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Education Policy Strategies and Applications for Metaverse Environments in Teaching

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Abstract

Research Objectives and Problems: The focus of this research is the virtual learning environment, which is a priority in developing new learning strategies. The aim is to analyze the process to describe policies related to changes in learning environments. The research objectives include examining theoretical approaches to modeling virtual learning environments and highlighting the signs of change in virtual teaching/learning environments from various perspectives. The research focuses on how virtual teaching and learning environment modeling is contextualized within the evolving Lithuanian education policy. This study explores questions regarding the perception of changes in learning environments and the key trends shaping virtual learning within the framework of new education policies.

Research Methods: This study employs a combination of literature analysis and semi-structured focus group interviews to gather insights from teachers,

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education experts, and policymakers. The findings offer a deeper understanding of the virtual teaching and learning environment modeling process and its implications for educational policy and practice.

Structure of the Article: The paper is structured into five main sections: an introduction, a literature review, a methodology description, an analysis of the main findings, and a discussion and conclusions section. A list of references is provided at the end.

Research Findings and Their Impact on Educational Sciences: This research explores the modeling of virtual teaching and learning environments and its implementation within educational contexts. As schools navigate a rapidly evolving world, understanding and shaping virtual learning environments is crucial. The study aims to analyze the process of modeling virtual teaching and learning environments, particularly in terms of the inclusive and operationalizing context of open learning spaces, content elements, and learning styles. Through a reflexive approach, the paper investigates how modern schools are transitioning toward more organized teaching and learning services and identifies new directions in skill development, knowledge acquisition, learner networking, and value creation. The virtual teaching and learning environment is presented as a central vision for learner-centered education, promoting personalized learning, diverse learning styles, and trust-based learning cultures.

Conclusions and Recommendations: Lifelong learning emerged as a central theme across all concept maps. This cluster was not only deemed pivotal for the future of learning but also served as a unifying element for other clusters. According to experts, the anticipated shifts in learning strategies and approaches are closely tied to the notion that skills and competencies will increasingly be acquired through lifelong learning.

***Keywords*:** metaverse, digital learning environment, learning policy, curriculum contexts, educational policy, teaching

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Introduction

Discussions on shifts in the educational landscape are often led by politicians and educational experts who seek to characterize these changes, establish a framework for understanding them, and integrate them into ongoing educational reform efforts (Affouneh et al., 2020; Dhawan, 2020). In response, education policymakers work to shape visions of how teaching and learning should progress. These narratives are crafted by experts and function to promote specific ideologies for educational reform. By exploring these representations, we see a continual reshaping of educational settings, presenting a modality framework that provides meta-theoretical tools for describing and categorizing the learning environment, thereby defining key contextual dimensions.

Changes in educational spaces reflect shifts in prevailing paradigms. As Dhawan (2020) and Donahoe et al. (2019) suggest, these changes constitute a socially conceptualized domain, aiming to delve into subjective interpretations and constructs. This analysis aligns with social phenomenology, explaining how educational shifts are perceived in policymaking discourse and within broader social groups. Bourdieu's perspective on social phenomenology is particularly relevant here, as it highlights how practical knowledge and everyday understanding contribute to a knowledge-based society (Martin, 2020; Affouneh et al., 2020).

Preliminary investigations into perceptions of the educational environment reveal that influential perspectives shape general views on these settings and the culture of change around them. Mehall (2020) argues that the evolution of educational environments is shaped by the definitions and semantics of space, where group identities adapt to and are transformed by spatial dynamics. Memory, which helps delineate the meaning of spaces, plays a pivotal role in this relationship, providing an ideological framework to understand the educational environment.

Europe's 2030 Strategy (EC, 2010) recognizes the need for smart, sustainable, and inclusive growth to stay competitive and address contemporary challenges. Achieving these aims requires investing in citizens' skills and competencies. Thus, a key goal for Europe's 2030 Strategy (EC, 2010)

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includes modernizing education and training systems. With rapid technological and socio-economic changes, learning strategies and structures have evolved significantly over the past two decades (Affouneh et al., 2020; Mehall, 2020), prompting new approaches to knowledge, communication, and learning methods that align with emerging competencies (Mehall, 2020). Understanding how these opportunities evolve within educational spaces is essential to advising policymakers as they plan reforms from 2013 to 2022.

Preparing students for future societal roles requires anticipating essential competencies and how they will be nurtured within a student-centered virtual learning environment (Huang et al., 2020). This study thus seeks to address a central research question: how the development of virtual teaching and learning environments is situated within evolving Lithuanian educational policies. The study is guided by the following research questions: (i) How are changes in the learning environment discussed in policy discourse? (ii) What are the significant trends in virtual learning as new policies take effect in education?

This research centers on the virtual learning environment as a key element in applying modern educational strategies. Its purpose is to examine the development process of virtual learning spaces within schools, emphasizing policy perspectives on educational environment changes.

Research objectives

1. To investigate theoretical frameworks for designing a virtual learning environment.
2. To identify indicators of change within the virtual teaching and learning environment from the perspectives of general education teachers, education leaders (school administrators), and policymakers (education department officials).

The study used two main methods for data collection: a scientific literature review to explore theoretical foundations of virtual learning

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environment design and semi-structured focus group interviews to capture practical insights into changes and their manifestations in general education. The focus group data's validity and reliability were supported by an adequate sample size, participant homogeneity, and questions grounded in relevant academic literature.

This article relies on research from general education schools to provide a clearer understanding of participants' viewpoints. For assembling the reference list, AI tools like Copilot and Litmaps were utilized to align with the standards of the chosen citation style.

Praxeology of Change in the Teaching/Learning Environment: New Virtual Environment Modeling Approaches

Europe is increasingly recognizing that learning within a fully digitalized, networked knowledge society will differ fundamentally from traditional learning methods. Advances in information and communication technologies (ICTs), combined with socio-economic and demographic changes, are creating not only new learning opportunities but also a demand for new skills essential for work, education, self-development, and active societal participation (Affouneh et al., 2020; Mehall, 2020; Dhawan, 2020; Donahoe et al., 2019).

The process of shaping virtual teaching and learning environments is driven by a vision of digital literacy, which includes acquiring skills to effectively navigate and engage in these digital spaces. Beyond familiarity with ICT tools, digital literacy also requires advanced cognitive skills for full engagement. Key competencies include the ability to search, assess, organize, and effectively utilize digital information and resources. This encompasses structuring knowledge according to individual needs and creating personalized systems for tracking and managing information.

In a connected knowledge society, communication is also highly valued, with interaction skills becoming an essential component of digital literacy. Through ongoing participation in ICT-supported virtual learning environments and through interactions with peers and mentors,

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individuals develop both technical and communication skills. These competencies are integral to lifelong learning and are continuously reinforced through engagement in virtual learning spaces, supporting the development of comprehensive digital literacy (Huang et al., 2020).

Policy Guidelines for Virtual Teaching/Learning Environment Modeling

Policymakers and stakeholders in Europe largely agree that achieving key policy objectives—such as enhancing competitiveness, promoting growth, increasing employment, and strengthening social cohesion—requires fundamental changes in education and training. This vision aligns with the Lisbon Strategy goals (ES 2000; E&T 2010). Education, along with research and innovation (the "knowledge triangle"), is seen as essential for creating a competitive and inclusive knowledge-based society. ICT, in particular, plays a critical role in these transformations, as virtual learning environments increasingly rely on it as a core or supplementary tool. Although technology alone cannot drive change, the impact of ICT becomes significant within a social, economic, and organizational landscape that encourages innovation and is supported by progressive policy (Punie & Cabrera, 2006; Donahoe et al., 2019).

The main focus is on how to integrate these new demands into Europe's formal education and training systems. Many agree that substantial advancements in educational reforms are still required to accelerate the knowledge society's growth (Donahoe et al., 2019; Mehall, 2020). Learning contributes greatly to personal growth, social development, and self-expression, making skills like critical thinking, social skills, and collaboration even more crucial. As the nature of information and knowledge evolves, so does the concept of essential skills and methods for acquiring them. In today's networked society, knowing where and how to find information, who can access it, and understanding its relevance are vital. Social skills and "relationship capital" are also becoming integral parts of digital literacy in the knowledge economy, especially

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as web 2.0 and social computing applications expand (Dhawan, 2020; Mehall, 2020; Huang et al., 2020). Various European stakeholders are now focused on defining the digital literacy and skills needed for full participation in the digital age and to keep educational institutions competitive. These skills are categorized into ICT work skills, ICT user skills, and e-business skills (COM, 2007).

As society becomes more digital, ICT user skills are essential for everyone. While younger generations tend to be more adept with technology, simply knowing how to use ICT is not enough; it is equally important to grasp its applications in new work and communication methods. These are the foundational skills needed to succeed in a knowledge-based society. Recognizing this, the European Commission has incorporated digital literacy into the "key competences" for lifelong learning, a set of skills promoting personal growth, active citizenship, social inclusion, and employability (Mehall, 2020; Donahoe et al., 2019). Digital literacy encompasses the skilled, thoughtful use of Information Society Technologies (ISTs) in work, recreation, and communication, building on foundational ICT skills such as gathering, evaluating, organizing, presenting, and exchanging information, and collaborating through online networks (COM, 2007). This article explores the competencies that make up the digital literacy necessary for effective learning in a knowledge-based society.

Modeling a Virtual Learning Environment: A Vision for Learning in a Knowledge Society

As educational institutions adapt to new learning models, ICT plays a pivotal role in redefining education for a knowledge-based society. Virtual learning environments (VLEs) embody a forward-looking vision for education that demands both fundamental ICT skills and the cultivation of new competencies. In this framework, ICT serves as a central, though not exclusive, catalyst for the development of these environments, which are crafted to be interactive and personal rather than solely digital constructs. Despite shifting educator roles, leadership and communication

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remain essential elements (Mehall, 2020; Huang et al., 2020). VLEs are envisioned as dynamic, learner-centered spaces that position education as a collaborative social experience. These environments exhibit several core characteristics:

- *VLEs as Personalized Digital Spaces:* Learners and educators have access to tailored digital learning environments, accessible anytime and across devices, providing resources that support lifelong learning outside of traditional settings. This personalized approach fosters self-confidence and personal growth, allowing learners to customize their educational journey and present their skills securely online (Martin, 2020; Dascala & Maghiros, 2007).
- *VLEs as Social and Interactive Spaces:* These environments bring together various participants—students, educators, family members, and experts—fostering collaboration and sharing through a mix of real-time and asynchronous communication channels. This interaction allows students to connect with mentors and experts globally, promoting self-directed learning that blends real-world insights with academic concepts (Martin, 2020; Mehall, 2020; Huang et al., 2020).
- *Trust-Centered VLEs:* Trust is integral to VLEs, as it supports open communication, critical thinking, and secure knowledge exchange. While private VLEs protect sensitive information, public certification systems validate the expertise of those providing instruction, establishing a trusted foundation for learning (Donahoe et al., 2019; Mehall, 2020).
- *Flexible and Engaging VLEs:* Adapting to diverse learning styles, VLEs accommodate a variety of instructional formats—such as video lessons, group projects, or self-study. This flexibility helps bridge formal, informal, and self-directed learning, catering to the needs of individuals and communities alike.
- *Certification Opportunities in VLEs:* In addition to formal certification, VLEs offer recognition from informal networks, peers, and tutors, accommodating different learning experiences and reinforcing lifelong learning. Learners can showcase their achievements in personal portfolios, documenting skills acquired through their digital environment.

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- *Controlled and Accessible VLEs:* Open access allows learners to engage at their convenience with modular systems that encourage reflection and review. These environments can simulate complex tasks or scenarios, offering safe practice spaces for skill development, particularly in ICT literacy.
- *VLEs as Knowledge Management Systems:* VLEs provide a structured means for learners to manage resources and knowledge by linking personal spaces with others. This facilitates collaborative growth and fosters connections that support both individual and institutional learning.
- *Inclusive VLEs:* Designed for accessibility, VLEs welcome people of diverse backgrounds, abilities, and languages, offering flexible learning paths that cater to various needs. These environments emphasize social interaction and enable digital literacy for learners from all walks of life.

Strategic VLE Modeling

To achieve the full potential of VLEs, strategic changes are needed across educational structures, accreditation processes, and institutional support. A holistic understanding of VLE design includes three interrelated dimensions: personal and social skills, learning design, and learning structure. These components are fundamental for aligning personal engagement with the digital tools necessary to foster inclusion and innovation.

- *Learning Design:* This approach accommodates diverse talents, allowing people to align learning with personal goals and self-directed study. ICT-based environments support situational learning and real-world application, though effective integration also requires educators to adapt to evolving roles and facilitate open, innovative learning cultures (Mehall, 2020; Martin, 2020; Dhawan, 2020).
- *Teaching and Learning Structure:* Enabling open access to educational resources requires substantial institutional collaboration. While

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educational change is challenging, involvement across the entire educational ecosystem—from students and educators to technology providers and policymakers—is essential for systemic progress (Punie & Cabrera, 2006; Martin, 2020; Donahoe et al., 2019).

- *Inclusion:* Ensuring broad access to technology and digital literacy is vital. For inclusive learning environments, barriers such as limited access to computers and internet skills must be addressed. ICT-based learning initiatives linked with social inclusion efforts can provide opportunities for disadvantaged individuals to re-engage with education (Punie & Cabrera, 2006; Martin, 2020).

Therefore, the vision for VLEs relies on user-friendly technology and equitable access, laying the foundation for lifelong learning that is inclusive and adaptable to diverse learners' needs.

Research Methods and Methodology

This study adopted a qualitative research approach aimed at exploring perspectives from those actively engaged in the educational process. A semi-structured focus group interview method was applied (Denzin & Lincoln, 2017), involving discussions with educational experts (N = 10), teachers (N = 100), and policy-makers (N = 10) during public consultations and seminars. This approach served two main purposes: first, to foster discussion and gather insights grounded in practical experience, and second, to create a reflective educational environment where participants could voice opinions and consider potential personal contributions and collaborative opportunities for improvement (Denzin & Lincoln, 2017). During the discussions on virtual teaching and learning environment modeling, the group dynamics offered additional qualitative insights. Concept maps were also created, illustrating key shifts in learning strategies and the adaptive responses of educational systems to evolving challenges. Each vision developed by participants had its unique emphasis, collectively contributing to a comprehensive and adaptable model where technological

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trends and socio-economic factors impact teaching and learning approaches. This research, conducted in May 2021, highlights several aspects relevant to future studies on changes within educational environments.

Research Process and Key Findings

The study's primary research questions were carefully crafted beforehand. During focus group sessions, all participants were actively engaged, encouraged to share their thoughts, and given the chance to respond to open-ended questions, which often centered on their roles and experiences. This qualitative exploration of virtual learning environment modeling shed light on stakeholders' perspectives regarding the virtual learning landscape, revealing their expectations and attitudes.

Teachers' Perspectives on Changes in Education

In the study, teachers were asked to identify notable changes within school-based education. Their responses were organized into clusters, each with subtopics, to categorize the primary transformations within the overarching theme of optimizing the learning process (Table 1).

Table 1. Contexts for changes in the learning process

Category	Subcategory	Contextual learning
Changes in the learning process	Learning objectives	"Promoting values, respect, diversity…"; "Learning 'how' instead of 'what'"; "A new balance between content and competencies…"; "Learning about one's own culture and the culture of others…"
	Learning methods	"task-based learning"; "learning by doing"; "interactive learning"; "understanding the subject matter, not just receiving information…"; "practical, not just abstract, learning."
	Learning roles	"reduced hierarchy"; "students develop their knowledge individually, under the guidance of a teacher"; "teachers are moderators"; "teachers are not the owners of information."
	Student-centered learning	"learning is more individualized"; "greater account is taken of individual progress"; "constructive learning"; "specially adapted for pupils."
	Learning spaces	"a high-tech environment"; "ICT employed everywhere, not just at school"; "mobile technologies"; "iPads for every learner"; "learning should be open to the public."
	Learning links	"global learning"; "involving the local community."

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Upon comparing the research findings to primary educational objectives, it becomes apparent which priorities should shape education policy to enhance learning quality by 2022. The *Strategic Framework for Education* (2014) identifies several actions to improve the effectiveness and alignment of efforts to enhance the learning process. Key among these actions is promoting a student-centered approach, focusing on personalized learning (e.g., "more individualized attention" and "emphasis on individual progress"), fostering global and community engagement, and upholding principles of social justice, inclusivity, and equitable access to education. Consequently, learning quality becomes central, supported by the integration of inputs, processes, environments, and outcomes that collectively enhance the learning experience (Donahoe et al., 2019).

Two primary levels are noted: the internal level, where students learn within a structured environment (e.g., "individual knowledge building with teacher guidance"), and the external level, representing the broader education system that supports and facilitates learning (e.g., "learning 'how' over 'what,'" and balancing content with competencies). Within this model, educational organizations focus on centering the student experience.

At the student level, learning materials and tools are adapted to reflect modern societal and individual needs. Teachers are therefore increasingly incorporating: 1) active learning strategies, emphasizing experiential and hands-on approaches, collaboration, and evidence-based activities, where students construct their own knowledge through tasks and peer communication. This student-centered learning model adapts to individual progress and needs, shifting traditional teacher roles towards mentoring, while students engage in collaborative, self-driven learning; 2) revised learning objectives, highlighting skills alongside knowledge, and fostering competencies that emphasize respect, cultural understanding, and responsibility, which have become vital in a highly connected and information-rich world; and 3) the development of new learning environments and contexts. Learning goals now call for dynamic and adaptable virtual environments that connect learning to both local

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and global contexts, supporting collaboration and removing physical and virtual boundaries. This holistic, socially connected learning environment integrates community relevance.

In the consultation's second phase, teachers discussed key competencies necessary for future learners. The identified competencies largely align with those prioritized across Europe, affirming their continued importance. However, participants suggested ways to refine these competencies for the future, such as expanding digital literacy to incorporate ongoing online engagement and versatile communication tools (e.g., Web 2.0, digital identity management).

Teachers highlighted the importance of multifaceted learning strategies in response to the rapid expansion of information and technological advances. In the 21st century, new learning needs necessitate that individuals in any field can identify, understand, and address emerging problems, applying knowledge adaptively in varied situations.

Insights from education experts (school heads, N = 10) on changes in teaching and learning environments were also gathered, providing a broader perspective on national learning trends. When juxtaposed with teachers' school-focused feedback, several shared themes emerged. Both teachers and experts identified technological change as a major force influencing educational transformation. Central to both perspectives are key shifts in learning strategies, focusing on competencies and attitudes rather than solely on knowledge. They prioritize learner-centered approaches, personalized learning, and collaboration-based strategies that transform both student-teacher dynamics and integrate learning into real-world contexts (Table 2).

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Table 2. Contexts for changes in the learning system

Category	Subcategory	Proving statements
Changes in the learning process	Socio-economic trends (*Lifelong learning*)	*"Increasing importance of lifelong learning, but also the separation of institutions"; "Balance between primary education and training, and lifelong learning"; "More reliance on lifelong learning"; "Personal lifelong learning becomes an advantage"; "New ways of learning will emerge, tailored to future skills-related needs in line with the demands of the labor market";*
	Learning processes and strategies: assessment, personalization	*"There will be more research-based learning, the development, testing, and continuous improvement of personal theories"; "New models of assessment (especially formative assessment)"; "Personalization of learning strategies"; "Less unnecessary skills and expertise will be required from students when learning"; "Holistic learning management"; "Learning in project teams."*
	New skills: collaboration	*"Learning from peers will be part of the learning process"; "The market will decide what we will need to learn (loss of knowledge about our cultural heritage)"; "The need to learn how to educate oneself"; "Need for multiple skills (multidisciplinary and 'do-it-yourself' practice)"; "Problem-solving and adaptation skills"; "Focus on knowledge creation"; "Skills development takes precedence over knowledge."*
	The science of educating oneself	*"To integrate, test, and continuously improve"; "Teachers will be more involved in team training activities"; "Leadership-based learning."*
	New strategies and technologies	*"Strong artificial intelligence."*
	Learning with technology	*"High-quality digital learning environments"; "Learning without physical classrooms"; "Augmented reality and innovative modeling"; "Learning motivation will be based on social networks"; "... Mobile tools will be a substitute for learning and memory"; "Mobile tools support learning."*
	Content and education programs	*"The content and environment of learning will change"; "A proportionately growing knowledge base."*

Education experts are envisioning a rapidly transforming world where the principles of integration, collaboration, coordination, and personalization will become essential strategies for equipping citizens with the skills and mindsets necessary for active, meaningful participation in society. In this emerging framework, individuals are not only prepared to engage with current social and professional landscapes but are also empowered to adapt to ongoing shifts in these environments. Recognizing the diverse skills needed in a dynamic world, experts emphasize that educational systems must now prioritize creating environments that foster adaptability, creativity, and resilience among learners.

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According to experts, education and training institutions are undergoing a profound evolution, shifting from traditional, isolated learning models into interconnected "learning communities." These communities are designed not only to deliver knowledge, but also to engage directly with industry and employers. Through these partnerships, educational institutions can better identify and respond to specific skill demands in the workforce, thereby tailoring learning experiences to meet both societal needs and individual aspirations. This collaboration between learning institutions and employers results in more targeted, practical learning opportunities, helping students acquire relevant skills that enhance their employability and social contribution.

In the idealized future teaching and learning environment, as described by education specialists, a highly flexible and inclusive approach to learning prevails. This future envisions a diverse array of learning opportunities accessible to all, with resources readily available and adaptable to the unique needs, interests, and backgrounds of each learner. In such an environment, learners are encouraged to direct their educational journey, accessing a broad spectrum of freely available resources that enable them to learn at their own pace and in a manner best suited to their individual preferences.

Insights gathered from education policymakers, specifically municipal education department specialists, reflect a similar commitment to the principles of flexibility and inclusivity within the educational system. These policymakers recognize that to achieve effective systemic educational change, there must be a deliberate shift in focus from traditional, standardized approaches to more holistic and adaptive models that support lifelong learning (Table 3). Such a system would actively dismantle barriers to access, ensuring that students of all backgrounds have equal opportunities to learn and thrive. Furthermore, the incorporation of new technologies and digital learning tools would enhance the accessibility and personalization of learning experiences, supporting students in shaping their own learning paths.

The systemic changes outlined by policymakers indicate a growing understanding of the complex nature of modern education, where

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learning extends beyond formal institutions and becomes a continuous, life-spanning endeavor. This reformed system would promote not only academic excellence but also social equity and inclusion, cultivating an educational environment where diverse learners can come together, exchange perspectives, and build on shared experiences. Ultimately, the envisioned model of education aims to create a society where knowledge is not confined to the classroom but accessible everywhere, preparing citizens to engage meaningfully and effectively in an ever-evolving world.

Table 3. Contexts of systemic changes in education

Category	Subcategory	Proving statements
Contexts of systemic changes in education	Institutions	*"more integrated into the world"; "accessible to the needs of pupils and society"; "the boundaries of formal and informal learning are exceeded."*
	New skills	*"technological, digital literacy skills";*
	Compatibility of education and training with labor market objectives	*"matching programs to the needs of the labor market"; "improving the transition from training to the labor market"; "employees are more involved in education and training."*
	Technologies	*"ICT will be commonplace and integrated into the education program.";*
	Challenges	*"implementation gap"; "to respond to technological and demographic changes."*

Like teachers and education experts, policy-makers recognize technology as a key force driving transformation in the learning environment. They suggest that as personalization and collaborative learning methods become more widespread, both teachers and students will have greater opportunities to design learning experiences tailored to individual needs, while remaining adaptable to ongoing societal shifts. Policy-makers emphasize that although the current core competencies will continue to hold value, the future will see a heightened focus on the skills and attitudes cultivated through lifelong learning, rather than solely on the accumulation of knowledge.

Policy-makers anticipate that learning will increasingly align with labor market demands, with curricula, content, and learning goals being

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more directly connected to the skills required in the workforce. They argue that the labor market should play a more proactive role in shaping and updating educational programs, thereby smoothing students' transition from education and training into the job sector. Education and training institutions, according to policy-makers, will need to enhance transparency, be more publicly accountable, and responsive to the evolving needs of learners. Additionally, they advocate for greater recognition of non-formal learning activities as part of a more inclusive educational system.

A central challenge for the future of education, policy-makers note, is closing the "implementation gap," which requires turning longstanding insights and recommendations into effective action (Mehall, 2020; Dhawan, 2020). This task will be complex, given expected budget constraints, rapid technological advancements, and shifting demographics. Furthermore, barriers to adopting innovative learning strategies—such as ethical concerns around data privacy and inadequate or misaligned teacher training—must be addressed to enable meaningful, lasting educational reforms.

Discussion and Conclusions

The preferences of teachers, experts, and policy-makers were carefully compiled and analyzed, utilizing multidimensional scaling and hierarchical cluster analysis to reveal the structure of the resulting data. Experts organized the various statements on a concept map, where each item's placement reflected its relationship to others, either by proximity or distance. Through an analysis of the content across groups (clusters), four broad directions were identified.

The first cluster group illustrates anticipated changes in formal education. Experts project that educational institutions will shift towards being more empowering and interconnected within an increasingly globalized education market. Informal skills will receive greater recognition and will be more seamlessly integrated into qualification frameworks, aligning educational outcomes with the needs of modern careers.

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A significant trend observed within this cluster is a shift in responsibility for competency acquisition from institutions to individual learners, fostering a culture of self-directed learning.

The second cluster highlights a growing role for teachers as mentors, guiding learning strategies that cater to both individual and professional growth. At the core of these concept maps lies the theme of lifelong learning, which not only plays a central role in the future of education but also connects all clusters. Experts emphasize that future learning strategies and skill development will hinge on lifelong learning, allowing individuals to continuously adapt in a world that values ongoing skill renewal. The role of Information and Communication Technology (ICT) is underscored in shaping future learning landscapes. While all groups acknowledge the evolving nature of learning models influenced by ICT, three groups explicitly demonstrate that new technologies are central to developing future learning strategies. Among the anticipated transformations, several key changes stand out: learning will increasingly center on student engagement, with personalized and socially oriented approaches tailored to meet the needs of individuals. ICT will facilitate innovative pedagogical methods, such as experiential and inclusive learning, which integrate both social and cognitive processes into the learning journey. This requires educational institutions to be agile and responsive, offering learning opportunities that are embedded into daily life and accessible to all citizens.

A particularly noteworthy outcome of the research is the profound impact of ICT on future learning strategies. Experts anticipate that ICT will play a transformative role, not only as a tool but as an essential infrastructure in both society and education. With advancements in high-quality, mobile, and affordable technologies—as well as the emergence of user-friendly, customizable, and secure applications—the integration of ICT into everyday life will be seamless. Experts foresee potential developments in sophisticated technologies, such as inclusive 3D learning environments and powerful AI applications, which could drive further changes by making personalized and adaptive learning tools widely available.

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The rise of adaptable and integrated technological solutions will underscore the importance of new skills. Evolving communication and interaction patterns will prioritize interpersonal abilities, including communication, collaboration, and problem-solving skills. With vast amounts of information at everyone's fingertips, metacognitive skills—such as critical thinking, self-reflection, and effective information management—will be crucial (Martin, 2020; Mehall, 2020). The ability to navigate complex learning environments will also require self-determination, resilience, creativity, and an entrepreneurial mindset to actively manage one's personal and professional growth.

ICT will not only influence what people learn but also how they learn. Its widespread accessibility and adaptability to diverse learning needs will enable a range of personalized learning paths. Experts predict that future learners will access a variety of flexible and adaptive educational options, including self-paced courses, interactive assessments, virtual reality experiences, serious games, and modeling activities. Learning environments will increasingly cater to individual learning preferences, objectives, and developmental goals, allowing for a dynamic interaction between learners and virtual learning communities. Peer networks and collaborative platforms will promote mutual support and help individuals track progress.

In formal education, including schools and universities, ICT will reshape pedagogical strategies, transforming curricula to better match real-world demands. Mobile learning tools and immersive technologies will bring real-life experiences into classrooms, aligning student skills with the needs of modern workplaces. Teachers will be empowered to create tailored learning materials, monitor student progress through digital portfolios, and adjust instructional approaches in real-time. Engaging, interactive content will become standard, enhancing learning effectiveness and fostering continuous improvement.

For these technological advancements to be truly inclusive, education policy-makers must ensure equal access to ICT and equip all citizens, especially those from vulnerable groups, with the skills needed to thrive in an increasingly digital educational landscape. Policy efforts must focus

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on making technology-based learning opportunities equitable and accessible, thus fostering an educational ecosystem where every learner is prepared to participate actively and adaptively in a tech-driven world.

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