Building an Innovative Learning Ecosystem: A Model for Secondary Schools in Hanoi, Vietnam

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Abstract – **In an era characterized by rapid technological advancements and evolving educational needs, the development of innovative learning ecosystems is crucial for fostering creativity and critical thinking among students. This study investigates the components and characteristics of such an ecosystem tailored for secondary schools in Hanoi, Vietnam, a city recognized as a UNESCO Creative City. Grounded in theories of system, ecology, connection, and creativity, the proposed model emphasizes the integration of technology and creative teaching methods. The research identifies five primary elements of the innovative learning ecosystem: creative learning individuals; creative knowledge; smart technology; creative context; and cultures, innovative institutions, strategies. Each primary element includes secondary components with distinct characteristics, providing a comprehensive framework for schools to develop their specific ecosystems. Grounded in theories of systems, ecology, connection, and creativity, the research highlights the importance of technology and creative teaching methods in fostering a holistic and sustainable educational environment. The proposed model facilitates interactions at multiple levels, encompassing schools, families, and society, aiming to enhance academic outcomes, holistic development, and contributions to economic and cultural growth.**

The study identifies the necessity of a supportive policy framework, investment in teacher training, and active stakeholder engagement for the successful implementation and sustainability of the innovative learning ecosystem. This research contributes to the broader understanding of educational innovation, underscoring the significance of creativity in addressing global challenges and promoting economic development.

Keywords – **Creative education, innovative learning ecosystem, creativity, ecosystem, smart learning.**

1. Introduction

The intertwining of smart devices and human creativity has become a defining force across various facets of society, shaping realms such as innovation, education, morality, and societal perceptions. Studies, such as that by Subramaniam and Youndt [1] underscore the pivotal role of intellectual capital, organizational capital, and social capital in selectively influencing both incremental and radical innovative capabilities. This highlights the critical interplay of human, organizational, and social capital in driving innovation within the context of smart devices and human creativity.

The advent of artificial intelligence (AI) has expanded the dimensions of creativity and creative geographies. This development suggests that smart devices, particularly those integrated with AI, are not only influencing but also shaping the creative processes and spatial dynamics within society [2]. The impact extends beyond conventional boundaries, reflecting the evolving nature of the relationship between humans and AI in creative endeavors. The integration of artificial intelligence and emerging technologies in smart classrooms reflects the evolution of educational spaces and the incorporation of technological advancements to support learning environments [3].

The concept of innovative learning ecosystem, referring to an environment that fosters and encourages creativity in learners, becomes pivotal in this context. Fan [4] characterizes it as valuing ideas, encouraging risk-taking, and providing opportunities for students to engage in creative activities. This ecosystem plays a crucial role in stimulating and enhancing students' creativity within the classroom. By enhancing goal-oriented learning, network relationships, and knowledge sharing, the innovative learning ecosystem contributes significantly to students' overall creativity across various fields, including mathematics, geography, physics, biology, and art [4], [5], [6].

In the contemporary educational landscape, the emphasis on creative thinking is growing, reflecting the globalized and interconnected nature of the 21st century [7]. This underscores the imperative to incorporate creative thinking into learning classes, acknowledging the pivotal role of creativity in evolving learning environments. Entrepreneurial teaching strategies, such as blended and flipped learning, have been demonstrated to create an environment conducive to creativity, highlighting the significance of innovative teaching methods in fostering creative thinking skills [8]. Educational psychologists have recognized the importance of creativity in educational settings, delving into the potentials and pitfalls of creativity research [9]. SMART learning environments have been identified as a means to foster creativity and language skills, emphasizing the role of technology in enhancing creativity in foreign language learners [10]. The intersection of creativity, intentions, and entrepreneurship education offers intriguing possibilities for future research, emphasizing the relevance of creativity in the context of entrepreneurial endeavors [11].

The development of creative methods for creativity research highlights the ongoing recognition of creativity as a fundamental practice associated with learning, innovation, and societal development [12]. Additionally, the comparison of lecture-based and self-centered learning's effects on nursing students' creativity underscores the foundational role of creativity in educational evolution. Interactive teaching methods have been identified as effective means of developing the creative activity of instrumentalist students, emphasizing the practical significance of innovative teaching approaches in fostering creativity [13].

The importance of creativity in finding solutions for global problems and the role of teachers in promoting student creativity have been recognized, highlighting the importance of fostering creativity in classrooms [14].

Furthermore, the impact of creative infrastructure on regional income underscores the economic significance of creativity and education in driving regional development [15]. Additionally, the influences of employee engagement, authentic leadership, and human capital factors on employee creativity emphasize the multifaceted nature of creativity and its relationship to organizational dynamics [16].

The development of smart learning environments and personalized learning models reflects ongoing efforts to enhance creativity and critical thinking skills in students, highlighting the role of technology in supporting creative skill development [17], [18]. Furthermore, the reorientation and renewal of education curriculum paradigms based on the creative economy, character education, and local cultural values underscore the evolving nature of educational approaches to incorporate creativity and innovation [19].

In essence, the significance of an innovative learning ecosystem in the contemporary educational landscape is evident through the recognition of creativity as a fundamental skill for addressing global challenges, fostering innovation, and promoting economic development. The evolving educational landscape emphasizes the importance of integrating technology, innovative teaching methods, and creative learning environments to support the development of creativity and critical thinking skills in students. This perspective aligns with the vision of creative urban governance, the driving force behind UNESCO's Creative Cities program and network. Since its establishment in 2004, the network of creative cities has been promoting and sharing this innovative approach to sustainable cities [20]. Through practical activities, UNESCO has paved the way to demonstrate the vital role of creativity in urban sustainability, supporting national and local government agencies internationally. Through real-world actions and collaborative relationships, Creative Cities is determined to place innovation at the core of territorial development.

Based on various models of learning ecosystems, creativity in education, and the practices of secondary schools, this study proposes a model for the innovative learning ecosystem of secondary schools. The research content aims to address the following questions:
1) What elements constitute the model of the innovative learning ecosystem for secondary schools?
2) What characteristics define the innovative learning ecosystem of secondary schools?
3) How can the model of the innovative learning ecosystem be applied in the practical education setting in Hanoi, Vietnam?

2. Literature Review

There are various methods and models to create an innovative learning environment. For instance, the STEAMification model in a flipped classroom setting has encouraged creative thinking and innovative skills [21]. The argument-driven inquiry (ADI) model challenges students' creativity through investigative activities and argumentative approaches [22]. The use of digital technology, such as virtual learning environments and gamification, can also foster creativity in the learning process [23]. To design an effective learning environment that encourages creativity, it is important to consider strategies related to activities, construction, collaboration, and self-creation. Scientific research has provided evidence that the most innovative learning often arises from these teaching strategies [24].

Furthermore, exploring creative thinking can be encouraged by creating an environment focused on innovation and fostering creative thinking and creation [25]. The learning environment characterized by innovation is marked by several key features. It values ideas and encourages a willingness to take risks, allowing students to explore and experiment with new concepts and methods. It promotes goal-oriented learning, networking, and knowledge sharing among students [26]. The atmosphere in this environment is considered favorable, healthy, and supportive of imagination, providing opportunities for exploration, independent work, and uniqueness [6]. Numerous studies have shown that an innovative learning environment significantly influences students' creativity by enhancing goal-oriented learning, collaborative networking, and knowledge sharing.

Teachers play a crucial role in promoting an innovative learning environment by encouraging students to learn and think creatively, supporting their ideas, and providing freedom and choice in tasks. There are several key factors in an innovative teaching model. Firstly, it involves providing opportunities for students to express themselves and explore. This can be done through activities such as drawing, music, art, and composition, allowing students to unleash their creativity and develop their talents and interests [27]. Secondly, an innovative teaching model emphasizes the importance of critical thinking and problem-solving skills. It encourages students to think outside the box, challenge assumptions, and provide innovative solutions to problems. This can be achieved through project-based learning, where students are assigned real-world problems to solve and are encouraged to use their creativity to find solutions [28].

Another important aspect of an innovative teaching model is integrating creativity into various fields, recognizing that creativity is not limited to the arts but can be applied to all disciplines. For example, in mathematics, students may be encouraged to find creative ways to solve non-standard problems. In science, they can engage in hands-on experiments and exploratory learning to nurture creativity [29]. Moreover, an innovative teaching model involves the role of the teacher in supporting creativity. Teachers play a crucial role in creating a supportive environment where students feel comfortable expressing their opinions and taking risks. They can provide guidance, feedback, and encouragement to help students develop their creative abilities [30]. Assessing creativity in the classroom is an important aspect of an innovative teaching model. It allows teachers to measure and monitor the progress of students' creative skills. Various assessment methods and tools have been developed, including branching thinking tasks and observation or ranking assessment scales.

There are many benefits to an innovative teaching model. Research has shown that nurturing creativity in education can lead to improved problem-solving skills, critical thinking, and innovation. It also enhances confidence, motivation, and student participation in the learning process [29]. However, implementing an innovative teaching model may face challenges. One challenge is the lack of clear definitions and consensus on what creativity is and how to assess it. Different countries and education systems may have different approaches to defining and encouraging creativity [31]. Additionally, a lack of focus on creativity in education policies and practices can hinder the development of an innovative teaching model [32].

The integration of smart devices and human creativity is a transformative force across various societal dimensions, influencing innovation, education, morality, and social perceptions. This evolving interplay has implications for individual development and societal dynamics. Examining the multifaceted impact of smart devices on societal development reveals complex phenomena across domains such as morality, technology adoption, privacy concerns, social connectedness, governance, and sustainability. These implications extend beyond individual behavior to encompass broader social, economic, and cultural dimensions.

The emergence of artificial intelligence (AI) expands the perspective on creativity and creative geographies, highlighting the formation of new techno-material relations and spatialities when humans and AI collaborate [2].

This implies that smart devices, especially those integrated with AI, influence and shape creative processes and spatial dynamics within society.

Moreover, the impact of smart devices extends beyond creativity to influence moral behaviors and human conduct. Evidence from the evolving moral economy of indebtedness and the redefinition of credit and debt in society illustrates the profound influence of smart devices on shaping moral and ethical considerations [33], [34]. Thus, smart devices are not only instrumental in fostering creativity but are also significant drivers of moral and ethical transformations within society.

Innovative learning ecosystems create a learning environment that nurtures creativity among students, emphasizing the importance of valuing ideas, encouraging risk-taking, and providing opportunities for creative engagement [4]. This environment plays a pivotal role in stimulating and enhancing students' creativity within classrooms, fostering goal-oriented learning, building networks of relationships, and facilitating knowledge-sharing among students across diverse fields [5].

In essence, the contemporary educational landscape recognizes creativity as a fundamental skill for addressing global challenges, fostering innovation, and promoting economic development. This is reflected in the emphasis on integrating technology, innovative teaching methods, and creative learning environments to support the development of creativity and critical thinking skills in students.

3. Methodology

To establish a robust educational ecosystem for secondary education, our research delved into foundational theoretical frameworks and systematic methodologies utilized in academic studies. This section provides a detailed exploration of the specific methods and techniques employed for data collection, analysis, and interpretation, ensuring the reliability and validity of our findings. Encompassing study design, data collection tools, sampling strategies, and analytic frameworks, our methodology offers a clear and comprehensive roadmap for replicating and understanding the outcomes of our research efforts.

3.1. Theoretical Foundation of the Innovative Learning Ecosystem

The theory of innovative learning ecosystems is approached in research construction as an ecosystem system with diverse and comprehensive factors, divided into multiple levels with varying degrees of creativity.

The ultimate goal of the innovative learning ecosystem is creative individuals and a sustainable creative education system based on intelligent technology. Therefore, the ecosystem is built on the foundation of system theory, ecological theory, connection theory, and creative theory.

System theory

A system is considered a set of interacting elements to create a specific structure or function. System theory not only focuses on analyzing the individual components of the system but also on how they interact with each other and create complex phenomena. System theory is the foundation of the structure of the innovative learning ecosystem with attributes: dominance, unity, balance, complexity, and goal orientation.

Dominance in the innovative learning ecosystem is manifested in creativity as a dominant factor that aims to differentiate this system from the existence of ordinary systems.

Unity in innovative learning ecosystems expresses the unified connection between different levels in the system. Unity is represented by a spiral helix in 3-dimensional space, with organization, coordination, and rational linkage.

Balance: The system has the nature of a living organism consisting of cycles of generation, development, and decline. Transitioning states is crucial for a system.

Complexity: The system consists of 5 main components, divided into 3 levels. Each component has its organization with complex interactions, corresponding to the 3 levels: National/District/City. Goal orientation: The innovative learning ecosystem aims for unified and specific goals.

Ecological Theory

Ecosystem, as outlined in his bioecological theory of human development, consists of four interconnected systems: the microsystem, mesosystem, exosystem, and macrosystem. The microsystem involves the immediate environment where an individual interacts directly, such as family and school [35]. The mesosystem focuses on the connections between different microsystems, like the relationship between family and school environments [36]. The exosystem includes external settings that indirectly influence the individual, such as social networks and mass media [37]. Lastly, the macrosystem encompasses the broader cultural context, including societal norms, values, and political systems [38]. Understanding and considering these interconnected systems are crucial for creating a conducive learning environment, promoting a sense of belonging in schools, and analyzing factors influencing behaviors like vaccination decisions [39].

Connection Theory

Connectionism is a theory in the field of computer science and artificial intelligence, especially in machine learning and artificial neural networks. This theory suggests that human learning and reasoning abilities and computer systems can be simulated by modeling the structure and operation of artificial neural networks. According to connection theory, computer systems process information through artificial neural networks, where neurons are connected through weighted links. When the system receives input, information is transmitted through neurons, and these links are adjusted based on input data and output results. This process helps the system learn and improve its reasoning and prediction abilities. Connection theory has played an important role in developing modern machine learning and artificial intelligence models, especially in applications such as natural language processing, image recognition, and autonomous driving.

The innovative learning ecosystem is built on the foundation of intelligent technology, and connection theory is the method of linking and operating the innovative learning ecosystem.

Creative Theory

Creative theory encompasses various perspectives on creativity, focusing on who is creative, how creativity manifests, why individuals engage in creative activities, and what constitutes creativity across different domains [40]. It involves understanding the creative process, which typically starts with a creative individual utilizing a unique approach to generate original ideas and products, often involving synthesis, analysis, and evaluation. Additionally, creative career coaching emphasizes the importance of incorporating imagination, intuition, and critical reflection into coaching practices to effectively engage clients and adapt to their specific needs, especially for "harder to help" groups [41].

Creativity is the goal and criterion for evaluating the products of the innovative learning ecosystem through creative learning subjects. The relationship of theories in shaping the innovative learning ecosystem can be seen in Figure 1.
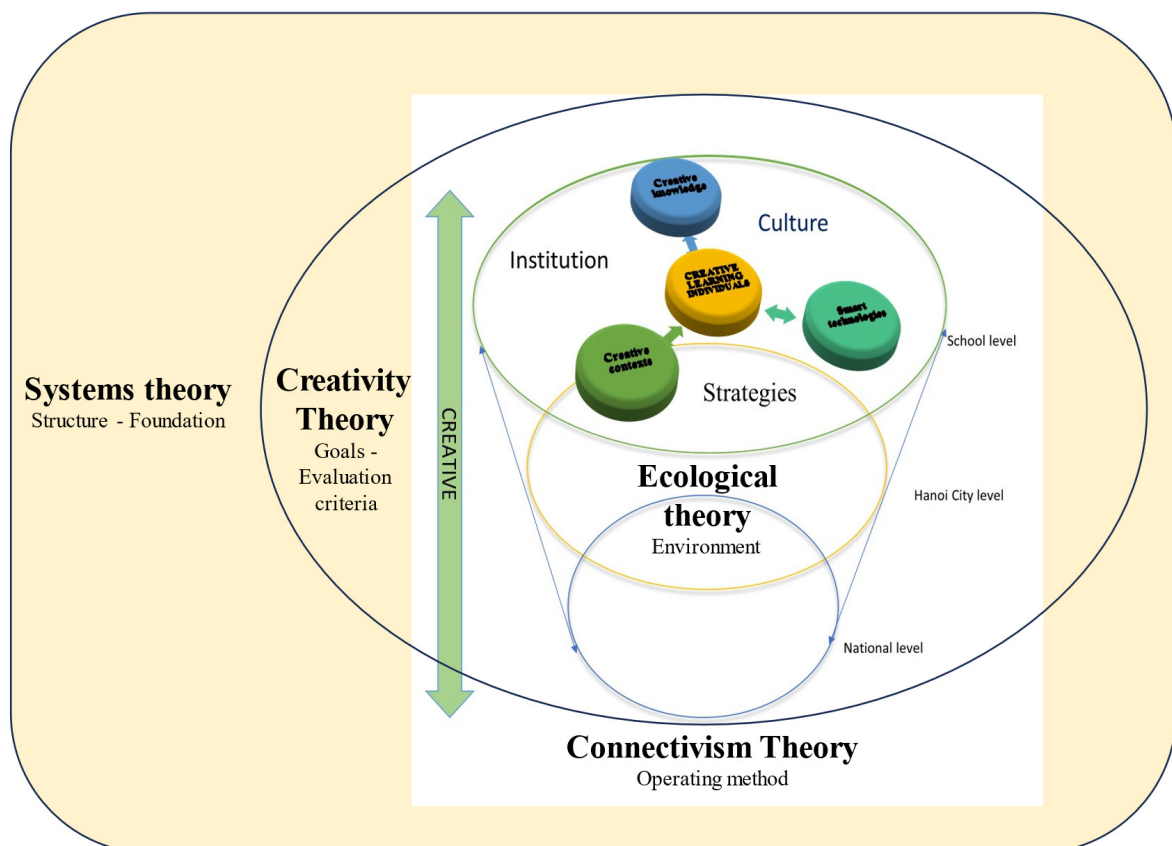

Figure 1. The theoretical foundation for building an Innovative learning ecosystem

3.2. High School Education in Hanoi, Vietnam

Hanoi, as the pioneer city in Vietnam, achieved universal primary education in 1990 and lower secondary education in 1999, establishing itself as a leader in educational standards.

With a sprawling education network encompassing over 2.2 million students, nearly 140 thousand teachers, and 2,746 preschools and schools, Hanoi boasts the largest educational infrastructure in the nation.

The city consistently leads the nation in education quality, attributable to its exceptional human resources and substantial economic investment in education, fostering a highly conducive environment for the establishment and evolution of the innovative learning ecosystem.

At the lower secondary school level, the educational focus revolves around cultivating profound knowledge and essential skills among students.

The curriculum prioritizes fundamental subjects such as mathematics, literature, foreign languages, science, history, geography, civic education, and physical education. Encouraging student participation in extracurricular activities is also paramount to enhancing social skills.

Hanoi places paramount importance on enhancing education quality by providing optimal learning environments for students. Additionally, the city is committed to fostering diversified education, encompassing both academic and vocational realms, to cater to the diverse needs of its students. Innovative teaching methods are emphasized, creating conducive conditions for students to engage in creative and effective learning. Moreover, Hanoi focuses on cultivating a positive learning environment that fosters students' confidence, creativity, and personal development. The city's educational vision extends towards comprehensive education, targeting the intellectual, spiritual, physical, and social dimensions of students.

Recognizing the pivotal stage of cognitive, emotional, and social development that high school students undergo, Hanoi emphasizes the customization of creative learning experiences to meet individual needs, interests, and aspirations. The innovative learning ecosystem designed for secondary schools in Hanoi revolves around several key components:

• Development of a curriculum incorporating interdisciplinary approaches and technology integration to foster students' innovative and problem-solving skills.

• Provision of continuous training and support for teachers to implement innovative teaching methods, integrate technology into lessons, and facilitate student-centered learning experiences.

• Promotion of active participation, collaboration, and self-directed learning through interactive activities, group projects, and opportunities for innovative expression.

• Ensuring access to modern educational facilities, equipment, and resources to facilitate learning, experimentation, and hands-on exploration.

• Establishment of partnerships with relevant stakeholders in the industry, community organizations, and cultural institutions to enrich students' learning experiences, provide real-world context, and inspire career aspirations.

In essence, the innovative learning ecosystem for secondary schools in Hanoi aims to empower students to become critical thinkers, innovative problem solvers, and lifelong learners, equipped to thrive in the dynamic global landscape of the 21st century. Implementing the innovative learning ecosystem necessitates the enactment of supportive policies prioritizing creativity, innovation, and comprehensive development in education. This includes investment in teacher training programs, workshops, and professional networks focused on innovative pedagogy, educational technology, and 21st-century skills. Engaging stakeholders in the design, implementation, and evaluation of innovative learning initiatives is crucial for ensuring their relevance and sustainability. Establishing mechanisms for monitoring progress, collecting feedback, and evaluating the impact of innovative learning interventions is essential for continuous improvement and evidence-based decision-making.

3.3. Innovative Learning Ecosystem Model for Secondary Schools in Hanoi, Vietnam

At the core of the learning activities is the learner and the innovative learning ecosystem comprises elements that impact the learner at different levels, scopes, and contexts.

School: The educational institution serves as the foundation for learning where students and teachers engage in the learning and teaching processes. It is not merely a physical location but encompasses a learning environment and relationships among members of the school community. Through schools, students gain access to the knowledge, skills, and learning experiences necessary for personal development. Additionally, schools play a vital role in building and developing societies. Schools come in various forms, each catering to different purposes and age groups including preschools, elementary schools, middle schools, and high schools.

Family: The family is the primary and crucial environment for shaping, nurturing, and educating an individual's personality. It preserves and promotes good traditional values. Factors within the family influence learners, including family members, family traditions, and the family's educational perspectives and methods.

Society and Community: This includes external entities such as organizations, institutions, groups, and individuals beyond the school. They support and collaborate with schools to organize educational activities and scientific research.

They provide opportunities for teachers and learners to participate in observation, experiential activities, internships, and research. Additionally, they contribute to creating a safe and healthy educational environment, preventing activities that may adversely affect learners. Societal and community involvement ensures that citizens within the specified age range fulfill their educational obligations to achieve universal education and complete compulsory education, enabling learners to engage in cultural, recreational, and healthy physical activities.

Society and community serve as a real-world environment that helps students enhance life skills, influencing their thoughts and actions.

3.4. Elements of the Innovative Learning Ecosystem

3.4.1. Creative Learning Individuals

The innovative learning subject encompasses individuals within the school community (teachers, students, administrators, staff), with the learner at the center of external factors. This involves the relationship between family, school, and society, organized into groups/networks centered on the learner. Creativity is expressed through the active engagement and development of innovative thinking during the learning process. Teachers demonstrate creativity in fostering innovative thinking in students, while administrative staff contributes to creating an innovative educational environment.

3.4.2. Creative Knowledge

Creative knowledge comprises the knowledge and creativity within the learning process. It represents the goals that learning subjects aim to achieve. Knowledge includes data, information, and skills acquired through practical experience or education. Creativity in this element involves a complex, diverse, and innovative learning knowledge system that meets the diverse needs of learning subjects.

3.4.3. Smart Technologies

This involves the application of knowledge, tools, and devices that allow the use of technology in education.

It addresses problem-solving in education through the utilization of information technology. Innovative creativity is reflected in the comprehensive infrastructure that meets the requirements of digital transformation in education, aiming to build smart and modern schools. Smart management systems are designed to meet educational and school needs, supporting various software for creative and integrative learning environments.

3.4.4. Creative Context

The learning context comprises various situations and scenarios related to learning needs. It includes theoretical learning, conceptual learning, skill acquisition, practical experiences, group exercises, seminars, performances, essays, reflections, and research. Creativity in this context involves designing a diverse and innovative learning environment, methods, contexts, situations, and learning projects to achieve specific goals for each educational level or subject.

3.4.5. Cultures, Innovative Institutions, and Strategies

Culture represents the characteristic features of the spirit, material, knowledge, and emotions of a society or a group of people in society. Structure refers to the regulations and laws of a social system that people must adhere to. Strategy is the process of defining the long-term basic goals of an organization, choosing ways or directions of action, and allocating essential resources to achieve those goals. Creativity in this element is the source of innovation for learning subjects, derived from the foundational cultural values of the school, local community, industry, and the cultural identity of the nation. It involves the establishment of comprehensive, scientific, and technologically advanced management documents, integrating smart technology into school operations, creating connections between management levels, and planning strategies suitable for internal and external resources with clear directions and implementation paths.

The framework model of the innovative learning ecosystem can be summarized as shown in Figure 2 below:
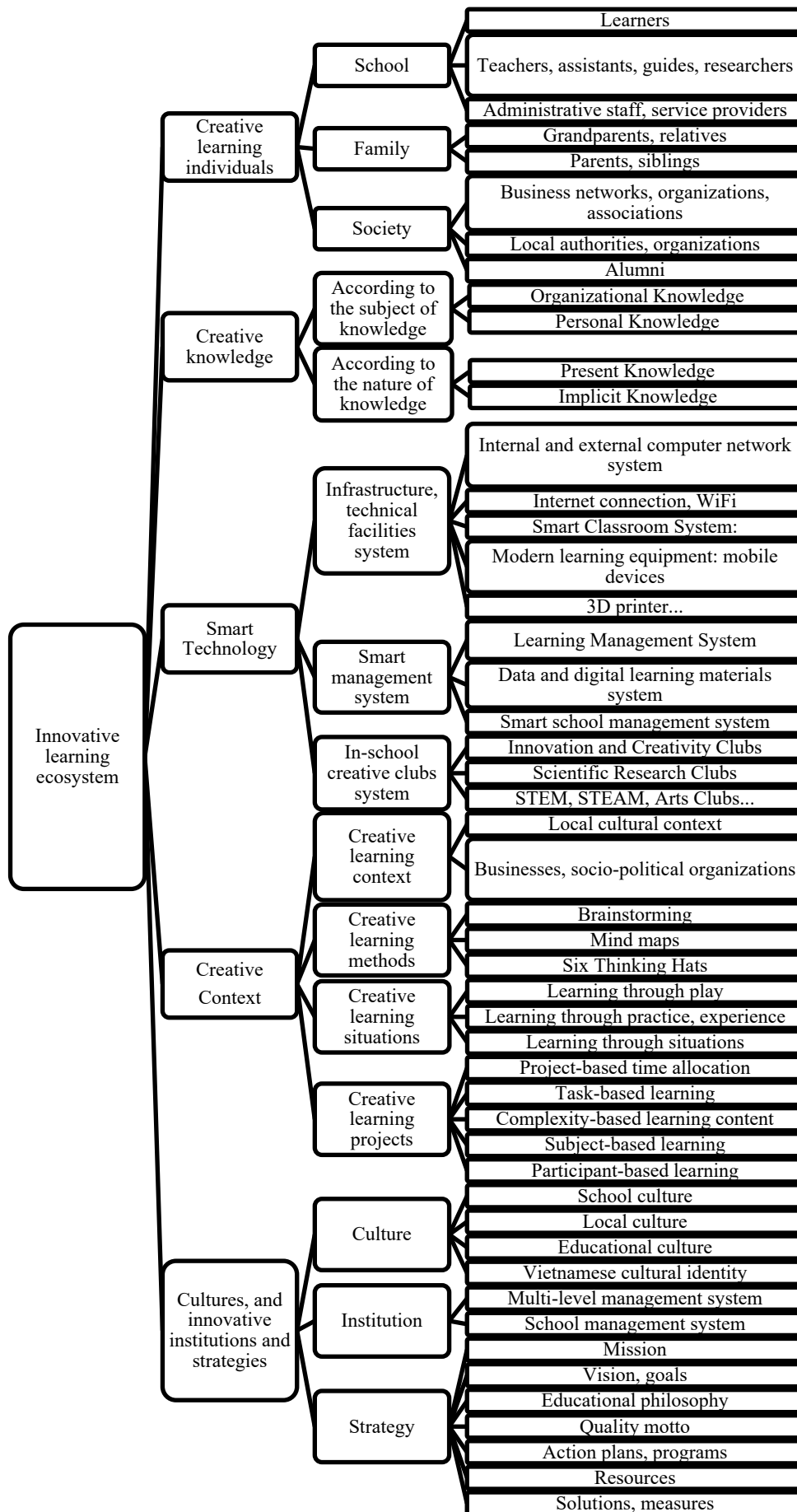
Figure 2. Innovative learning ecosystem model

3.5. Implementation Steps for Innovative Learning Ecosystem

To implement the innovative learning ecosystem, it is crucial to carry out several key components with a clear strategy. The following steps can be considered for effective implementation:

Define Vision and Strategy: Clearly articulate the objectives and target audience for implementing the innovative learning ecosystem. Establish purpose and goals, specifying targets for each participating group.

Develop a comprehensive plan: Construct a detailed plan outlining necessary steps, resources, and timelines for the innovative learning ecosystem implementation. Address factors such as infrastructure requirements, technology integration, teacher training, and learner support services [42].

Upgrade technology and infrastructure: Upgrade or acquire necessary technologies and infrastructure to support the innovative learning ecosystem. This may involve investments in hardware, software, learning management systems, and other educational technologies [43].

Train, develop, and support teachers: Organize professional development programs and training sessions for educators to familiarize them with relevant technologies and teaching methods. Focus training on integrating technology into teaching methods, designing engaging learning activities, and utilizing data analysis for personalized instruction.

Encourage student engagement in learning: Promote active participation and enthusiasm among students by incorporating interactive and collaborative learning activities within the innovative learning ecosystem. Utilize online discussion forums, virtual simulations, gamified learning experiences, and multimedia resources [44].

Implement learning data analysis and construction: Utilize tools and techniques for learning data analysis to collect and analyze student learning outcomes, participation, and academic achievements. This data can offer valuable insights for personalized guidance, early interventions, and continuous improvement of the innovative learning ecosystem.

Enhance collaboration: Encourage collaboration among departments, faculties, and relevant stakeholders within the educational institution. This could involve interdisciplinary projects, joint research initiatives, and partnerships with industries and community organizations.

Monitor and evaluate: Continuously monitor and evaluate the performance of the innovative learning ecosystem. Collect feedback from students, teachers, and other stakeholders to identify areas for improvement and make necessary adjustments for an enhanced learning experience [42].

Ensure sustainability: Develop strategies to ensure the long-term sustainability of the innovative learning ecosystem. This may include establishing policies, allocating resources, and fostering a culture of continuous innovation and improvement.

By following these systematic steps, educational institutions can successfully implement and sustain the innovative learning ecosystem, fostering an environment that nurtures innovation and learning excellence.

3.6. Benefits of the innovative learning ecosystem

An innovative learning ecosystem brings numerous advantages to individuals and society as a whole. Some of these benefits include:

Holistic development: An innovative learning ecosystem promotes holistic development by nurturing both critical thinking and creativity. It recognizes that creativity is a crucial aspect of human intelligence and fosters the development of critical thinking, problem-solving skills, and creativity alongside academic knowledge.

Improved academic outcomes: Engaging in creative activities enhances academic outcomes by providing hands-on experiences, promoting active learning, and cultivating a profound understanding of concepts. Creativity allows individuals to explore and communicate complex ideas, making learning more meaningful and memorable.

Physical and mental development: Participation in creative activities contributes to personal and physical development. Creativity provides a means to express oneself, release emotions, and reduce stress. It sets the stage for confidence, self-esteem, and the ability to cope with pressure, promoting both mental and physical well-being.

Economic and cultural development: The development of an innovative learning ecosystem contributes to economic and cultural growth. Creative industries generate economic value, create employment opportunities, and attract investments. Cultural organizations and events attract tourists, stimulate the local economy, and preserve cultural heritage. The ecosystem also fosters innovation and entrepreneurship, promoting economic development and competitiveness.

4. Conclusion

The development of an innovative learning ecosystem in secondary schools in Hanoi, Vietnam, marks a significant advancement in fostering creativity, critical thinking, and holistic student development.

The proposed model, rooted in theories of systems ecology, connection, and creativity, highlights the importance of integrating technology and creative teaching methods to create a sustainable and dynamic educational environment. However, there is currently no comprehensive model that encompasses all activities of secondary schools, including the connections between schools, families, and society. Given Hanoi's status as a UNESCO Creative City, the need for such a model is particularly urgent, underscoring the necessity for further research and development in this area to shape the future of education.

As society undergoes transformative changes driven by smart devices and human ingenuity, the importance of fostering creativity through education becomes increasingly evident. This study addresses a gap in the existing literature by proposing a comprehensive model tailored specifically for secondary schools. Key components of this innovative ecosystem include a curriculum that emphasizes interdisciplinary approaches and technology integration, continuous teacher training to support innovative pedagogies, and the promotion of active student participation through interactive activities and group projects. Additionally, ensuring access to modern educational facilities and resources is crucial for enabling hands-on exploration and experimentation.

Partnerships with industry stakeholders, community organizations, and cultural institutions further enrich learning experiences by providing real-world contexts and inspiring career aspirations. The model also underscores the necessity of supportive policies that prioritize creativity and innovation in education, alongside investment in teacher training programs and professional networks focused on 21st-century skills. For the innovative learning ecosystem to be successfully implemented and sustained, active engagement from all stakeholders in the design, implementation, and evaluation processes is essential. Establishing mechanisms for monitoring progress, collecting feedback, and evaluating the impact of innovative interventions ensures continuous improvement and evidence-based decision-making.

Ultimately, this model aims to empower students to become critical thinkers, innovative problem solvers, and lifelong learners, equipped to thrive in the dynamic global landscape of the 21st century. The findings of this study contribute to the broader understanding of educational innovation, emphasizing the crucial role of creativity in addressing global challenges and promoting economic and cultural growth. An essential element of a creative education model is providing opportunities for students to express themselves and explore their identities. This can be achieved through activities such as painting, music, arts, and composition, enabling students to unleash their creativity, develop talents, and pursue individual interests.

The study also highlights the need for innovative teaching methods to integrate intelligent learning environments into both general and contextual educational settings. The research emphasizes the importance of personalization and coordination between formal and informal learning. In the ecosystem of intelligent services, technical factors play a crucial role, contributing to the development of the ecosystem.

The research findings reveal that the innovative learning ecosystem model is structured around five key groups of elements: Subject; Knowledge; Technology; Context; Culture, structure, and strategy. Each group encompasses secondary elements with well-defined characteristics, providing a nuanced understanding of the components necessary for an effective creative learning environment. By elucidating the intricacies of these elements, the model establishes a solid foundation for secondary schools to tailor and implement specific ecosystems that align with their unique institutional contexts.

As the global landscape continues to evolve, the role of education in nurturing creativity becomes paramount. The proposed innovative learning ecosystem model not only contributes to the scholarly discourse on innovative educational frameworks but also serves as a practical guide for secondary schools in Hanoi and potentially beyond. By embracing and adapting this model, schools can actively contribute to developing a creative and dynamic society, aligning with the overarching goals of UNESCO's Creative City initiative in Hanoi, Vietnam.

5. Limitations and Recommendations

(1) Assistive technology has become an indispensable element in education. This study aims to construct a theoretical model of the innovative learning ecosystem, focusing on leveraging the strengths of technology to foster creativity in learning. However, to transition from the theoretical model to real-world application, more specific research is required.

(2) The capacities of individuals participating in the ecosystem need to be elucidated, particularly in terms of teaching methods and digital literacy.

(3) Evaluating the theoretical model of the learning ecosystem remains a research gap. Additional studies are needed to build a more comprehensive and refined model.

(4) This research emphasizes the design of a theoretical model. Therefore, future research needs to concentrate on constructing and implementing an innovative learning ecosystem model in practical settings.

References:

[1]. Subramaniam, M., & Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. *Academy of Management journal*, *48*(3), 450-463.
Doi: 10.5465/amj.2005.17407911.

[2]. Lundman, R., & Nordström, P. (2023). Creative geographies in the age of AI: co-creative spatiality and the emerging techno-material relations between artists and artificial intelligence. *Transactions of the Institute of British Geographers*, *48*(3), 650-664.
Doi: 10.1111/tran.12608.

[3]. Dimitriadou, E., & Lanitis, A. (2023). A critical evaluation, challenges, and future perspectives of using artificial intelligence and emerging technologies in smart classrooms. *Smart Learning Environments*, *10*(1), 12.
Doi: 10.1186/s40561-023-00231-3.

[4]. Fan, M., & Cai, W. (2022). How does a creative learning environment foster student creativity? An examination on multiple explanatory mechanisms. *Current Psychology*, *41*(7), 4667-4676.
Doi: 10.2991/sschd-19.2019.47.

[5]. Karakaya, A. F., & Demirkan, H. (2015). Collaborative digital environments to enhance the creativity of designers. *Computers in Human Behavior*, *42*, 176-186.
Doi: 10.1016/j.chb.2014.03.029.

[6]. Toivanen, T., Halkilahti, L., & Ruismäki, H. (2013). Creative pedagogy-Supporting children's creativity through drama. *The European Journal of Social & Behavioural Sciences*, *7*, 1168-1179.
Doi: 10.15405/ejsbs.96.

[7]. Smare, Z. (2022). The need to engage students' creative thinking in language learning classes. *TESOL and Technology Studies*, *3*(2), 18-33.
Doi: 10.48185/tts.v3i2.644.

[8]. Tabieh, A. A., Hileh, M. M., & Al-Shakea, H. M. (2020). Blended and flipped learning: Entrepreneurial teaching strategies for acquiring creative thinking skills. *Humanities & Social Sciences Reviews*, *8*(4), 745-754. doi: 10.18510/hssr.2020.8474.

[9]. Plucker, J. A., Beghetto, R. A., & Dow, G. T. (2004). Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research. *Educational psychologist*, *39*(2), 83-96.
Doi: 10.1207/s15326985ep3902_1.

[10]. Huh, K., & Lee, J. (2020). Fostering creativity and language skills of foreign language learners through SMART learning environments: Evidence from fifth-grade Korean EFL learners. *TESOL Journal*, *11*(2), e489. Doi: 10.1002/tesj.489.

[11]. Hamidi, D. Y., Wennberg, K., & Berglund, H. (2008). Creativity in entrepreneurship education. *Journal of small business and enterprise development*, *15*(2), 304-320.
Doi: 10.1108/14626000810871691.

[12]. Koro, M., & Tanggaard, L. (2022). Creative methods for creativity research (ers)? Speculations. *Review of Research in Education*, *46*(1), 324-344.
Doi: 10.3102/0091732X221090510.

[13]. Filipchuk, N., Filipchuk, S., Hutsal, O., Oleksiuk, M., & Ozymovska, H. (2022). Interactive teaching methods as a means of developing creative activity of instrumentalist students in the context of distance learning. *Scientific Bulletin of Mukachevo State University. Series "Pedagogy and Psychology*, *8*(3), 67-73. Doi: 10.52534/msu-pp.8(3).2022.67-73.

[14]. Kozmus, A. & S. Kaučič. (2022). For Creative Students, We Need Creative Teachers: The Views Of Slovenian Primary School Teachers On Promoting Creativity In The Classroom. *International Journal of Education Humanities and Social Science*, *5*(5), 78–91. Doi: 10.54922/IJEHSS.2022.0441.

[15]. Batabyal, A. A., & Yoo, S. J. (2017). A Measurement Issue Regarding the Link between a Region's Creative Infrastructure and Its Income. *SSRN*. Doi: 10.2139/ssrn.3063489.

[16]. Adekanmbi, F., & Ukpere, W. I. (2021). Stimulating creative behaviors in the work environment: influences of employee engagement, authentic leadership, and human capital factors on employee creativity. *EUREKA: Social and Humanities,(5)*, 24-33. Doi: 10.21303/2504-5571.2021.001995.

[17]. Abidin, N. R., & Anggoro, S. (2021, November). Development of Smart Paper Engineering (SMART-PEN) Thematic Media using the RADEC model to train creative skills and critical thinking elementary school students. In *ICONESS 2021: Proceedings of the 1st International Conference on Social Sciences, ICONESS 2021, 19 July 2021, Purwokerto, Central Java, Indonesia*, 329. European Alliance for Innovation. Doi: 10.4108/eai.19-7-2021.2312667.

[18]. Lister, P. (2021). Understanding experience complexity in a smart learning journey. *SN Social Sciences*, *1*(1), 42. Doi: 10.1007/s43545-020-00055-9.

[19]. Nugroho, M. N. (2016). Reorientation and Renewal of Indonesia Economy Education Curriculum Paradigm based on Creative Economy, Character Education and Local Cultural Values. In *2016 Global Conference on Business, Management and Entrepreneurship*, 37-52. Atlantis Press.
Doi: 10.2991/gcbme-16.2016.7.

[20]. Guimarães, A. D., Ribeiro, S. B., & Machado, A. F. (2021). Repercussion of the label in a comparative analysis of indicators: the case of two UNESCO Creative Cities. *Creative Industries Journal*, *14*(2), 152-168. Doi: 10.1080/17510694.2020.1796461.

[21]. Wannapiroon, N., & Petsangsri, S. (2020). Effects of STEAMification Model in Flipped Classroom Learning Environment on Creative Thinking and Creative Innovation. *TEM Journal*, *9*(4).
Doi: 10.18421/TEM94-42.

[22]. Afifa, I. N., Hasnunidah, N., & Maulina, D. (2021). Effectiveness of argument-driven inquiry (ADI) learning model on students' creative thinking skill: Environmental pollution. *Biosfer: Jurnal Pendidikan Biologi*, *14*(1), 1-12. Doi: 10.21009/biosferjpb.17316.

[23]. Prawiyogi, A. G., Aini, Q., Santoso, N. P. L., Lutfiani, N., & Juniar, H. L. J. (2021). Blockchain education concept 4.0: Student-centered ilearning blockchain framework. *JTP-Jurnal Teknologi Pendidikan*, *23*(2), 129-145. Doi: 10.21009/jtp.v23i2.20978.

[24]. Sawyer, K. (2015). A call to action: The challenges of creative teaching and learning. *Teachers College Record*, *117*(10), 1-34. Doi: 10.1177/016146811511701001.

[25]. Lou, S. J., Chung, C. C., Dzan, W. Y., & Shih, R. C. (2012). Construction of a creative instructional design model using blended, project-based learning for college students. *Creative Education*, *3*(7), 1281. Doi: 10.4236/ce.2012.37187.

[26]. Fan, M., & Cai, W. (2022). How does a creative learning environment foster student creativity? An examination on multiple explanatory mechanisms. *Current Psychology*, *41*(7), 4667-4676. Doi: 10.1007/s12144-020-00974-z.

[27]. Running, D. J. (2008). Creativity research in music education: A review (1980–2005). *Update: Applications of Research in Music Education*, *27*(1), 41-48. Doi: 10.1177/8755123308322280.

[28]. Barbot, B., Besançon, M., & I Lubart, T. (2011). Assessing creativity in the classroom. *The Open Education Journal*, *4*(1). Doi: 10.2174/1874920801104010058.

[29]. Saptono, A., Purwana, D., Wibowo, A., Wibowo, S. F., Mukhtar, S., Yanto, H., ... & Kusumajanto, D. D. (2019). Assessing the university STUDENTS'ENTREPRENEURIAL intention: Entrepreneurial education and creativity. *Humanities & Social Sciences Reviews*, *7*(1), 505-514. Doi: 10.18510/hssr.2019.7158.

[30]. Hui, A. N., & Lau, S. (2010). Formulation of policy and strategy in developing creativity education in four Asian Chinese societies: A policy analysis. *The Journal of Creative Behavior*, *44*(4), 215-235. Doi: 10.1002/j.2162-6057.2010.tb01334.x.

[31]. Cater, J. J., Young, M., Al-Shammari, M., & James, K. (2022). Re-exploring entrepreneurial intentions and personality attributes during a pandemic. *Journal of International Education in Business*, *15*(2), 311-330. Doi: 10.1108/JIEB-04-2021-0050.

[32]. Makel, M. C. (2009). Help us creativity researchers, you're our only hope. *Psychology of Aesthetics, Creativity, and the Arts*, *3*(1), 38. Doi: 10.1037/a0014919.

[33]. Sui, J., & Mo, T. (2022). Morality in the era of smart devices. *International Journal of Emerging Markets*, *17*(4), 1107-1122. Doi: 10.1108/IJOEM-06-2021-0917.

[34]. Marambio-Tapia, A. (2023). The evolving moral economy of indebtedness in Chile: resignifying credit and debt in the oldest neoliberal society. *Journal of Consumer Culture*, *23*(2), 409-427. Doi: 10.1177/14695405221100383.

[35]. Tudge, J. R., Merçon-Vargas, E. A., Liang, Y., & Payir, A. (2022). The importance of Urie Bronfenbrenner's bioecological theory for early childhood education. In *Theories of early childhood education*, 50-61. Routledge. Doi: 10.4324/9781003288077-5.

[36]. El Zaatari, W., & Maalouf, I. (2022). How the Bronfenbrenner bio-ecological system theory explains the development of students' sense of belonging to school?. *SAGE Open*, *12*(4), 21582440221134089. Doi: 10.1177/21582440221134089.

[37]. Arrieta-Villarreal, J. L., Guzmán-Saldaña, R., & Lerma-Talamantes, A. (2022). El modelo ecológico de Bronfenbrenner-Morris como marco explicativo de los factores que inciden en la vacunación versus COVID-19. *XIKUA Boletín Científico de la Escuela Superior de Tlahuelilpan*, *10*(19), 51-52. Doi: 10.29057/xikua.v10i19.8219.

[38]. Amali, N. A. K., Ridzuan, M. U. M., Rahmat, N. H., Seng, H. Z., & Mustafa, N. C. (2023). Exploring learning environment through Bronfenbrenner's ecological systems theory. *Journal of Academic Research in Progressive Education and Development*, *12*(2), 144-162. Doi: 10.6007/IJARPED/v12-i2/16516.

[39]. Dharma, D. S. A. (2022). Membaca peran teori ekologi bronfenbrenner dalam menciptakan lingkungan inklusif di sekolah. *Special and Inclusive Education Journal (SPECIAL)*, *3*(2), 115-123. Doi: 10.36456/special.vol3.no2.a6642.

[40]. Kanematsu, H., M. Barry, D., Kanematsu, H., & Barry, D. M. (2016). Theory of creativity. *STEM and ICT education in intelligent environments*, 9-13. Doi: 10.1007/978-3-319-19234-5_2.

[41]. Beghetto, R. A., & Kaufman, J. C. (2022). Theories of creativity. In *Creativity and Innovation*, 23-36. Routledge. doi: 10.4324/9781003233923-3.

[42]. Jeladze, E., & Pata, K. (2018). Smart, digitally enhanced learning ecosystems: Bottlenecks to sustainability in Georgia. *Sustainability*, *10*(8), 2672. Doi: 10.3390/su10082672.

[43]. Gupta, S. K., & Sengupta, N. (2021). Webinar as the future educational tool in higher education of India: A survey-based study. *Technology, Knowledge and Learning*, *26*(4), 1111-1130. Doi: 10.1007/s10758-021-09493-7.

[44]. Sharma, B. N., Nand, R., Naseem, M., Reddy, E., Narayan, S. S., & Reddy, K. (2018). Smart learning in the Pacific: Design of new pedagogical tools. In *2018 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE)*, 573-580. IEEE. Doi: 10.1109/TALE.2018.8615269.