QTIMES
JOURNAL OF EDUCATION
Technology and Social Studies

3
Luglio 2025

Learning cities bridging innovation and transformative education: the Viennese case study of *Bildungsgrätzl*

Le learning cities come ponte tra innovazione ed educazione trasformativa: il caso studio viennese del *Bildungsgrätzl*

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Doi: https://doi.org/10.14668/QTimes_17320

ABSTRACT

Today, the Smart Cities (SC) concept has quickly become popular in the debate on sustainable urban development. However, some critics argue that it has become a trendy buzzword. From a systemic view, cities are socio-ecological, complex, and adaptive systems addressed to integral wellbeing. Thus, SC strategy should not merely focus on solving pre-defined problems with technological innovation, but it should also focus on being a citizen in these evolving urban environments. Integrating the Learning City (LC) framework into such strategies is essential, as it highlights the transformative role of education rather than limiting it to job creation. This paper discusses the ecosystemic transformative learning model through the Bildungsgrätzl case study (neighborhood education), an initiative within the Viennese SC strategy, similar to Italian community educational pacts. These initiatives bridge SC and LC frameworks, as well as individual and community-based learning, and local and global practices.

Keywords: learning city, learning community, socio-ecological systems, transformative learning, smart city.

RIASSUNTO

Oggi, il concetto di smart cities (SC) è centrale all'interno del dibattito sullo sviluppo urbano sostenibile, nonostante ci siano alcune critiche rispetto al suo utilizzo. Le città sono sistemi socio-ecologici complessi e adattivi volti al benessere integrale. Pertanto, le SC non dovrebbero focalizzarsi esclusivamente sull'innovazione tecnologica, limitandosi a risolvere problemi predefiniti, bensì devono contribuire a formare i cittadini del futuro. Per questo motivo è cruciale integrare a queste strategie politiche il framework delle learning cities (LC), il quale pone l'accento sul potenziale trasformativo dell'educazione, piuttosto che sulla mera formazione professionale. Questo studio discute l'apprendimento trasformativo ecosistemico attraverso il Bildungsgrätzl (educazione di quartiere), un'iniziativa presente all'interno della SC strategy di Vienna e simile ai patti educativi di comunità in Italia, creando un ponte tra SC/LC, apprendimento personale/comunitario e pratiche locali/ globali.

Parole chiave: learning city, learning community, socio-ecological systems, transformative learning, smart city.

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1. INTRODUCTION

The concept of Smart Cities (SC) has rapidly gained popularity in debates on sustainable urban development (Colding & Barthel, 2017). However, this paper takes a critical perspective on the SC discourse, arguing for the importance of integrating the Learning Cities (LC) framework to address not only technological innovation but also to foster broader transitions toward enriched urban environments. To contextualize the integration of these two concepts, the paper focuses on the *Bildungsgrätzl* (BG) case study (educational neighbourhoods or learning communities in English), an initiative embedded in the Smart Climate City Strategy Vienna (SCC Strategy Vienna, 2022). These district-level educational communities, including in-school and out-of-school initiatives, aim to support children and young people in navigating transitions (Francesconi *et al*., 2024 and Table 1 for details).

In literature, various related concepts are often used interchangeably, such as learning communities, learning ecologies, learning networks, and learning hubs (Sangrá *et al*., 2019; Knight, 2024). Concrete examples emerge across different countries, like the Education Action Zones in the UK, the Educating Cities movement in Spain and Latin America, and the Community educational pacts in Italy (Locatelli, 2024).

This paper begins by exploring the integration of SC and LC frameworks and then develops a theoretical perspective rooted in ecological systems theory, named ecosystemic transformative learning. Finally, it examines how the *BG* initiative bridges SC and LC frameworks, links individual and community-based learning, and addresses local practices to global challenges, offering a pathway for evaluating local initiatives within an ecosystemic transformative learning framework.

The *Bildungsgrätzl* case study: a learning community in the Smart Climate City Strategy Vienna	
Origin	The initiative was launched by the City of Vienna in 2017 inspired by previous practical work in some Viennese neighborhoods.
General purposes	Enhancing collaboration between local institutions to extend education beyond the school setting, covering the non-formal and informal education sector.
Stakeholders involved	A minimum of two institutions must be involved, including at least one school, with the desirable involvement of non-school institutions like libraries, youth centers, music schools, and adult education centers within a district.
No. of active *Bildungsgrätzl*	34 up to date
Organization	Internal organization: BG implementation is voluntary, although it is increasingly being recognized as a possibility within the Vienna School Act. Each BG is autonomous in choosing its learning offers but should align with the priorities of collaborating institutions and children's needs, interests, and potential. Within each BG, there is a coordinating institution. Each organization involved designates a person to take responsibility for the BG network (in the case of a school, this does not have to be the head teacher). In general, the internal structure of a BG is loosely organized. Some institutions hold regular meetings, while other partners only get involved when it is necessary.
	External organization: The BGs cooperate with various city departments, e.g., the Department for Education and Youth. They act as a steering group alongside other partners from the City of Vienna, i.e., the Department for Compulsory Schools and the University of Education Vienna. The steering group meets twice a year to discuss the organization of the BGs, identify needs, and determine necessary resources.
Support and funding	General funding amounts to 5,000 euros per year. Additionally, individual funding for specific activities, projects, and festivals is available. Other forms of support include start-up funding, promotional support, networking opportunities, and workshops funded by development advisors from the University of Education Vienna.
Activities	The intensity of the offerings depends on the willingness of the parties involved. Activities are mainly addressed to children and young people, students, teachers, educators, parents, and guardians. They include health education, violence prevention, language skills acquisition, sustainability and peace education, STEM, and digital education. Other activities are, for example, celebrations for the newly founded BG, graduation ceremonies, and neighbourhood festivals. Networking meetings among all participating institutions are held typically once a year for information and idea exchange.
Evaluation	There has been no external, systematic evaluation of activities, even though a recent online survey was conducted. The evaluation and quality assurance processes are conducted within each BG. The process encompasses the formulation of objectives, the delineation of the target population, the specification of services or activities to be offered, and the submission of a report that documents the objectives that have been successfully achieved, the aspects implemented, and the future adjustments.

Tab. 1. Overview of the Viennese case study based on the preliminary findings of the research project "EQoL – Teaching the Good Life" (FWF, Grant-DOI: 10.55776/PAT5101523)

2. SUSTAINABLE URBAN DEVELOPMENT BETWEEN INNOVATION AND LEARNING

In 2015, the SC strategy became a key policy direction of the United Nations (2015), aiming to promote both urban sustainability and resilience. The concept of SC had already been coined in the 1990s, after the advent of the ICT revolution. Originally focusing on economic growth and industrial

markets, it gained popularity across multiple sectors and attracted increasing interdisciplinary attention (Anthopoulos, 2019). SC strategies typically emphasize the role of companies and institutions in fostering innovation and translating research and development into concrete solutions within specific urban areas (Méndez & Sánchez Moral, 2011). The goal was to generate dynamic competitive advantages in productivity and both local and global economies (Méndez & Sánchez Moral, 2011). In this context, cities are privileged places for the concentration of resources, knowledge, and talent to promote creativity and innovation. Before the SC concept gained prominence, a succession of related terms emerged, such as informational city, intelligent city, knowledge-based city, creative city, and LC, reflecting shifting priorities and conceptual underpinnings (Méndez & Sánchez Moral, 2011).

Over time, the SC literature has become an increasingly dominant paradigm on sustainable urban development, placing particular emphasis on reconciling and mutually enhancing economy and ecology, integrating sustainability, innovation, and governance dimensions with the application of ICT (Colding & Barthel, 2017). As articulated in a joint definition by UNECE and ITU "smart sustainable city is an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects" (UNECE, 2015, p. 3).

Despite its widespread adoption, a clear consensus on the purposes, models, and implementation tools for SC is still lacking (Anthopoulus, 2019). Not all solutions are universally applicable, making it difficult to establish objective measures of a city's "smartness" (Fernandez-Anez *et al*., 2018). The common patterns that emerged in the various conceptual approaches and models on SC are their focus on governance, supported by concrete projects and case studies that often adopt a multi-scalar perspective (Fernandez-Anez *et al*., 2018). Furthermore, existing literature suggests that the differences and similarities among SC strategies are not primarily shaped by geographic or demographic factors, but by the underlying strategic purposes (Méndez & Sánchez Moral, 2011; Anthopoulos, 2019). Therefore, public policies are called upon to recognize and promote this diversity of contexts, worldviews, and knowledge systems, as well as the crucial importance of participatory processes in the construction of shared knowledge.

The SC model is commonly seen as contributing to urban sustainability, based on the idea of positive feedback loops between high-tech business environments and broader public benefits (Colding & Barthel, 2017). This model is closely linked to the notion of human capital as a strategic asset enhanced through education, the attraction of talent, and the mobilization of creative individuals to boost employment, productivity, and competitiveness (Méndez & Sánchez Moral, 2011). However, this approach tends to instrumentalize social networks as economic assets, overlooking deeper relational, cultural, and ecological dimensions of urban life (Colding & Barthel, 2017). The prevailing discourse assumes that strengthening social capital will automatically yield public benefits, yet it often neglects how such models can exacerbate social inequalities, depoliticize civic engagement, and sideline ecological thinking.

Beyond technical and economic dimensions, critical views have also raised concerns about unintended consequences, not limited to cybersecurity or digital inequality. For instance, environmental psychology literature increasingly highlights the importance of emotional and experiential connections to nature, including place attachment and biophilic responses (Colding & Barthel, 2017). SC initiatives may inadvertently increase the amount of 'screen time' in daily life, contributing to a growing disconnection from nature. This is problematic, as time spent outdoors is

strongly linked to improved mental health, stress reduction, and overall quality of life (Colding & Barthel, 2017).
Although ICTs have the potential to serve as a kind of "planetary nervous system", enabling shared knowledge and informed civic participation for more democratic urban governance, the various criticisms, the lack of consensus on the purposes and models, as well as the dramatic increase in the number of publications addressing this concept, suggest that SC has turned into a trendy buzzword (Colding & Barthel, 2017).

2.1 The crucial role of Learning city

Concurrently the broader paradigm of SC, the concept of the LC has undergone a parallel evolution. While its roots can be traced back to ancient philosophy, its contemporary formulation began to take shape in the 1980s, through the efforts of international organizations such as the OECD and the European Commission (UIL, 2013). In this framework, all sectors of society, including public administration, industry, communication, and transport, are seen as jointly responsible for promoting education, driven by the collective need to generate the knowledge required for innovation (Osborne, 2013).
According to the Global Network of Learning Cities (GNLC), LC is a city that effectively mobilizes its resources across all sectors to:

- promote inclusive learning from basic to higher education
- revitalize learning in families and communities
- facilitate learning in and for the workplace
- extend the use of modern learning technologies
- enhance quality and excellence in learning
- foster a culture of lifelong learning

By pursuing these goals, LCs contribute to individual empowerment, social cohesion, and both economic and cultural prosperity (GNLC, 2015). Like SCs, LCs are expected to operate in a global, competitive, and interdependent landscape. However, they do so by striving to balance economic development with human rights and social justice. In this view, citizens become active agents in achieving their personal fulfillment and shaping collective transformation.
The idea of a city that learns, and not only a city as an environment where people learn, is based on the concept that learning is inherently social, emerging through interactions and relationships with others. In line with this view, LCs often emphasize civic participation, collaborative practices, and the co-creation of public policies. This approach values cultural diversity, situated knowledge, and local contexts, while also addressing the challenges of global interdependence through connections with regional and international networks. Therefore, implementing LCs becomes essential to strengthening educational systems, fostering innovation, collective knowledge, and linking these efforts in support of sustainable development.
Collective knowledge embodies shared values, which are intersubjectively transmitted through human interaction, along with personal beliefs and habits of mind (Mezirow, 1991). Within this context, lifelong learning should be regarded as a common good, moving beyond public goods, typically limited to state responsibility (UNESCO, 2019). This concept encourages us to go beyond public or private dichotomy, conceiving new forms of participatory democracy. According to Locatelli (2024), education as a common good implies the possibility of designing and implementing innovative forms of cooperation shaped on various contexts. This means that different forms of

education, whether formal or non-formal, are mutually enriched by giving space to the different groups in society, and that educational change can only be achieved together. Thus, all actors must take responsibility for this change at several levels.

In other words, common goods refer to resources, whether publicly or privately owned, that are defined by their collective purpose and contribute to the realization of fundamental rights and human well-being (UNESCO, 2019). Here, by human wellbeing I refer to a plural concept, understood in an integral sense. Although it may appear grounded in a form of monism at the level of foundational principles, according to the Capability Approach, wellbeing is fully realized in the achievement of personal functionings, as defined by the individuals themselves, and in their capabilities, understood as the set of alternatives and possible functionings that individuals can choose and achieve[1] (Sen, 2014). Building on this theoretical integration, conceiving education as a common good through the lens of the Capability Approach reaffirms its collective dimension and highlights its role as a shared social responsibility. Thus, local and national communities are understood as inherently educational ecosystems.

In summary, LCs offer a humanistic and relational perspective that can rebalance the technocentric vision of SCs, contributing to truly sustainable, equitable, and transformative urban development. However, a more systemic and integrative approach is needed to frame cities as complex, adaptive socio-ecological systems designed to foster integral well-being (Folke *et al*., 2016). This view offers a valuable alternative by recognizing humans as part of a wider, interdependent network that transcends city boundaries (Colding & Barthel, 2017).

The operationalization of the key features of LCs, as defined by the GNLC (2015), lacks a systemic view of cities as collective agencies comprising diverse stakeholders, communities, and organizations. To evaluate such complex systems, both quantitative and qualitative data are crucial, as the GNLC also emphasized (2015). Qualitative evaluations are essential to investigate, describe, and explore educational activities and practices implemented by public and private institutions, as well as NGOs and minoritized communities, offering the opportunity to compare them in longitudinal and cross-national studies. However, no qualitative tools currently assess the learning processes across the cities.

Furthermore, the current indicators struggle to capture the dynamics that bridge individual and collective learning. For instance, according to the GNLC (2015), improvements in governance and stakeholders' participation are assessed through coordination mechanisms, plans, actions, stakeholders' commitment, and private sector involvement. Similarly, the evaluation of resource mobilization and utilization is based, for example, on financial investments in education and citizens' contribution to helping other citizens to learn.

Similarly, the prevailing SC discourse also often lacks integration with ecological theory despite the emergence of urban ecology studies over three decades ago (Colding & Barthel, 2017). From this perspective, SC strategy should not solely aim to find solutions to pre-framed technological problems or manage the impact of these transformations but rather focus on what it means to be a citizen in these new urban spaces (Felt & Sepehr, 2024).

[1] The explicit reference to the Capability Approach is necessary, as education is described by Sen (2014) as a semi-public good rather than a common good. In his view, however, pluralism is central and not derived from mainstream individualist socio-economic theory, which risks interpreting public goods through the lens of market logic and economic growth.

3. ECOSYSTEMIC TRANSFORMATIVE LEARNING FRAMEWORK

The ecosystemic transformative learning framework (Figure 1) is based on the idea that human development and learning occur through interactions at different social and environmental levels. This perspective draws on Bronfenbrenner's ecological systems theory, which describes how individuals are influenced by a network of relationships and contexts, as well as on the learning theories of Bateson and Mezirow, which explore how people can transform their habits of mind. This framework helps us to understand how learning occurs at different levels: individual (microsystems), community (mesosystems), organizational and interorganizational (exosystems), and global (macrosystems).

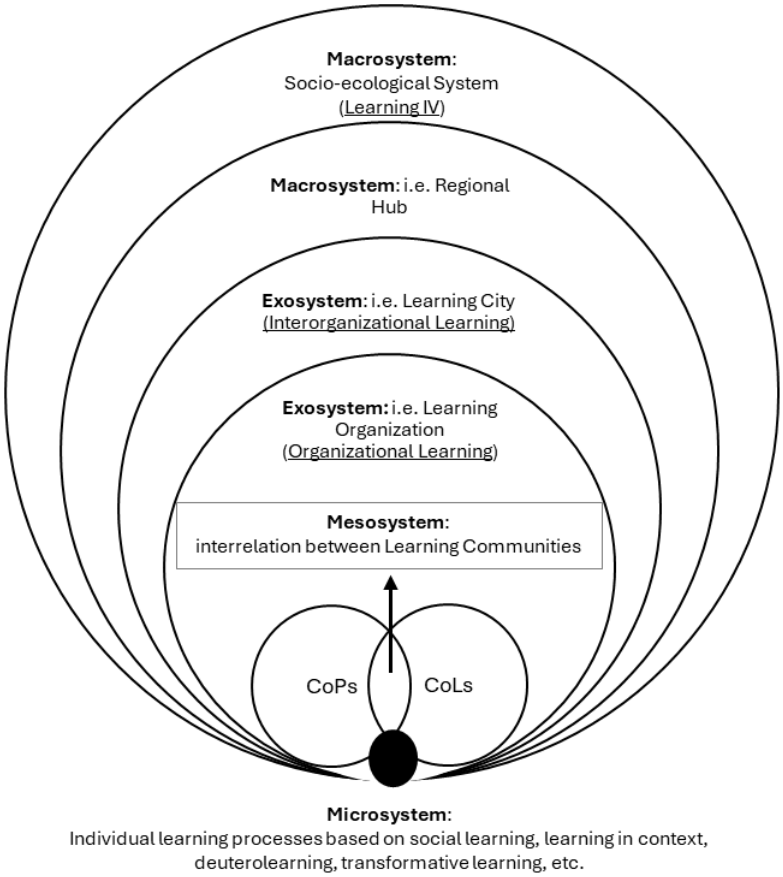

Fig. 1. Ecosystemic transformative learning framework. CoPs stands for Communities of Practice, and CoLs for Communities of Learners.

3.1 Microsystems and Mesosystems

A microsystem is a pattern of activities, social roles, and interpersonal relations experienced directly by the person (Bronfenbrenner, 1994). At the foundation of these interdependencies lies the concept of social learning. This concept posits that people transform and adapt themselves through learning processes that arise from relationships, both with other people and with the encompassing environment. Consequently, a human cannot be fully understood in the absence of relationships (Locatelli, 2024). According to Enactivism, learning is based on structural coupling with the environment, hence, it consists of embedded and embodied modifications (Maturana & Varela, 1992). From this perspective, the human internal structure, conceptualized as a configuration of meaning,

includes the habits of mind, the frames of reference, and cognitive and affective-emotional lenses through which people give meaning to the world, perceive it, live in it, and transform it dynamically (Margiotta, 2015).

From a systemic view, Bateson's theory (1977) could be extended by integrating Mezirow's four types of learning: perspective-broadening, perspective-taking, perspective-shifting, and perspective-enlarging (or deepening according to Stapleton, 2021). It is important to note that transformational learning theory is a theory of adult learning (Stapleton, 2021). In fact, during childhood, individuals develop their initial meaning perspectives, a process that Bateson refers to as learning I and II (deuterolearning). In contrast, adulthood provides opportunities to transform these perspectives.

Deuterolearning is essential for integrating new knowledge into one's pre-existing internal structure by refining and elaborating personal habits. Often referred to as learning to learn, it involves the capacity to extend existing habits of mind to similar contexts. This process enables individuals to generate solutions by reducing cognitive effort, though the process may lack flexibility (Bateson, 1977). According to Transformative Learning Theory, elaborating one's habits of mind broadens perspective by refining existing beliefs or adding new ones. However, this process does not necessarily question the fundamental assumptions underlying those beliefs. Deuterolearning encompasses this perspective-broadening and includes also perspective-taking. Indeed, learning a new frame of reference requires recognizing that one's perspective is just one among many and that others may operate within entirely different frames of reference. Only after this awareness can people change their points of view (perspective-shifting) or engage in perspective-enlarging (or deepening) that involves transforming their habits of mind.

For example, considering the Viennese case study and the education and training addressed to teachers employed by different schools within the same district, they may broaden their perspective (perspective-broadening) by learning about the cultural values and practices of their students, refining their understanding of diversity without necessarily questioning their cultural assumptions. As they interact more deeply, they may begin to take the perspectives of their students, as well as their colleagues (perspective-taking), realizing that their cultural lens is just one among many. This awareness might lead to a shift in their point of view (perspective-shifting), such as adopting a more inclusive approach to teaching. Finally, through continued reflection and engagement, they may undergo a deeper transformation (perspective-enlarging or deepening), fundamentally reconfiguring their habits of mind to embrace a more global and adaptive worldview.

The transformation of habits of mind, which typically entails a shift in unconscious assumptions following a disorienting dilemma, could align with Bateson's Learning III. This type of learning emerges from "contraries" and differences in habits produced at the level of Learning II. Thus, Learning III enables an adaptive modification of the internal structure, resulting in a new and more open perspective. However, people are predisposed to habit acquisition (Learning II); hence, without adequate support, such deep changes may become disruptive, potentially leading to identity fragmentation. Integrating Mezirow's four learning types with Bateson's Learning II and Learning III enriches our understanding of transformative learning. Within this framework, deuterolearning is seen in continuity with Learning III, adding conceptual depth to Bateson's hierarchy. Transformative learning, then, enlarges perspective, transforming own habits of mind. In this sense, Learning III complements the notion of deuterolearning by emphasizing the need, in certain cases, for profound reconfiguration of pre-existing assumptions.

Once the internal learning process is clarified, the microsystem in which it takes place can be seen as the network of direct relationships, both physical and virtual, that shape the individual's experience.

These microsystems may include communities of interest, which generate knowledge only for individual use, informal Communities of Practice (CoPs), or more structured Communities of Learners (CoLs), such as professional learning communities (PLCs). Both types of communities can be considered learning systems that go beyond individual learning processes. CoP refers to a group of individuals who share a concern or a passion for a topic, and within the members engage in collective learning through shared practices, discussions, and decision-making (Wenger, 1998). Conversely, CoL specifically focuses on learning and is typically designed and facilitated by someone inside or outside the community (Dingyloudi & Strijbos, 2020). However, the boundary between the two is often blurred and may evolve over time.
These communities, in which individuals realize themselves, form what Bronfenbrenner defines as the mesosystem: the interrelation between different contexts directly experienced by the individual, such as the connection between home, school, or workplace. From a systemic view, it is thus possible to explore both individual learning, influenced by the mesosystem, and collective or community learning processes.

3.2 Exosystems

An exosystem influences the individual's microsystems and mesosystems. It comprises processes occurring between various contexts, at least one of which does not directly involve the person. At this level, we refer to organizations more complex than CoPs and CoLs; for example, the workplace, which may include various departments and multiple CoPs or PLCs. In this regard, scholars talk about Learning Organizations (LOs) and the related process of Organizational Learning (OL)[2].
The literature on this topic is disparate, with several definitions and approaches. For instance, Argyris and Schön, drawing on Bateson's theory, conceptualize single-loop and double-loop learning (Argyris & Schön, 1996). They define double-loop learning as a form of organizational deuterolearning, which involves reflection on underlying assumptions. In short, at the organizational level, double-loop learning entails questioning and potentially transforming the organization's tacit knowledge (theories-in-use according to the authors), especially if organizational beliefs contrast with each other. Building on the earlier-discussed integration between Mezirow's levels of learning and Bateson's notions of deuterolearning and Learning III, double-loop learning can be seen as extending from the development of organizational habits to the recognition of alternative frames of reference, culminating in what can be described as truly transformative learning, or organizational Learning III. Indeed, some scholars include triple-loop learning in the educational function of participatory modeling (Kenny *et al*., 2022). As in the individual learning process, however, challenging organizational beliefs may not always be desirable, as such changes can destabilize or even disintegrate the organization (Argyris & Schön, 1996).
At the exosystem level, we may include not only LOs but also LCs, which are entities engaged in inter-organizational learning (IOL). IOL has been explored within the framework of LO theory, particularly in studies focusing on the private sector. However, it is evident that public sector organizations differ significantly due to their bureaucratic and formalized structures, the multiplicity of stakeholder interests, and the weaker relations between actors (Anand & Brix, 2022). These

[2] Although the distinction between the two constructs is not always clearly articulated in the literature, OL refers to the processes through which organizations learn, whereas an LO is a specific organization that can learn effectively (Anand & Brix, 2022).

differences contribute to the lack of consensus on what drives IOL at various levels, resulting in the absence of a clear and shared definition of the concept, and a limited understanding of how IOL develops across different contexts (Anand *et al*., 2021).
According to Anand et al. (2021), the core processes underpinning IOL include collaboration between organizations, knowledge sharing, and the co-creation of inter-organizational knowledge. While OL (intra-organizational learning) tends to support exploitation, the recombination of existing knowledge, IOL favors exploration, namely the generation of new knowledge based on shared knowledge among various organizations. However, recent studies on IOL suggest that some organizations can pursue both exploration and exploitation simultaneously if they are open to integrating new perspectives (Anand *et al*., 2021). Furthermore, contemporary literature focuses on the growing attention to hybrid networks as key analytical units. Networks provide new contexts for learning as they can facilitate IOL and knowledge transfer. From a systemic view, it is necessary to explore IOL both at the dyadic level between specific organizations and at the broader systemic level, which includes network dynamics and structures.

3.3 Macrosystems

Bateson (1977) also hypothesized an additional step, Learning IV, defined as a combination of ontogenetic and phylogenetic development, integrating the various systemic levels of learning. In this view, the core of evolution lies not only in genetic evolution but also in learning. It is possible to comprehend extensive networks, like Regional Hubs and socio-ecological systems, as collective agencies that shape global knowledge (Montanari, 2024). In fact, according to socio-ecological systems theory, adaptation and transformation of such systems are possible only through continuous learning (Folke *et al*., 2016). Therefore, building on this theoretical integration, we can define Learning IV as an integration of ontogeny and, not only human phylogeny, but rather systemic socio-ecological evolution at the integral level. In summary, this kind of coevolving learning explores the dynamic interplay between the various learning processes and the transformation of broader socio-ecological systems.
The present article does not elaborate further on this level of learning due to the focus on the BG case study, which consists of collaboration among various institutions and stakeholders, thus, the exosystemic level.

4. CONCLUSION

Studies on SC have rapidly gained popularity in recent years, likely due to increasing pressure from top–down international policies aimed at promoting alternative paths to human wellbeing (UN, 2015). This paper has argued for the need to adopt a more integrated and critical perspective on urban development by bridging SC and LC frameworks through the lens of ecosystemic transformative learning. While SC strategies often prioritize technological and economic innovation, they tend to overlook the relational, affective, and ecological dimensions essential to human development and urban sustainability. In contrast, the LC paradigm provides a more human-centered approach, fostering lifelong learning as a common good.
The Bildungsgrätzl case study offers a concrete example of how this integration can be operationalized in a systemic perspective. By fostering cross-institutional collaboration and embedding learning in local organizations, this neighborhood-based learning exosystem highlights

how individual and collective learning processes can contribute to the development of LCs. LCs have the potential to adapt in response to stimuli from broader macrosystems and to co-create socio-ecological environments on a larger scale. However, the analysis reveals limitations in current evaluation frameworks within BG and calls for more robust qualitative tools capable of capturing complex, multi-level learning dynamics.

Furthermore, the activities of the BG primarily focus on the individual learning of students and teachers, though, the case study inherently fosters interactions among diverse organizations and communities. These interactions generate valuable tacit inter-organizational knowledge that should be made explicit in order to be discussed and, if necessary, transformed. Regarding this, the annual stakeholders meeting represents a valuable opportunity to share knowledge and ideas and has the potential to facilitate transformative processes at increasingly systemic levels, ultimately contributing to the realization of an LC. However, to achieve this, organizations should be open to learning new perspectives; otherwise, the shared knowledge risks being acquired only at an individual level by those participating in the annual stakeholders' meeting. Therefore, inter-organizational learning can occur only if there is reflection on underlying organizational assumptions (double-loop learning) and the subsequent exploration of new organizational perspectives, reconfiguring pre-existing ones (Learning III).

This paper explores how BG can bridge innovation and transformative education. Currently, this local initiative focuses more on educational aspects related to formal education systems, rather than on innovative technological dimensions, despite being embedded in smart policy frameworks. For LCs implementation, collaboration with schools remains essential, as they are key educational institutions capable of connecting generations, individuals, and administrations. Concurrently, informal education centers also play a crucial role.

For a more robust systemic evaluation of the BG, exploratory methods such as participatory observation, action-oriented approaches, focus groups, and interviews, especially those focused on IOL, should be implemented. In addition, more cross-country comparative analyses and longitudinal data are also needed, in line with the IOL literature (Anand *et al*., 2021).

In conclusion, this paper suggests that sustainable urban transformation requires more than just smart infrastructure and digital solutions. It also necessitates transformative learning processes embedded in social relationships and local contexts. Since local learning ecosystems vary greatly from one context to another, for a new ecosystemic transformative approach to SC and LC, a critical analysis of governance, local structure, and responsibility distribution is crucial. Ecosystemic transformative learning offers a valuable framework for understanding and guiding these processes, recognizing cities as dynamic educational exosystems. By embracing this integrated approach, researchers, policymakers, educators, and urban planners can co-create more sustainable and inclusive urban futures.

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How to cite this paper: Montanari, S. (2025). Le learning cities come ponte tra innovazione ed educazione trasformativa: il caso studio viennese del *Bildungsgrätzl* [Learning cities bridging innovation and transformative education: the Viennese case study of *Bildungsgrätzl*]. *QTimes webmagazine*, anno XVII, n. 3, 228-240.
Doi: https://doi.org/10.14668/QTimes_17320