and pedagogical process but also to human resources management. Human resource management includes interventions in relevant psychological domains due to motivational aspects and due to the perspectivism indexed to controversial school cultures. Concerning innovation focused on pedagogical and organisational experiences, leaders' actions, as well as teachers' and students' actions, contemplate three dimensions: empowerment, transformation, and support (Figure 3). The first one, empowerment, refers to strategically assuming control and making positive decisions supported by knowledge, based on a vision and predefined goals. Transformation is moving to action focusing on the defined goals and a strategy to transform teaching and learning that is assured by the school's professional capital. At last, support ongoing innovative processes focused on improving and refining practices, assuming individual and collective responsibility, a shared responsibility across the system. In different levels of school structure, empowerment, transformation, and support are shared by leaders, teachers, and students, even though the role accomplished by each element changes.

Figure 3 The integral perspective of innovation strategy in schools considering the role of the educational actors (see online version for colours)



Source: [1]OECD (2021)

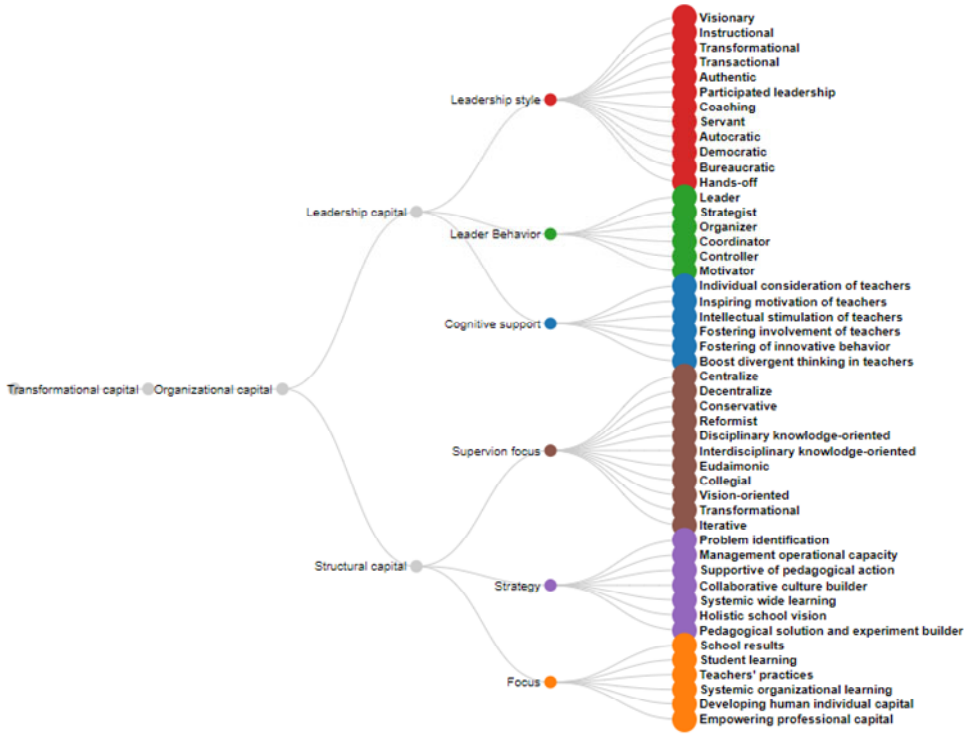
4 A classification of promoters and hindrance factors in educational innovation

Currently, the social demand for innovation and school transformation imposes the adoption of a systemic culture of innovation in educational systems. To support this metamorphosis (Morin, 2010; Nóvoa, 2019), principals, teachers, policymakers, and scholars must access a common understanding of the multiple factors that restrict innovation. The classification built considers metaclasses, higher-order operators in the typology, defined as structural domains of the educational process of schools' transformation and related dimensions (Table 1). The two domains defined, organisational capital (Figure 4) and professional capital (Figure 5), reunite factors that, by themselves, combined or depending on the degree of their manifestation, impact positively or negatively school transformation. The factors proceeding from the literature review were organised into the domains and dimensions predetermined (Table 1) and then clustered into the categories detailed in Table A1. The typology aims to fulfil an epistemic, phenomenological, and propositional purpose. It harmonises criteria concerning the following aspects of innovation:

- At the functional/strategic level – 'Leadership style' from the dimension of educational leadership capital; 'focus', 'strategy' and 'supervision focus' regarding the dimension of structural capital; 'vision and focus' and 'meaningfulness' from the dimension of decisional capital.
- At the relational level – 'Leadership behaviour', 'professional practices' and 'individual morale' respectively framed with the dimensions of educational leadership capital, social capital and individual human capital.

- At the behavioural level – 'Cognitive support' integrated with the dimension of educational leadership capital and 'individual behaviour', 'innovative behaviour' and 'working posture' from the dimension of individual human capital.
- At the environmental level – 'Procedural principles' and 'responsiveness' belong to the dimension of decisional capital, and 'school capital for transformation' is from the dimension of social capital.

Figure 4 Dendrogram of factors that influence innovation in schools reported as organisational capital (see online version for colours)



The proposed typology systematising promoters and hindrance factors of educational innovation represents a differentiated approach from the one presented by Tyunnikov (2017) concerning innovation objectives. Both classifications constitute tools to leverage innovative practices in schools and foster more organic institutions. Classifying is an approach to data that involves sorting concepts, events or constructs into categories. Classifications of innovation are essential tools for a better understanding of relationships between organisational and pedagogical processes in educational contexts.

Schools are complex systems, and the equation for understanding it means building solid leadership that can establish ethical and organisational control in building knowledge capital. According to Sujudi et al. (2020), the result will be a reflection of the leadership needed in this current era of disruption. Considering the broader factors that influence innovation and consequently the school transformation, changing becomes a vast and complex process that requires the real mobilisation of the whole institutional

school system. The steps to achieve school transformation by making use of the map of innovation exposed in the typology proposed may include:

1 analysing the school context considering the domains, dimensions and categories of classification

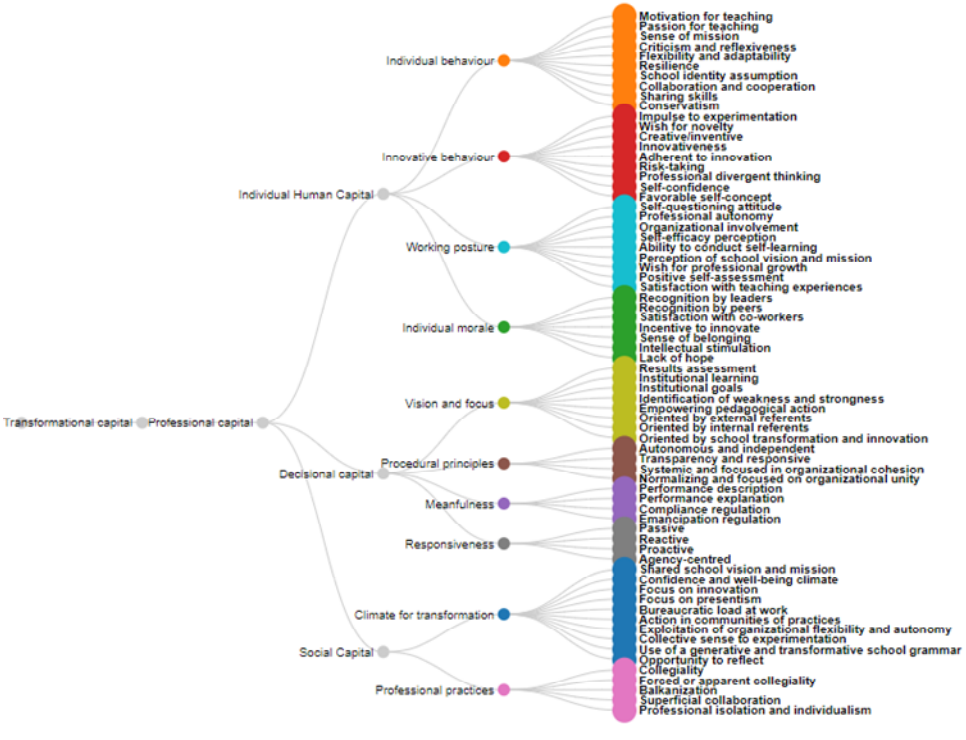
2 identifying contextual promotors and hindrance factors that impact the school as an organisation

3 defining an articulated and integral system-generated strategy that allows a contextualised intervention

4 to diffuse the system-generated strategy, promote reflection and involve all school community in a conscious and sustainable school transformation process.

The complexity of educational organisations demands a 'new leadership' characterised by the following components: 'experts in context', "engaging in joint determination throughout the process", establishing a 'culture of accountability', and becoming a 'system player' [Fullan, (2020b), p.140]. By identifying potential promotors and hindrance factors of innovation, this study may support this 'new leadership', allowing a better understanding of the school context and how to promote school transformation.

Figure 5 Dendrogram of factors that influence innovation in schools reported as professional capital (see online version for colours)



5 Conclusions and final considerations

Innovation is imperative for a future-oriented teaching profession. Therefore, we present a discussion centred on identifying and typifying the factors that positively mark the innovative phenomenon and the barriers to innovation. Highlighted by a theoretical model for studying innovation in educational systems, a methodology was developed for classification focused on four main strands that characterise schools, which are organisational, pedagogical, cultural, and technological. These four strands led the whole process of reuniting factors identified as being promoters and obstacles to innovation in the literature. The classification outlines the potential paths for implementing innovation in schools and deepening the study of the innovative process. The classification follows a structure of a typology. It appears as a pragmatical tool that challenges the current thinking to develop and support education. The typology's primary purpose is to make the innovation process more sustainable in schools and leverage students' learning. The typology provides orientations to principals on the complex, multitask, plural, interrelated, adaptative, creative, and challenging process of leadership. The typology also attempted to arrange a significant and common language to understand and study the problem that assembles innovation and schools' transformation.

Two main domains were pointed to classify factors that entangle innovation. The first one is organisational capital which points out the whole school's management and administration. The second one is professional capital which "consists of simultaneously building individual and collective efficacy and creating links of lateral accountability that push and pull team members to get better at their practice" in a process "described as accountability for student learning" [Fullan et al., (2015), p.8].

This approach does not intend to substitute other classifications or taxonomies on innovation proposed by other scholars. Still, it aims to provide a rational typology on determinant factors that impact educational innovation and schools' leadership, making it possible to differentiate agendas for school transformation and uncover interesting and relevant research questions and issues to follow up. The large number of factors included in the typology, promoters, and obstacles to innovation, make us signal a perspective on the topic of school transformation that may have remained obscured. Even though many factors were identified, studied, and appear as being crucial elements, perhaps, one or two unfavourable factors influencing an organisation, when combined with a higher number of favourable factors, might have a minor impact. The opposite is also a hypothesis. In the context of the predominance of positive combined factors due to school transformation, a single or a few factors might have a considerable impact. This classification and the model that frames the typology present a possible approach for comprehensively and globally studying innovation in schools. Finally, the typology acts as a groundwork for continuing study schools because it provides a broad matrix of variables that might be correlated or act as moderators or mediators for innovation. The typology presented may suggest new lines of analysis and catalyse studies that may provide a further understanding of the innovative phenomenon.

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Appendix

Table A1 A typology for innovation centred on the fostering factors and obstacles

Structural domains		*Dimensions*		*Categories*
Transformational capital	Intellectual capital	Educational leadership capital	*Leadership style*[1]: Leaders' characteristics used for school managing	• Visionary, progress-focused • Instructional, supportive, and communicative • Transformational, challenging, and communicative • Transactional, performance-focused • Empowered, enhancing self-efficacy and performance • Authentic, focused on team culture and positive work relationships • Participated leadership, fostering responsibility, involvement, and autonomy • Coaching, motivation-focused • Servant, humble and protective • Autocratic, authoritarian, and result-focused • Democratic, supportive, and innovative • Bureaucratic, hierarchical, and duty-focused • Hands-off, autocratic, and delegatory
			Leader behaviour[2]: Leaders' actions for school managing	• Leader • Strategist • Organiser • Coordinator • Controller • Motivator
			Cognitive support[3]: Leadership activity oriented to improving the intellectual consciousness of teachers	• Individual consideration of teachers • Inspiring the motivation of teachers • Intellectual stimulation of teachers • Fostering the involvement of teachers • Fostering innovative behaviour • Boost divergent thinking in teachers

Source: [1]Demirtas and Karaca (2020); [2]Tyunnikov (2017), [3]Lee et al. (2020), [4]Andrews and Conway (2020), [5]Zhao and de Pablos (2009), [6]Fullan et al. (2015), [7]Maroy and Dupriez (2000), [8]Leithwood and Earl (2000), [9]Henriques et al. (2020), [10]Wang (2019), [11]Goodson (2000), [12]Rogers (2003) and [13]Shirley et al. (2020)

Table A1 A typology for innovation centred on the fostering factors and obstacles (continued)

Structural domains		*Dimensions*	*Categories*
Transformational capital	Intellectual capital	Structural capital	*Focus*[4]: The core of the leadership activity concerning school the sustainability of the whole school's improvement	• Focus on school results • Focus on student learning • Focus on teachers' practices • Focus on systemic organisational learning • Focus on developing individual human capital • Focus on empowering professional capital
			Strategy[5]: Leadership strategic action orientation for school management based on school organisational learning	• Problem identification oriented • Management of existing operational capacity oriented • Monitoring and supportive, being pedagogical action-oriented • Building collaborative culture-oriented • Systemic wide learning-oriented • Pedagogical solutions and pedagogical experiments builder-oriented • Holistic school vision commitment-oriented
			Supervision focus: Orientation of leadership supervision activity of teachers	• Centralise, defining orientations for educational action • Decentralise, valuing participation of the community in decision-making and organisational autonomy • Conservative focused on presentism and short-term-oriented • Reformist focus on innovation and innovative behaviour and is future-oriented • Disciplinary knowledge-oriented, investing mainly in the curricular disciplinary approach • Interdisciplinary knowledge-oriented, investing in integrated knowledge and methods from different subjects as part of the teaching-learning process • Eudaimonic, inducing self-realisation and well-being, and trust among teachers

Source: [1]Demirtas and Karaca (2020); [2]Tyunnikov (2017), [3]Lee et al. (2020), [4]Andrews and Conway (2020), [5]Zhao and de Pablos (2009), [6]Fullan et al. (2015), [7]Maroy and Dupriez (2000), [8]Leithwood and Earl (2000), [9]Henriques et al. (2020), [10]Wang (2019), [11]Goodson (2000), [12]Rogers (2003) and [13]Shirley et al. (2020)

Table A1 A typology for innovation centred on the fostering factors and obstacles (continued)

Structural domains			*Dimensions*	*Categories*
Transformational capital	Intellectual capital	Structural capital	*Supervision focus:* Orientation of leadership supervision activity of teachers	• Collegial, fostering collective reflection and cooperation, as well as shared, diffusion, and circulation of professional capital
				• Vision-oriented, fostering organisational consciousness through a shared holistic vision and mission
				• Transformational, oriented to the operationalisation of transformational generative school grammar
				• Iterative, oriented to systemic and internalised mutual accountability
	Professional capital	Decisional capital	*Vision and focus*[6]*:* Sets the direction for education due to the school's self-knowledge process	• Focus on results assessment
				• Focus on institutional learning, results, and teaching-learning school practices
				• Focus on institutional goals assessment
				• Focus on the identification of weaknesses and strongness
				• Focus on empowering pedagogical action through in-force school resources management
				• Focused and oriented by external evaluation referents
				• Focused and oriented by internal evaluation referents aligned with the school mission
				• Focused and oriented for school transformation and innovation
			Procedural principles[7]*:* Characteristics of the process conducted by internal school evaluation	• Autonomous and independent
				• Transparency and responsive
				• Systemic and focused on organisational cohesion
				• Normalising and focusing on organisational unity
			Meaningfulness[8]: Value and significance of data produced by internal school evaluation	• Tool for performance description
				• Tool for performance explanation
				• Tool for compliance regulation
				• Tool for emancipation regulation
			Responsiveness: Regarding the nature of the reaction adopted by the internal school evaluation	• Passive, delaying action and non-empowering
				• Reactive, being iterative, and analytical
				• Proactive, being intentional, and reflexive
				• Agency-centred, being comprehensive, empowering, and creative

Source: [1]Demirtas and Karaca (2020); [2]Tyunnikov (2017), [3]Lee et al. (2020), [4]Andrews and Conway (2020), [5]Zhao and de Pablos (2009), [6]Fullan et al. (2015), [7]Maroy and Dupriez (2000), [8]Leithwood and Earl (2000), [9]Henriques et al. (2020), [10]Wang (2019), [11]Goodson (2000), [12]Rogers (2003) and [13]Shirley et al. (2020)

Table A1 A typology for innovation centred on the fostering factors and obstacles (continued)

Structural domains			*Dimensions*	*Categories*
Transformational capital	Professional capital	Social capital	*Professional practices*[9]: Nature and the way how teachers' work is conducted	• Collegiality • Forced or apparent collegiality • Balkanisation • Superficial collaboration • Professional isolation and individualism
			School climate[10] *for transformation:* Work environment oriented to school transformation	• Shared school vision and mission • Confidence and well-being climate • Focus on innovation • Focus on presentism • Bureaucratic load at work • Action in communities of practices • Exploitation of organisational flexibility and autonomy • Collective sense of experimentation • Use of a generative and transformative school grammar
		Individual human capital	*Individual behaviour*[11]: Actions and responses of teachers due to internal and external forces	• Opportunity to reflect • Motivation for teaching • Passion for teaching • Sense of mission • Criticism and reflexiveness • Flexibility and adaptability • Resilience • School identity assumption • Collaboration and cooperation • Sharing skills • Conservatism

Source: [1]Demirtas and Karaca (2020); [2]Tyumnikov (2017), [3]Lee et al. (2020), [4]Andrews and Conway (2020), [5]Zhao and de Pablos (2009), [6]Fullan et al. (2015), [7]Maroy and Dupriez (2000), [8]Leithwood and Earl (2000), [9]Henriques et al. (2020), [10]Wang (2019), [11]Goodson (2000), [12]Rogers (2003) and [13]Shirley et al. (2020)

Table A1 A typology for innovation centred on the fostering factors and obstacles (continued)

Structural domains			*Dimensions*	*Categories*
Transformational capital	Professional capital	Individual human capital	*Innovative behaviour*[12]*:* Perceptions and feelings about the application of new methods, strategies, and solutions to the educational process	• Impulse to experimentation • Wish for novelty • Creative/inventive • Innovativeness • Adherent to innovation • Risk-taking • Professional divergent thinking • Self-confidence • Favourable self-concept
			Individual morale[13]*:* Well-being feelings of teachers in the work context	• Recognition by leaders • Recognition by peers • Satisfaction with co-workers • Incentive to innovate • Sense of belonging • Intellectual stimulation • Lack of hope
			Working posture: Ability to drive self-professional capital factors	• Self-questioning attitude • Professional autonomy • Organisational involvement • Self-efficacy perception • Ability to conduct self-learning • Perception of school vision and mission • Wish for professional growth • Positive self-assessment • Satisfaction with teaching experiences

Source: [1]Demirtas and Karaca (2020); [2]Tyunnikov (2017), [3]Lee et al. (2020), [4]Andrews and Conway (2020), [5]Zhao and de Pablos (2009), [6]Fullan et al. (2015), [7]Maroy and Dupriez (2000), [8]Leithwood and Earl (2000), [9]Henriques et al. (2020), [10]Wang (2019), [11]Goodson (2000), [12]Rogers (2003) and [13]Shirley et al. (2020)