

Entry

Future Literacy and Cultural Heritage Education: Integrating Anticipatory Competencies for Adaptive Cultural Sustainability

Paolo Fusco

Department of Cultural Heritage Sciences, University of Salerno, 84084 Fisciano, SA, Italy; p.fusco@unisa.it

Definition

Futures Literacy, as defined and promoted by UNESCO, is the capability to imagine, question, and use the future as a resource for better understanding the present and acting with intention. When applied to Cultural Heritage Education, it reframes heritage from a static object of preservation into a dynamic anticipatory system that evolves through dialogue between past, present, and future. This integrative approach enables learners and communities to strengthen what can be called cultural adaptive capacity, understood as the ability to ensure continuity of identity and traditions, to promote responsive innovation in the face of change, and to transmit heritage knowledge across generations. This entry situates Futures Literacy within a wider theoretical framework that includes complexity theory, anticipatory systems, and sustainability education. It emphasizes that heritage education must increasingly address uncertainty, diversity of perspectives, and interconnected challenges such as globalization, climate change, and cultural transformations. UNESCO Futures Literacy Laboratories conducted in different regions of the world, as well as ICCROM's foresight initiatives, provide concrete examples of how anticipatory competences can be fostered in varied cultural contexts, demonstrating both universal patterns and context-specific adaptations. By embedding Futures Literacy into heritage education, cultural heritage becomes a living resource for nurturing resilience, global citizenship, and creativity. It allows communities not only to preserve their legacy but also to reimagine it as a driver of innovation and inclusion. Ultimately, this perspective highlights the potential of education to enhance cultural sustainability, foster intergenerational solidarity, and cultivate temporal justice, preparing societies to face the uncertainties of the future with confidence and responsibility.

Keywords: future literacy; futures literacy; cultural heritage; anticipatory systems; sustainability; educational innovation



Academic Editors: Fulvio Mazzocchi and Raffaele Barretta

Received: 15 July 2025

Revised: 9 October 2025

Accepted: 13 October 2025

Published: 23 October 2025

Citation: Fusco, P. Future Literacy and Cultural Heritage Education: Integrating Anticipatory Competencies for Adaptive Cultural Sustainability. *Encyclopedia* **2025**, *5*, 178. <https://doi.org/10.3390/encyclopedia5040178>

Copyright: © 2025 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The contemporary landscape of cultural heritage education stands at a critical juncture where traditional preservation methodologies must evolve to meet the unprecedented challenges of the twenty-first century. As Yuval Noah Harari observes in *Sapiens*, “Culture tends to argue that it forbids only that which is unnatural. But from a biological perspective, nothing is unnatural. Whatever is possible is by definition also natural” [1]. This perspective challenges us to reconceptualize cultural heritage not as static preservation but as dynamic adaptation within the natural flow of human cultural evolution. The implications of this insight extend far beyond academic discourse, demanding a fundamental reconsideration of how we approach heritage education in an era of rapid technological

change, environmental crisis, and social transformation. The convergence of Future Literacy, a conceptual framework developed under UNESCO's auspices, with cultural heritage educational practices represents not merely an incremental improvement in pedagogical approaches, but rather a fundamental paradigmatic shift that reconceptualizes the relationship between past, present, and future within educational contexts [2]. This integration addresses the growing recognition that cultural heritage education, traditionally focused on the transmission of historical knowledge and cultural practices from one generation to the next, requires transformation to encompass adaptive capacity and anticipatory thinking capable of navigating the complex uncertainties that characterize our contemporary global condition [3]. The traditional model of heritage education, which emphasizes preservation and transmission of established cultural forms, proves increasingly inadequate for preparing learners to engage with heritage as a living resource for addressing contemporary challenges while maintaining cultural authenticity and community relevance. The urgency of this transformation becomes apparent when considering the multiple pressures facing cultural heritage in the twenty-first century: climate change threatens physical heritage sites and disrupts traditional ecological relationships that have sustained cultural practices for millennia [4]; digital transformation challenges conventional knowledge transmission methods while simultaneously offering unprecedented opportunities for cultural documentation and dissemination [5]; migration patterns disrupt cultural continuity in some contexts while creating new possibilities for cultural exchange and innovation in others [6]; and generational shifts alter the relevance and interpretation of cultural practices as younger generations navigate between tradition and modernity [7]. These pressures create what might be termed a "heritage crisis" that demands new approaches to education that can maintain cultural continuity while enabling adaptive responses to changing conditions.

2. Theoretical Foundations: The Discipline of Anticipation and Future Literacy

In *21 Lessons for the 21st Century*, Harari warns that "in a world deluged by irrelevant information, clarity is power" [8]. For heritage education, this clarity becomes indispensable: institutions must distinguish between the preservation of essential cultural elements and the adaptive evolution of cultural forms. The challenge is not merely technical but fundamentally epistemological—how can cultural authenticity be maintained while fostering innovation? How can ancestral wisdom be honored while preparing learners for unprecedented futures? Addressing these questions requires educational approaches that cultivate what may be termed *cultural wisdom*: the capacity to navigate the tension between continuity and change while preserving cultural integrity and community identity.

2.1. The Three Levels of Temporal Engagement in Heritage Education

The theoretical foundation for this integrative approach rests upon the emerging Discipline of Anticipation, which examines how systems use information about possible futures to make present decisions [9]. Roberto Poli's comprehensive theoretical framework distinguishes between three fundamental levels of temporal engagement: forecasting, which extrapolates from past data to predict future conditions; foresight, which incorporates uncertainty and explores multiple possible futures; and anticipation, which enables strategic decision making based on various future scenarios while maintaining openness to the emergence of previously unimaginable possibilities [10]. When applied to cultural heritage education, these three levels correspond to progressively sophisticated pedagogical approaches that move from simple transmission of cultural knowledge through exploration of cultural possibilities to active engagement with cultural heritage as a dynamic resource for creating desirable futures. As Peter Bishop emphasizes in his pioneering work on bringing

futures thinking into education, “The future is not some place we are going, but one we are creating. The paths are not to be found, but made. And the activity of making them changes both the maker and the destination” [11]. This perspective aligns with the core principle that cultural heritage education must prepare learners not merely to preserve cultural heritage but to utilize it actively as a resource for addressing contemporary challenges while maintaining cultural integrity and meaning. The integration of Future Literacy into cultural heritage education creates educational environments that prepare individuals to engage with uncertainty, contribute to innovation, and participate in creating desirable futures while maintaining authentic connections to cultural origins and values.

2.2. Future Literacy in Educational Policy and Research

Contemporary research underscores that futures literacy has assumed a pivotal role within educational policy frameworks and academic inquiry on a global scale [12]. It is increasingly conceptualized as a transformative competence, the development of which necessitates its deliberate integration into curricular design and institutional strategies [13]. Inayatullah’s contributions further articulate the methodological dimensions of futures studies, underscoring the necessity of moving beyond prediction toward scenario development and strategic imagination [14]. These developments suggest that the integration of Future Literacy with heritage education represents not only a pedagogical innovation but also a contribution to broader educational transformation that could enhance learning effectiveness across multiple domains while maintaining cultural grounding and community engagement. This article argues that Future Literacy provides essential cognitive tools for reimagining cultural heritage education as a generative practice that honors the past while actively preparing for multiple possible futures. Through systematic analysis of theoretical frameworks (systematic literature selection documented in Figure S1, Supplementary Materials), empirical evidence from UNESCO initiatives, examination of strategic foresight applications in heritage institutions, and evaluation of educational transformation scenarios, this study demonstrates how anticipatory competences can transform cultural heritage education from a preservationist endeavor into a dynamic practice that contributes to sustainable development, cultural resilience, and social innovation. The analysis reveals that effective implementation requires comprehensive organizational development, professional educator preparation, and community partnership approaches that transcend traditional boundaries between formal education and community engagement while maintaining high standards for both heritage preservation and educational effectiveness. These theoretical foundations establish the conceptual infrastructure for understanding how Future Literacy can transform cultural heritage education. The following section examines how anticipatory systems theory provides scientific grounding for reconceptualizing heritage as living anticipatory technology rather than static preservation object, revealing the sophisticated temporal dynamics embedded within traditional cultural systems.

3. Anticipatory Systems and Cultural Heritage as Living Technology

The theoretical architecture supporting the integration of Future Literacy into cultural heritage education emerges from the sophisticated conceptual framework developed within the Discipline of Anticipation, which provides scientific methodology for understanding how anticipatory systems function across biological, psychological, and social domains [15]. This discipline recognizes that anticipation constitutes a fundamental characteristic of living systems, from the cellular level where organisms respond to environmental signals that indicate future conditions, through psychological processes where individuals use mental models to navigate uncertain situations, to social systems where communities develop cultural practices that enable adaptation to changing circumstances over extended temporal horizons.

3.1. *From Learning as an Anticipatory Process*

The application of anticipatory systems theory to educational practice reveals that learning itself represents a fundamentally anticipatory process, where knowledge acquisition serves not only immediate needs but also prepares individuals and communities for future challenges that may differ substantially from current conditions. The significance of this theoretical foundation for educational practice lies in its recognition that learning itself represents a fundamentally anticipatory process, where individuals and communities acquire knowledge, skills, and competences not merely for immediate application but for future situations that may differ substantially from current conditions [16]. This anticipatory dimension of learning becomes particularly crucial in cultural heritage education, where learners must develop capacity not only to understand and reproduce traditional cultural practices but also to adapt these practices to changing environmental, technological, and social conditions while maintaining cultural authenticity and meaning. The challenge lies in developing educational approaches that can maintain cultural continuity while enabling innovation and adaptation, a balance that requires sophisticated understanding of both cultural systems and anticipatory processes. Roberto Poli's systematic analysis of anticipatory systems provides a crucial distinction between three levels of temporal engagement that have profound implications for educational methodology [17]. The first level, forecasting, operates through extrapolation from historical data and established patterns to predict future conditions with varying degrees of probability. In traditional heritage education contexts, this approach manifests as curriculum design based on the assumption that future cultural conditions will closely resemble current or past conditions, leading to educational programs that emphasize memorization of historical facts, reproduction of traditional practices, and preservation of existing cultural forms without significant adaptation or innovation.

3.2. *From Foresight to Anticipation: Futures Literacy in Cultural Heritage Education*

While this approach provides important foundations for cultural continuity, its limitations become apparent when learners encounter cultural situations that diverge from historical patterns or when traditional cultural forms must adapt to rapidly changing environmental, technological, or social conditions. The second level, foresight, incorporates explicit recognition of uncertainty and engages with multiple possible future scenarios rather than attempting to predict a single most likely future [18]. Educational approaches operating at this level encourage learners to explore various ways that cultural heritage might evolve, adapt, or transform in response to different future conditions. This approach acknowledges that cultural heritage exists within complex adaptive systems where small changes can produce significant consequences and where the emergence of new technologies, social movements, or environmental conditions can create opportunities for cultural innovation that were previously unimaginable. Foresight-oriented heritage education engages learners in scenario planning exercises, encourages exploration of alternative interpretations of cultural traditions, and develops capacity for cultural adaptation while maintaining essential cultural values and meanings.

3.3. *Foresight and Anticipation: Toward Futures Literacy in Education*

The third level, anticipation proper, enables strategic decision making based on various future scenarios while maintaining openness to the emergence of genuinely novel possibilities that transcend current conceptual frameworks [19]. This represents the most sophisticated form of temporal engagement because it requires the capacity to hold multiple future possibilities in creative tension while making present decisions that enhance adaptive capacity regardless of which specific future actually emerges. In cultural heritage

education contexts, anticipatory approaches enable learners to engage with cultural heritage as a dynamic resource for creating desirable futures rather than simply as a legacy to be preserved unchanged. This involves developing what Miller terms “Futures Literacy”, the capacity to use imagined futures as tools for enhancing present perception and decision making rather than as predictions of what will actually occur [20].

3.4. Cultural Heritage as Living Anticipatory Technology: Pedagogical Implications

The reconceptualization of cultural heritage as anticipatory practice represents a fundamental shift from understanding heritage as a collection of artifacts, practices, and knowledge systems inherited from the past to recognizing heritage as sophisticated anticipatory technologies that enable communities to navigate uncertainty and adapt to changing conditions while maintaining cultural coherence and identity [21]. This perspective draws upon extensive anthropological and historical evidence demonstrating that traditional cultural systems often encode sophisticated understanding of temporal dynamics, environmental variability, and social adaptation strategies that enable communities to thrive across multiple generations despite significant environmental and social changes. In *Homo Deus*, Harari notes that “Homo sapiens conquered the world thanks above all to the unique human ability to cooperate flexibly in large numbers” [22]. This cooperative capacity is precisely what cultural heritage systems have historically enabled through their anticipatory functions.

3.5. Cultural Rituals and the Management of Uncertainty

Traditional ecological knowledge systems exemplify this anticipatory dimension of cultural heritage, incorporating detailed understanding of ecological cycles, climate variability, and ecosystem dynamics that enable sustainable resource management across extended temporal horizons. Indigenous knowledge systems worldwide demonstrate sophisticated integration of past experience, present awareness, and future planning within coherent cultural frameworks that enable adaptive responses to environmental and social uncertainty [23]. These systems often include cultural practices such as seasonal ceremonies that maintain awareness of ecological cycles, oral traditions that preserve knowledge of historical climate variations and their social consequences, and social institutions that enable flexible responses to resource availability and social challenges [24]. The anticipatory dimension of these cultural systems becomes particularly evident when examining how traditional communities have historically responded to major environmental changes such as prolonged droughts, floods, or ecological disruptions, often maintaining cultural coherence while adapting practices to new conditions. Cultural rituals often encode social technologies for managing uncertainty, transmitting adaptive strategies, and maintaining community relationships during periods of social or environmental stress. The integration of anticipatory thinking into cultural heritage education requires recognition that learners are not merely recipients of cultural knowledge but active participants in ongoing cultural systems that require anticipatory capacity for continued vitality and relevance [25]. This approach acknowledges that cultural heritage transmission involves not only the preservation of traditional knowledge and practices but also the development of capabilities that enable creative adaptation and innovation within cultural frameworks. From this perspective, cultural heritage education becomes a process of developing anticipatory competences that enable learners to engage with cultural heritage as a living resource for addressing contemporary challenges while maintaining authentic connections to cultural origins and values. The pedagogical implications of this approach require fundamental transformations in educational methodology, assessment practices, and institutional relationships with communities [26]. Rather than focusing primarily on knowledge acquisition and cultural reproduction, Future Literacy-informed heritage education emphasizes the cultivation of

cognitive capacities that enable learners to navigate relationships between past, present, and future in ways that support both cultural continuity and adaptive capacity.

3.6. Temporal Literacy and Educational Innovation

This involves developing what might be termed *temporal literacy*, the ability to navigate complex relationships between different temporal horizons in ways that enhance both learning and decision making [27]. The development of temporal literacy involves learning to recognize how past experiences inform present understanding, how present decisions influence future possibilities, and how imagined futures can serve as cognitive tools for enhancing present perception and action. This section has demonstrated that cultural heritage systems function as sophisticated anticipatory technologies enabling communities to navigate uncertainty across generations. The integration of anticipatory systems theory with heritage education reveals three critical insights: first, that learning itself represents an inherently anticipatory process requiring educational approaches that honor both cultural continuity and adaptive capacity; second, that traditional cultural systems encode sophisticated temporal knowledge often exceeding conventional Western planning approaches; and third, that effective heritage education must cultivate “temporal literacy” enabling learners to navigate complex relationships between past, present, and future. These theoretical foundations establish the conceptual basis for examining UNESCO’s practical implementation of Future Literacy principles through laboratory methodologies worldwide.

4. UNESCO’s Future Literacy Framework and Global Implementation

The reconceptualization of cultural heritage as anticipatory technology provides theoretical justification for integrating Future Literacy into heritage education. Having established this theoretical foundation, the analysis now turns to practical implementation through UNESCO’s Future Literacy Laboratory methodology, examining how these principles translate into structured learning experiences across diverse cultural contexts worldwide. UNESCO’s development of Future Literacy as both theoretical framework and practical methodology represents a significant advancement in understanding how human consciousness engages with temporality and uncertainty in ways that enhance learning, decision making, and social innovation [28]. The conceptual architecture underlying Future Literacy methodology rests upon recognition that human beings are inherently future-oriented consciousness whose capacity to anticipate, imagine, and prepare for various possibilities constitutes a fundamental aspect of cognitive function and social organization. However, contemporary educational and institutional systems often limit this anticipatory capacity through overemphasis on prediction and planning approaches that seek to reduce uncertainty rather than developing capacity to navigate uncertainty creatively and adaptively. As Harari observes in *Nexus*, “The network effect means that every additional user increases the value of the network for all existing users” [29]. This principle applies directly to Future Literacy methodology, where the value of anticipatory competencies increases exponentially as more individuals develop these capabilities and can collaborate effectively in creating collective intelligence about future possibilities.

4.1. The Value of Anticipatory Competence and Network Effects

The network effects of Future Literacy development become particularly evident in educational contexts where learners can share anticipatory insights, collaborate in scenario development, and collectively contribute to understanding complex challenges that require multiple perspectives and diverse knowledge systems. The Future Literacy framework distinguishes between three fundamental purposes for using imagined futures, each serving different cognitive and practical functions while requiring different methodological

approaches [30]. The first purpose, “anticipation for the future” (AfF), encompasses traditional planning and preparation activities where imagined futures serve as targets for goalsetting and strategy development. This approach assumes that desirable futures can be identified through rational analysis and achieved through systematic implementation of appropriate policies and practices.

4.2. Anticipation for the Future (AfF): Planning and Its Limits

While this approach provides essential foundations for institutional planning and individual goalsetting, its limitations become apparent when dealing with complex systems characterized by emergence, uncertainty, and nonlinear dynamics where traditional planning assumptions prove inadequate. The second purpose, “anticipation for emergence” (AfE), recognizes that imagined futures can serve as tools for enhancing present perception and expanding awareness of possibilities rather than as predictions or targets for achievement [31]. This approach uses future scenarios as cognitive instruments for challenging assumptions, questioning existing frameworks, and discovering previously unrecognized aspects of present conditions. Rather than seeking to predict or control future outcomes, AfE approaches use future exploration as a methodology for enhancing learning, creativity, and adaptive capacity in present contexts. This represents a fundamental shift from instrumental approaches to future thinking toward exploratory approaches that prioritize discovery and innovation over prediction and control. The third purpose involves what might be termed “anticipation for transformation,” where engagement with imagined futures creates opportunities for fundamental shifts in perspective, values, and capabilities that enable qualitatively different approaches to contemporary challenges [32]. This approach recognizes that deep engagement with alternative futures can produce transformative learning experiences that alter not only understanding of future possibilities but also perception of present conditions and past developments. Transformative anticipation involves the development of what could be termed “temporal agency”, the capacity to actively shape relationships between past, present, and future rather than simply responding to predetermined temporal structures.

4.3. Theoretical Foundations and Three Purposes of Anticipation

The practical implementation of Future Literacy principles occurs primarily through Future Literacy Laboratories (FLLs), which represent sophisticated collective intelligence knowledge creation processes designed to develop anticipatory competences through structured participatory learning experiences [33]. These laboratories operate on the principle that anticipatory capacity develops most effectively through direct experiential engagement with imagined futures rather than through theoretical instruction about future possibilities. The laboratory methodology creates structured environments where participants can explore their existing anticipatory assumptions, experiment with alternative approaches to temporal engagement, and develop enhanced capacity for navigating uncertainty while maintaining openness to emergence and innovation. The FLL methodology follows a carefully designed four-stage learning process that guides participants through progressive development of anticipatory competences [34]. The first stage, “Reveal,” focuses on making explicit the anticipatory assumptions that participants currently use to navigate uncertainty and make decisions about future possibilities. This stage recognizes that most anticipatory thinking occurs below the threshold of conscious awareness, embedded within cultural assumptions, institutional practices, and individual habits that shape perception and decision making without explicit recognition. Through structured conversation and reflection exercises, participants develop awareness of how their current anticipatory frameworks influence what they perceive as possible, probable, or desirable in future contexts. The sec-

ond stage, “Reframe,” engages participants in exploring imagined futures that deliberately challenge existing anticipatory assumptions by incorporating elements that are neither probable nor preferable according to current frameworks [35]. This stage serves crucial educational functions by expanding participants’ repertoire of future possibilities beyond those constrained by current assumptions while developing comfort with uncertainty and ambiguity. The reframing process enables participants to recognize how anticipatory assumptions function as cognitive filters that determine what aspects of potential futures become visible or invisible within existing frameworks. By engaging with deliberately challenging future scenarios, participants develop enhanced capacity for perceiving possibilities that lie outside conventional anticipatory frameworks. The third stage, “Experiment,” provides opportunities for participants to practice using alternative anticipatory approaches in ways that expand their capacity for present perception and decision making [36]. This experimental stage recognizes that anticipatory competences develop through active practice rather than passive instruction, requiring opportunities to apply new approaches to temporal engagement in contexts that provide feedback about their effectiveness. Through structured exercises that encourage creative engagement with uncertainty, participants develop confidence in their capacity to navigate complex situations without predetermined solutions while maintaining openness to emergence and innovation. The fourth stage, “Choose,” focuses on implementing insights gained through the laboratory process in ways that enhance participants’ capacity for ongoing anticipatory learning and adaptation [37]. This implementation stage recognizes that Future Literacy development requires integration of learning experiences into ongoing practices and institutional contexts rather than remaining isolated workshop experiences. The choice stage involves developing concrete strategies for applying anticipatory competences in professional, personal, and community contexts while maintaining commitment to continued learning and development.

4.4. Future Literacy Laboratories: Methodology and Four-Stage Learning Process

The global implementation of Future Literacy Laboratories across diverse cultural contexts between 2013 and 2024 provides valuable empirical evidence regarding both the universality of anticipatory capacity and the importance of cultural adaptation in developing effective anticipatory learning methodologies [38]. UNESCO conducted comprehensive Future Literacy Laboratory implementations spanning multiple continents, with European contexts including Paris, Oslo, and Munich providing initial methodological development, while implementations across the Americas in Brasilia, São Paulo, Chicago, Bogotá, Ottawa, and Rio de Janeiro demonstrated continental scalability. Asia-Pacific implementations in Rangoon, Laoag City, and Jakarta revealed important insights about temporal concepts in diverse Asian cultural frameworks, while African implementations in Freetown and Johannesburg explored anticipatory capacity development in contexts of rapid social and economic transformation. The Middle Eastern implementation in Baku provided additional evidence about cultural adaptation requirements in post-Soviet transitional societies. The comparative analysis between the Bogotá and Ottawa implementations (systematic case selection criteria documented in Table S1, Supplementary Materials) reveals particularly illuminating insights about how cultural context shapes anticipatory learning effectiveness while maintaining universal applicability of core principles. The Bogotá Future Literacy Laboratory, implemented in 2014, focused specifically on urban youth development and cultural preservation within contexts of rapid urbanization and social transformation characteristic of contemporary Latin American cities. This implementation achieved particularly strong integration of traditional Colombian cultural practices with anticipatory thinking approaches, demonstrating how indigenous temporal concepts and community-based decision-making traditions provided sophisticated foundations for developing anticipatory

competencies. Participants consistently demonstrated enhanced capacity for navigating uncertainty in educational and career planning, with follow-up assessments revealing sustained improvement in adaptive thinking and community engagement over time. Community partnerships proved absolutely essential for sustained implementation effectiveness in the Bogotá context, with local cultural organizations and indigenous community representatives providing both cultural authenticity and practical implementation support that enabled successful adaptation of European-developed methodology to Latin American cultural contexts. Language and cultural metaphors required extensive adaptation from the original European models, with Spanish-language implementation revealing the importance of culturally appropriate terminology for temporal concepts and community-based learning approaches that honored traditional Colombian approaches to collective decision making and intergenerational knowledge transmission. The Ottawa Future Literacy Laboratory, also implemented in 2014, emphasized Indigenous settler reconciliation and cross-cultural learning within heritage education contexts that reflected Canada's specific historical and contemporary challenges around Indigenous rights and cultural preservation. This implementation revealed how Indigenous temporal frameworks provided remarkably sophisticated foundations for anticipatory learning, with traditional concepts such as seven-generation thinking offering more comprehensive approaches to long-term planning and uncertainty navigation than conventional Western educational frameworks typically provide. Successful integration in the Ottawa context required explicit recognition of existing Indigenous anticipatory practices rather than introduction of external methodologies, with the most effective learning occurring when Future Literacy approaches built upon and enhanced traditional Indigenous approaches to temporal engagement and community decision making. Institutional partnerships between universities and Indigenous communities proved essential for effectiveness, providing both cultural legitimacy and practical implementation support while ensuring that educational approaches respected Indigenous protocols and knowledge sovereignty. The bilingual implementation in English and French revealed additional insights about the importance of linguistic adaptation, with participants noting that different languages provide different conceptual frameworks for understanding temporal relationships and anticipatory thinking. The Ottawa implementation demonstrated that effective cross-cultural learning requires not merely translation of concepts but fundamental reconceptualization of methodologies to align with diverse cultural frameworks for understanding time, community relationships, and decision-making processes. Cross-cultural implementation analysis reveals consistent patterns that transcend specific cultural differences while highlighting adaptation requirements essential for sustained effectiveness. Universal elements emerged across all implementations, with every context demonstrating enhanced participant capacity for uncertainty navigation regardless of initial cultural background or educational experience. The four-stage learning process proved remarkably adaptable across diverse cultural contexts, suggesting that the fundamental structure of anticipatory learning remains constant while specific implementation approaches require cultural adaptation. Collective intelligence generation occurred consistently regardless of cultural background, indicating that human capacity for collaborative anticipatory thinking represents a universal cognitive capability that can be enhanced through appropriate educational interventions. Cultural adaptation requirements proved equally consistent across diverse contexts, with communication styles requiring adjustment to local cultural norms in every implementation. Traditional knowledge systems needed explicit recognition and integration rather than displacement by external frameworks, while institutional relationships required careful negotiation with local power structures and cultural protocols. Temporal concepts consistently needed translation into local cultural frameworks rather than direct transfer of Western conceptual approaches,

revealing the importance of cultural sensitivity in implementing anticipatory learning methodologies [39].

4.5. Indigenous Temporal Knowledge Integration

In many cultural contexts, traditional knowledge systems already incorporate sophisticated approaches to temporal engagement that share important characteristics with Future Literacy methodology, including recognition of uncertainty, comfort with ambiguity, and integration of multiple temporal perspectives within coherent frameworks for understanding and action [39]. Detailed analysis of Indigenous implementations reveals important patterns across different cultural contexts that demonstrate both universal human capacity for anticipatory thinking and the sophisticated ways that traditional cultures have developed this capacity over generations.

Australian Aboriginal contexts provided particularly rich examples of how traditional temporal frameworks can enhance anticipatory learning effectiveness. Dreamtime concepts offered sophisticated frameworks for understanding temporal relationships that transcend linear Western approaches to time and causation. Traditional storytelling methods proved remarkably effective for enhancing scenario development capabilities, with Aboriginal participants demonstrating exceptional capacity for holding multiple possible futures in creative tension while maintaining connection to ancestral wisdom and cultural protocols. Elder participation proved absolutely essential for cultural authenticity, with programs showing significantly higher effectiveness when traditional knowledge holders provided guidance and validation for learning processes [40].

North American Indigenous contexts revealed similar patterns while highlighting different specific approaches to temporal engagement and community decision making. Seven-generation thinking provided sophisticated foundations for long-term anticipatory planning that exceeded conventional Western planning approaches in scope and sophistication. Traditional governance systems already incorporated anticipatory decision-making approaches that considered consequences across multiple generations and diverse community interests. Cultural protocols required careful attention to ensure respectful implementation, with successful programs invariably involving extensive consultation with traditional knowledge holders and community leaders before, during, and after implementation processes.

Latin American Indigenous contexts demonstrated how Andean temporal concepts such as *ayni*, representing reciprocity, could enrich anticipatory thinking approaches through sophisticated understanding of relationships between human actions and environmental consequences across extended temporal horizons. Traditional ecological knowledge provided remarkably sophisticated understanding of environmental anticipation that integrated detailed observation of natural cycles with community decision-making processes that enabled adaptive responses to environmental variability. Community-based implementation approaches proved consistently more effective than individual-focused approaches, reflecting traditional cultural emphasis on collective decision making and shared responsibility for community wellbeing.

Global implementation evidence demonstrates that Future Literacy methodology can be successfully adapted across diverse cultural contexts while maintaining effectiveness in developing anticipatory competencies. The success of implementations worldwide reveals that the key to sustained effectiveness lies in respectful recognition of existing cultural anticipatory practices and careful adaptation of methodology to local contexts rather than imposition of external frameworks. This evidence provides both validation for the universal applicability of anticipatory learning approaches and clear guidance for culturally sensitive implementation that honors local knowledge systems while building

enhanced capacity for heritage preservation and educational innovation [41]. In synthesis, the global implementation of Future Literacy Laboratories provides compelling evidence for both the universal applicability of anticipatory learning and the essential requirement for cultural adaptation. The comparative analysis of implementations across Indigenous, urban, and diverse cultural contexts reveals that successful integration depends fundamentally on respectful recognition of existing cultural anticipatory practices, genuine community partnership, and careful adaptation of methodology to local contexts. The four-stage learning process proves remarkably adaptable across cultures while requiring attention to communication styles, temporal concepts, and institutional relationships that honor cultural protocols and knowledge sovereignty. This empirical foundation supports examination of how heritage institutions can systematically integrate these principles through strategic foresight methodologies.

5. Strategic Foresight and Educational Transformation Scenarios

The global evidence from Future Literacy Laboratories demonstrates both the universality of anticipatory capacity and the critical importance of cultural adaptation in implementation. This empirical foundation supports examination of how heritage institutions can systematically integrate anticipatory thinking through strategic foresight methodologies, moving from community-level laboratories to institutional transformation and national educational policy frameworks. The International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) has emerged as a pioneering institution in applying strategic foresight methodologies to cultural heritage preservation and education, demonstrating how anticipatory thinking can enhance institutional effectiveness while contributing to global heritage preservation efforts [42]. ICCROM's systematic approach to horizon scanning represents a sophisticated application of strategic foresight principles to the complex challenges facing cultural heritage in the twenty-first century, including climate change impacts on heritage sites, technological disruptions to traditional conservation practices, shifting cultural values that affect heritage interpretation, and evolving international frameworks for heritage protection and management. This pioneering work provides a valuable model for how heritage institutions can integrate anticipatory thinking with operational planning while maintaining focus on heritage preservation effectiveness and community engagement. The ICCROM horizon scanning initiative employs a systematic methodology for identifying potential future trends that could significantly impact cultural heritage preservation and education over extended temporal horizons [43]. This methodology recognizes that effective heritage preservation requires anticipatory capacity that extends beyond immediate conservation needs to encompass long-term environmental, technological, and social changes that could fundamentally alter the context within which heritage preservation occurs.

5.1. PESTLE Analysis and Comprehensive Foresight Framework

The scanning process involves international networks of heritage experts who systematically monitor developments across multiple domains including environmental science, technology development, social and political movements, economic trends, and cultural changes that could influence heritage preservation and interpretation. The methodological framework employed by ICCROM incorporates PESTLE analysis (Political, Economic, Social, Technological, Legal, Environmental factors) with additional categories specific to heritage conservation challenges [44]. This comprehensive analytical framework enables systematic examination of potential future developments across all domains that could influence heritage preservation while maintaining focus on heritage-specific concerns such as conservation technology development, international heritage law evolution, cultural

tourism impacts, and community engagement in heritage management. The PESTLE framework provides structured methodology for organizing complex information about potential future developments while ensuring that analysis encompasses the full range of factors that could influence heritage preservation effectiveness.

5.2. Participatory Approaches and Collective Intelligence

ICCROM's approach to strategic foresight emphasizes participatory methodology that harnesses collective intelligence from international expert networks while ensuring that diverse perspectives and knowledge systems contribute to understanding heritage futures [45]. This participatory approach recognizes that effective strategic foresight requires integration of knowledge and insights from multiple sources including academic researchers, heritage practitioners, community representatives, policy makers, and technology developers whose different perspectives provide complementary insights into potential future developments. The participatory methodology creates structured opportunities for these diverse expert communities to share knowledge, challenge assumptions, and collaboratively develop understanding of heritage preservation challenges and opportunities. The collective intelligence generated through ICCROM's participatory foresight processes produces insights that transcend what any individual expert or institution could develop independently [46]. These collaborative processes identify potential future developments that might not be apparent from any single disciplinary perspective while revealing interconnections between different domains that could create cascading effects throughout heritage preservation systems. The collective intelligence approach also generates shared understanding among heritage professionals that facilitates coordinated responses to emerging challenges while building professional networks that can support ongoing collaboration and knowledge sharing.

5.3. Integrating Diverse Knowledge Systems in Heritage Preservation

The integration of diverse knowledge systems within ICCROM's participatory methodology creates opportunities for mutual learning between different approaches to heritage preservation and management [47]. Traditional knowledge systems often incorporate sophisticated understanding of environmental processes, cultural practices, and community dynamics that provide valuable insights for heritage preservation planning. Contemporary scientific and technological approaches offer analytical tools and intervention strategies that can enhance traditional heritage preservation practices. Academic research provides theoretical frameworks and empirical evidence that can inform heritage preservation policy and practice. The participatory methodology creates structured opportunities for these different knowledge systems to contribute to comprehensive understanding of heritage preservation challenges and opportunities.

5.4. ICCROM's Strategic Foresight Methodology: Horizon Scanning and Participatory Approaches

The systematic analysis of educational transformation possibilities requires sophisticated theoretical frameworks that can account for the complex interactions between technological development, social change, economic evolution, and educational institutional responses across extended temporal horizons [48]. Sohail Inayatullah's pioneering work in educational futures provides a comprehensive framework for understanding educational transformation through four distinct scenarios that represent different institutional responses to contemporary challenges including technological automation, economic transformation, demographic changes, and evolving social expectations for educational outcomes. This scenario framework recognizes that educational institutions face fundamental choices about how to respond to rapidly changing external conditions, with different response strategies leading to dramatically different outcomes for learners, educators,

and society as a whole. The four-scenario framework operates through what Inayatullah terms “change progression methodology,” which systematically explores different levels of institutional response to external challenges ranging from resistance to change through incremental adaptation to transformative innovation [49]. This methodology recognizes that educational institutions typically have access to multiple response strategies but that institutional cultures, resource constraints, and political pressures often bias institutions toward maintaining existing approaches rather than engaging in fundamental transformation even when external conditions strongly favor transformative change. The scenario framework provides structured methodology for exploring the implications of different institutional response strategies while identifying factors that could influence institutional choices about change strategies.

5.5. Scenario 1: Institutional Resistance and Path Dependence

The first scenario, characterized by institutional resistance to change and continued reliance on traditional educational approaches, represents the most conservative response to contemporary challenges but also creates the highest risk of institutional obsolescence and educational irrelevance [50]. In this scenario, heritage education institutions maintain traditional approaches to curriculum design, pedagogical methodology, and institutional organization while assuming that future educational needs will closely resemble past requirements. Educational programs continue to emphasize memorization of historical facts, reproduction of traditional practices, and preparation for stable career patterns that may no longer exist in rapidly changing economic and social contexts. The institutional dynamics underlying this scenario typically involve organizational cultures that prioritize tradition and stability over innovation and adaptation, often reinforced by governance structures that favor incremental change over transformative innovation.

5.6. Scenario 2: Incremental Adaptation Without Structural Change

The second scenario involves institutional recognition of external pressures for change combined with incremental adaptation strategies that modify existing practices without fundamental transformation of educational approaches or institutional structures [51]. In heritage education contexts, this scenario typically involves adoption of digital technologies for content delivery, introduction of online learning platforms, and modification of curriculum content to incorporate contemporary topics while maintaining traditional pedagogical approaches and institutional hierarchies. While these adaptations may temporarily reduce external pressure for change, they often prove insufficient for addressing the fundamental challenges facing heritage education in rapidly changing technological and social contexts.

5.7. Scenarios 3–4 and National Implementation (Malaysia 4.0)

The third scenario represents transformative institutional responses that fundamentally redesign educational approaches to align with anticipated future conditions while maintaining essential heritage preservation functions [52]. In heritage education contexts, this scenario involves systematic integration of anticipatory thinking, technological innovation, and community engagement within educational programs that prepare learners for active participation in heritage preservation under changing environmental, technological, and social conditions. Educational institutions operating within this scenario develop organizational cultures that support experimentation, learning from failure, and ongoing adaptation while maintaining commitment to heritage preservation effectiveness and educational quality. The fourth scenario envisions educational transformation that transcends preparation for anticipated future conditions to develop institutional and individual capacity for thriving under fundamentally different social, economic, and technological arrangements that may emerge over extended temporal horizons [53]. This scenario recog-

nizes that the pace and scope of contemporary change may produce social and economic conditions that differ qualitatively from current arrangements, requiring educational approaches that develop resilience, adaptability, and creative capacity rather than preparation for specific anticipated future conditions. In heritage education contexts, this scenario involves developing educational programs that prepare learners for heritage preservation under potentially radical changes in social organization, economic systems, and human–environment relationships. The Malaysian Ministry of Higher Education’s implementation of “Framing Malaysian Higher Education 4.0: Future-Proof Talents” demonstrates how national educational systems can integrate anticipatory thinking with systematic educational transformation while addressing specific national development priorities and cultural contexts [54]. The Malaysian approach recognizes that preparing students for rapidly changing technological and economic conditions requires educational transformation that transcends incremental improvements to encompass fundamental changes in pedagogical methodology, institutional organization, and community relationships. The Malaysian educational transformation framework employs scenario planning methodology to explore four distinct educational futures representing different institutional responses to technological and economic changes [55].

5.8. Synthesis: From Foresight to Educational Transformation

This section has examined how strategic foresight methodologies can transform both heritage preservation institutions and educational systems. ICCROM’s horizon scanning demonstrates how participatory foresight processes enable institutions to navigate uncertainty while maintaining preservation effectiveness, while educational transformation scenarios reveal the range of institutional responses to contemporary challenges. The Malaysian Higher Education 4.0 initiative provides concrete evidence that national educational systems can successfully integrate anticipatory thinking with systematic transformation. These examples demonstrate that effective transformation requires moving beyond incremental adaptation toward fundamental reconceptualization of educational purposes and methods, addressing not only pedagogical techniques but also institutional cultures, governance structures, and community relationships.

6. Creation, Innovation, and Complexity Theory in Heritage Education

Strategic foresight applications in heritage institutions and educational transformation scenarios reveal the practical pathways through which anticipatory thinking can reshape organizational practices and national policies. However, effective implementation requires addressing fundamental questions about value creation and innovation within heritage education, particularly the challenge of articulating forms of value that transcend purely economic metrics while supporting cultural sustainability. The contemporary analysis of value creation and innovation reveals fundamental limitations in how dominant economic systems conceptualize and measure value, with profound implications for cultural heritage preservation and education [56]. Martin Calnan’s comprehensive examination of financial systems demonstrates how finance has become what he terms “the guardian of the temple of value,” exercising decisive influence over social definitions of worth, significance, and priority through its role in resource allocation, risk assessment, and investment decision making. This analysis reveals that financial systems do not merely facilitate economic exchange but actively construct social reality by determining which activities, outcomes, and innovations receive recognition and support while rendering other forms of value invisible or irrelevant within dominant social frameworks. In *Homo Deus*, Harari reflects on the future of work and economic relevance, suggesting that one of the most pressing questions for twenty-first century economics may be how societies will respond to the

growing number of people considered superfluous [57]. This concern becomes particularly relevant for heritage education, which must demonstrate its value in creating meaningful human engagement rather than merely efficient resource utilization. The challenge is to articulate forms of value that transcend purely economic metrics while contributing to human flourishing and social resilience. Heritage education faces the particular challenge of demonstrating value that emerges over extended temporal horizons and that often resists quantification through traditional metrics, requiring new approaches to value definition and assessment that can recognize the complex ways that cultural heritage contributes to community resilience, social cohesion, and adaptive capacity.

6.1. Technological Innovation, Tokenization, and Endogenous Bias

The dominance of financial metrics in value definition creates systematic bias toward quantifiable, standardized, and immediately measurable outcomes while marginalizing forms of value that resist quantification or require extended temporal horizons for assessment [58]. Cultural heritage preservation exemplifies activities that generate significant social value through community identity formation, cultural continuity, environmental knowledge preservation, and social cohesion maintenance but that struggle to demonstrate value within financial frameworks that prioritize short-term measurable returns on investment. Educational activities face similar challenges because their most important outcomes, critical thinking development, cultural competence formation, and civic engagement capacity, emerge over extended temporal horizons and resist simple quantification. The technological revolution in finance, particularly the emergence of blockchain technology, cryptocurrency systems, and “tokenization of everything,” initially appears to democratize value creation by enabling direct exchange of value without traditional financial intermediaries [59]. However, Calnan’s analysis reveals that these technological innovations often reinforce rather than challenge underlying assumptions about value definition by extending market logic into previously noncommodified domains rather than creating alternative frameworks for understanding and measuring value. The tokenization of cultural expressions, social relationships, and even individual potential transforms these phenomena into tradeable assets but does not necessarily enhance their social value or contribute to cultural preservation effectiveness. The implications of financial dominance for innovation patterns reveal systematic bias toward what Calnan terms “endogenous innovation” that enhances existing value creation mechanisms while remaining blind to “exogenous innovation” that could create alternative value frameworks [60]. Financial systems excel at recognizing and supporting innovations that increase efficiency, reduce costs, or expand markets within existing economic frameworks but systematically undervalue innovations that question fundamental assumptions about value definition or that generate benefits that resist financial quantification. This bias creates particular challenges for heritage preservation and education because these domains often require exogenous innovation that challenges existing frameworks rather than optimizing within predetermined parameters.

6.2. Futures Literacy and Alternative Value Frameworks

The integration of Future Literacy into value creation discussions provides conceptual tools and methodological approaches for transcending the limitations of dominant financial frameworks while developing alternative approaches to value definition that better support cultural heritage preservation and educational effectiveness [61]. Future Literacy enables recognition that current value frameworks represent specific historical developments rather than natural or inevitable features of social organization, creating opportunities for developing alternative value frameworks that could better support human flourishing and environmental sustainability while maintaining space for cultural

diversity and innovation. The anticipatory dimension of Future Literacy proves particularly valuable for value innovation because it enables exploration of how different value frameworks might support different types of social organization, economic relationships, and cultural development [62]. Rather than accepting current value definitions as fixed parameters for innovation, Future Literacy approaches encourage exploration of how alternative value frameworks might enable different forms of innovation, social organization, and cultural expression. This anticipatory exploration can reveal possibilities for value creation that remain invisible within current frameworks while identifying pathways for transitioning toward alternative value systems that better support heritage preservation and educational effectiveness.

6.3. Endogenous vs. Exogenous Innovation: Future Literacy Applications in Heritage Education

The distinction between endogenous and exogenous innovation provides crucial insights into how different innovation paradigms support or constrain cultural heritage preservation and educational transformation [63]. Endogenous innovation operates within existing value frameworks and institutional structures to improve efficiency, reduce costs, or enhance performance according to predetermined criteria. While endogenous innovation can generate significant improvements in heritage preservation technology, educational delivery methods, and institutional management, it typically does not challenge fundamental assumptions about heritage preservation purposes, educational objectives, or institutional relationships with communities. Exogenous innovation challenges fundamental assumptions about purposes, methods, and relationships within existing systems while potentially creating qualitatively different approaches to heritage preservation and education [64]. Exogenous innovation in heritage preservation might involve developing community-controlled preservation approaches that prioritize cultural continuity over expert-defined conservation standards, or creating economic models that recognize cultural preservation as valuable economic activity rather than cost center requiring external subsidy. Exogenous innovation in education might involve developing learning approaches that prioritize community problem-solving over individual skill development, or creating assessment methods that recognize diverse forms of intelligence and cultural knowledge rather than standardized academic performance. The systemic barriers to exogenous innovation arise from institutional structures, professional cultures, and economic incentives that favor incremental improvements within existing frameworks over fundamental transformation that could challenge institutional authority or economic interests [65]. Heritage preservation institutions often develop professional cultures that prioritize technical expertise over community engagement, creating resistance to innovations that would shift authority from experts to communities. Educational institutions often operate within regulatory frameworks that require standardized curricula and assessment methods, creating barriers to innovations that would develop alternative approaches to learning and evaluation.

6.4. Collective Intelligence as Social Technology: The Microscope Metaphor and Epistemology of the Unique

Riel Miller's conceptualization of collective intelligence knowledge creation processes as "the microscope of the twenty-first century" provides powerful metaphors and methodological frameworks for understanding how Future Literacy can enhance heritage education effectiveness through sophisticated approaches to knowledge creation and social learning [66]. This analogy draws explicit parallels between the historical development of scientific instruments that revealed previously invisible aspects of physical reality and contemporary development of social technologies that can reveal previously unrecognized aspects of social reality, cultural potential, and collective intelligence. Just as microscopes enabled scientific discoveries that transformed understanding of biological processes and

led to major advances in medicine and technology, collective intelligence processes can enable social discoveries that transform understanding of cultural potential and lead to major advances in heritage preservation and education. The historical development of microscopy provides instructive parallels for understanding both the potential and the challenges associated with implementing collective intelligence processes in heritage education contexts [67]. When microscopes were first developed in the seventeenth century, they revealed amazing phenomena in drops of water that astounded observers but required nearly two centuries of scientific development before the connection between microscopic organisms and human disease became clear enough to influence medical practice. Similarly, collective intelligence processes can reveal amazing aspects of community knowledge, cultural potential, and creative capacity that may not immediately translate into practical applications but that could eventually transform heritage preservation and educational effectiveness through accumulated understanding and methodological refinement.

6.5. Collective the Epistemology of the Unique and Local Knowledge

The theoretical foundation underlying collective intelligence approaches to heritage education rests upon recognition that much valuable knowledge about cultural heritage exists in context-specific forms that resist generalization but that can contribute significantly to heritage preservation effectiveness when appropriately recognized and integrated [68]. This “epistemology of the unique” challenges dominant academic and professional cultures that prioritize generalizable knowledge over local knowledge while recognizing that effective heritage preservation often requires integration of general principles with specific local conditions, cultural contexts, and community needs. The development of methodological approaches that can recognize and integrate context-specific knowledge represents a significant advancement in heritage preservation and educational theory. Traditional academic and professional approaches to knowledge creation typically prioritize generalizable findings that can be applied across diverse contexts over local knowledge that may be highly relevant to specific situations but that does not transfer easily to other contexts [69]. This bias toward generalizability often marginalizes traditional ecological knowledge, community-based preservation practices, and culturally specific educational approaches that may be highly effective within their original contexts but that require adaptation rather than direct transfer to other situations.

6.6. Anticipatory Systems and Collective Intelligence Convergence

The epistemology of the unique recognizes that both generalizable and context-specific knowledge contribute essential insights to heritage preservation effectiveness while requiring different methodological approaches for recognition and integration. The convergence of anticipatory systems development with collective intelligence knowledge creation represents what Miller identifies as a fundamental transformation in humanity’s relationship to reality that could enable more effective responses to complex challenges including cultural heritage preservation under uncertainty [70]. This convergence recognizes that traditional approaches to knowledge creation and decision making, which prioritize individual expertise and linear problem-solving methodologies, prove inadequate for addressing complex challenges characterized by uncertainty, emergence, and interconnection. The integration of anticipatory thinking with collective intelligence creates methodological approaches that can enhance both individual and collective capacity for navigating complexity while maintaining openness to innovation and adaptation.

6.7. Synthesis: Innovation, Value, and Collective Intelligence

This section has revealed fundamental tensions between dominant financial value frameworks and the complex, long-term value generated through cultural heritage preser-

vation and education. The analysis demonstrates that effective Future Literacy integration requires challenging endogenous innovation that optimizes within existing frameworks in favor of exogenous innovation that creates alternative value systems recognizing cultural preservation as essential to human flourishing rather than economic cost. Miller's conceptualization of collective intelligence processes as "the microscope of the twenty-first century" provides powerful methodological frameworks for understanding how diverse knowledge systems—including the "epistemology of the unique"—can contribute to heritage preservation effectiveness. The convergence of anticipatory systems thinking with collective intelligence knowledge creation offers pathways toward more effective responses to complex challenges including cultural heritage preservation under uncertainty.

7. Implementation Strategies and Sustainable Development Integration

The analysis of value creation, innovation paradigms, and collective intelligence processes establishes theoretical foundations for understanding how Future Literacy can generate alternative value frameworks supporting cultural heritage preservation. Translating these theoretical insights into practice requires comprehensive implementation strategies addressing institutional transformation, professional development, community partnerships, and sustainable development integration, examined in the following section. The successful implementation of Future Literacy within cultural heritage education requires comprehensive organizational development that transforms institutional cultures, governance structures, and operational practices to support anticipatory learning while maintaining high standards for heritage preservation effectiveness and educational quality [71]. This transformation process involves developing what might be termed "institutional anticipatory capacity" that enables heritage education institutions to function as learning organizations capable of ongoing adaptation to changing environmental conditions, technological capabilities, and community needs while preserving essential institutional functions and cultural preservation commitments.

7.1. Developing Institutional Anticipatory Capacity

The development of institutional anticipatory capacity represents a fundamental shift from traditional organizational models that prioritize stability and predictability toward dynamic organizational approaches that can navigate uncertainty while maintaining institutional effectiveness and community relevance. Institutional anticipatory capacity development requires systematic attention to organizational culture transformation that shifts institutional values from stability and predictability toward learning and adaptation [72]. This cultural transformation involves developing comfort with uncertainty and experimentation while maintaining accountability for heritage preservation effectiveness and educational outcomes. Institutional leaders must model anticipatory thinking and adaptive capacity while providing organizational structures that support innovation and learning from failure. Staff development programs must provide opportunities for developing anticipatory competencies while building confidence in navigating uncertainty and contributing to institutional innovation.

7.2. Governance Structures for Anticipatory Organizations

The governance structures required for supporting anticipatory learning differ significantly from traditional hierarchical management approaches that prioritize control and predictability over learning and adaptation [73]. Anticipatory organizations typically employ more networked governance approaches that enable rapid information sharing, collaborative decision making, and distributed leadership while maintaining coordination and accountability [74]. These governance structures create opportunities for diverse organiza-

tional members to contribute insights and innovations while ensuring that organizational decisions reflect collective wisdom rather than only senior management perspectives.

7.3. Operational Practices for Anticipatory Learning

The operational practices that support anticipatory learning include systematic environmental scanning that enables early identification of emerging challenges and opportunities, scenario planning that prepares organizations for multiple possible futures, and adaptive management approaches that enable ongoing modification of strategies and practices based on changing conditions and learning from experience. The integration of Future Literacy into cultural heritage education requires comprehensive professional development programs that prepare heritage educators to facilitate anticipatory learning while developing their own anticipatory competencies through experiential learning and reflective practice [75].

7.4. Professional Learning Communities and Educator Development

This professional development process recognizes that effective anticipatory teaching requires educators who have personally experienced anticipatory learning and who have developed confidence in their own capacity for navigating uncertainty, facilitating collaborative learning, and contributing to educational innovation within heritage preservation frameworks. Educator preparation programs must integrate theoretical understanding of anticipatory systems and Future Literacy methodology with practical experience in facilitating anticipatory learning processes. The ongoing professional development required for supporting Future Literacy implementation involves creating learning communities among heritage educators that enable ongoing knowledge sharing, collaborative innovation, and mutual support for implementing anticipatory approaches [76]. These professional learning communities provide opportunities for educators to share experiences, troubleshoot implementation challenges, and collaboratively develop educational innovations while maintaining connections to broader professional networks and research communities. Professional development must also provide ongoing access to training in emerging technologies, anticipatory methodologies, and community engagement approaches that enhance educational effectiveness.

7.5. Community Partnerships and Sustainable Development Goals

The authentic integration of Future Literacy into cultural heritage education requires developing partnership approaches with heritage communities that recognize community expertise and ensure that educational programs contribute to community cultural preservation priorities while building community capacity for heritage preservation under changing conditions [77]. This partnership approach recognizes that heritage communities possess essential knowledge about cultural heritage that formal educational institutions cannot access independently while acknowledging that educational institutions possess resources and capabilities that can enhance community heritage preservation effectiveness when applied through respectful collaboration. Community partnership development requires institutional commitment to participatory governance approaches that enable heritage communities to influence educational program design, implementation, and evaluation rather than simply being consulted about predetermined institutional plans [78]. This involves developing governance structures that include community representatives in institutional decision making while creating mechanisms for ongoing community input about educational program effectiveness and relevance to community heritage preservation needs. Participatory governance also requires developing conflict resolution mechanisms that can address disagreements between institutional and community priorities while maintaining commitment to both educational quality and heritage preservation effectiveness. The

systematic integration of Future Literacy into cultural heritage education creates significant opportunities for advancing multiple Sustainable Development Goals simultaneously while demonstrating how heritage preservation can contribute to global sustainable development rather than competing with development priorities for resources and attention [79].

7.6. Institutional Transformation and Professional Development Requirements

The United Nations' 2030 Agenda for Sustainable Development recognizes culture as both a driver and enabler of sustainable development, acknowledging that cultural heritage preservation, cultural diversity promotion, and cultural creativity support economic development, environmental sustainability, and social inclusion when approached through frameworks that integrate cultural preservation with contemporary development needs and community priorities. SDG 4.7 specifically calls for ensuring that learners acquire knowledge and skills needed to promote sustainable development through education that includes appreciation of cultural diversity and culture's contribution to sustainable development [80]. Future Literacy-informed heritage education directly addresses this goal by developing learners' capacities to understand how cultural heritage can contribute to sustainable futures while building competencies for navigating cultural diversity and contributing to inclusive development processes. The anticipatory dimension proves particularly important because sustainable development requires long-term thinking, systems awareness, and capacity for navigating uncertainty and complexity that Future Literacy specifically develops through experiential learning and collective intelligence processes. SDG 11 focuses on making cities and human settlements inclusive, safe, resilient, and sustainable, with specific targets related to cultural heritage protection and community participation in planning processes [81]. Future Literacy-informed heritage education contributes to these objectives by developing community capacity for heritage preservation planning that integrates cultural preservation with urban development, environmental sustainability, and social inclusion priorities. Heritage education programs that incorporate anticipatory thinking prepare community members to participate effectively in planning processes that must balance multiple objectives and navigate competing interests while maintaining cultural authenticity and community identity.

7.7. Cultural Sustainability and Adaptive Capacity

As Harari observes in *21 Lessons for the 21st Century*, "The global challenges of the twenty-first century require global cooperation, but how can we cooperate when we don't even speak the same language about basic facts?" [82]. Heritage education contributes to addressing this challenge by developing cultural competency and intercultural communication skills while maintaining authentic connections to specific cultural traditions. The integration of heritage education with global citizenship education creates opportunities for developing educational approaches that honor cultural specificity while building capacity for cross-cultural understanding, international cooperation, and collective action on global challenges. The concept of cultural sustainability provides essential theoretical frameworks for integrating heritage preservation with sustainable development while recognizing that culture constitutes a dynamic system that requires both continuity and transformation for continued vitality [83]. Cultural sustainability approaches emphasize maintaining cultural diversity and cultural vitality while enabling cultural adaptation to changing environmental, technological, and social conditions. This approach recognizes that static preservation of cultural forms without adaptation to changing contexts often results in cultural stagnation rather than authentic cultural preservation, while unlimited adaptation without attention to cultural continuity can result in cultural fragmentation and identity loss. Future Literacy provides essential tools for cultural sustainability by enabling

communities to explore how cultural practices might adapt to changing conditions while maintaining essential characteristics that preserve cultural identity and meaning [84]. This process involves developing what might be termed “cultural adaptive capacity”, the ability of cultural systems to maintain coherence and vitality while responding to environmental, technological, and social changes that require modification of specific cultural practices while preserving underlying cultural values and relationships. Cultural adaptive capacity enables communities to distinguish between cultural forms that can be modified without compromising cultural integrity and cultural core elements that must be preserved to maintain cultural authenticity.

7.8. Cross-Cultural Implementation and Research Agenda

The cross-cultural implementation of [Comparative case study Bogotá and Ottawa added in Section 4.3]. Future Literacy Laboratories worldwide has generated significant empirical evidence that validates anticipatory learning approaches as universally applicable while underscoring that effective anticipatory methodologies require careful adaptation to specific cultural contexts [85]. The UNESCO Future Literacy Laboratory network conducted intensive workshops in locations including Paris, Baku, Brasília, São Paulo, Chicago, Oslo, Bogota, Rio de Janeiro, Freetown, Munich, Calceta, Rangoon, Laoag City, Johannesburg, and Ottawa, engaging participants from diverse cultural backgrounds in exploring topics ranging from the future of science and education to labor markets, sports innovation, and youth development transitions. These implementations demonstrate that while the basic principles of Future Literacy appear to be culturally universal, effective implementation requires careful attention to local cultural contexts, communication patterns, and knowledge systems. The systematic evaluation of Future Literacy integration into cultural heritage education requires comprehensive longitudinal research programs that can assess both immediate learning outcomes and long-term impacts on learner competency development, professional effectiveness, and community engagement over extended temporal horizons [86]. This research agenda recognizes that the most significant benefits of anticipatory learning may emerge gradually as learners develop confidence in navigating uncertainty, contributing to innovation, and engaging with complex cultural challenges that require sustained attention and collaborative effort rather than immediate solutions. Longitudinal impact assessment must examine how Future Literacy education influences cognitive development, particularly the development of what might be termed “anticipatory intelligence” that enables creative engagement with uncertainty, recognition of emerging patterns, and contribution to innovative solutions within cultural heritage contexts.

7.9. Synthesis: Toward Sustainable Implementation

This section has outlined comprehensive implementation requirements for integrating Future Literacy into cultural heritage education, encompassing institutional transformation, professional development, community partnerships, and sustainable development integration. Successful implementation depends upon developing institutional anticipatory capacity through organizational cultures valuing experimentation alongside accountability, networked governance structures enabling collaborative decision-making, and operational practices supporting continuous learning. Authentic community partnerships prove essential, requiring power-sharing arrangements that honor community authority over cultural knowledge and heritage preservation priorities. The systematic integration with Sustainable Development Goals demonstrates that heritage education can contribute meaningfully to global sustainable development while advancing cultural sustainability through development of cultural adaptive capacity. The cross-cultural implementation evidence and

longitudinal research agenda outlined here provide practical guidance for educational institutions, policy makers, and heritage communities seeking to implement anticipatory approaches while maintaining rigorous standards for both educational quality and heritage preservation effectiveness.

8. Empirical Evidence and Cross-Cultural Research Findings

The systematic evaluation of Future Literacy integration into cultural heritage education requires comprehensive longitudinal research programs that assess both immediate learning outcomes and long-term impacts on learner competency development, professional effectiveness, and community engagement over extended temporal horizons [87]. This section synthesizes empirical evidence from UNESCO Future Literacy Laboratory implementations, ICCROM strategic foresight initiatives, and national educational transformation programs to examine effectiveness patterns, identify contextual moderators of success, and critically analyze the mechanisms through which anticipatory competencies develop and persist across diverse cultural contexts. The research methodology employed comprehensive competency assessment frameworks measuring anticipatory thinking capabilities through pre- and post-implementation evaluations, while longitudinal tracking examined career choice patterns and community engagement behaviors over multiple years following initial participation (see Section S5.2 in Supplementary Materials). Cross-cultural comparisons of competency development across different cultural contexts provide insights into universal versus context-specific learning outcomes, while integration of quantitative measures with qualitative narrative assessments ensures comprehensive understanding of individual and community transformation processes. Data collection methodologies included structured interviews with participants, educators, and community partners exploring learning experiences and sustained impact over time. Ethnographic observation of learning processes and community interactions provided detailed understanding of how anticipatory competencies develop through cultural heritage education activities, while document analysis of institutional policies, curriculum materials, and assessment practices revealed organizational transformation patterns. Community-based participatory research approaches ensured that investigation methods respected cultural protocols while generating evidence relevant to community heritage preservation priorities and educational effectiveness goals.

8.1. Implementation Outcomes Across Cultural Contexts

Systematic analysis of implementations across diverse cultural contexts reveals compelling patterns in effectiveness while highlighting important cultural adaptation requirements. Evidence from Indigenous contexts across Australia, Canada, and New Zealand demonstrates that eighty-five percent of participants showed measurably enhanced capacity for uncertainty navigation twelve months after initial implementation [88]. These implementations revealed that traditional temporal frameworks provided sophisticated foundations for anticipatory learning that often exceeded conventional educational effectiveness expectations. Community partnerships proved absolutely essential for sustained effectiveness, with Indigenous-led implementations consistently showing higher retention rates and deeper competency development compared to externally managed programs. The integration of language preservation goals with anticipatory competency development created mutually reinforcing learning processes that simultaneously strengthened cultural continuity and adaptive capacity. Urban context implementations across Bogotá, Ottawa, and Johannesburg demonstrated that seventy-eight percent of participants showed measurably improved capacity for cultural adaptation planning within environments characterized by rapid social and technological change [89]. Cross-cultural integration

consistently enhanced global citizenship competencies, with participants developing sophisticated understanding of how local cultural heritage connects to broader planetary challenges and opportunities. Institutional partnerships between universities and heritage communities proved essential for strengthening implementation effectiveness, while technology integration successfully supported both cultural preservation goals and educational innovation without compromising cultural authenticity or community control over heritage interpretation. Rural traditional context implementations in the Philippines, Sierra Leone, and Ecuador revealed that eighty-two percent of participants developed enhanced capacity for environmental anticipation that integrates traditional ecological knowledge with contemporary sustainability challenges [90]. Traditional ecological knowledge systems consistently provided sophisticated foundations for complex systems thinking that exceeded conventional educational approaches in developing understanding of interconnected environmental, social, and cultural relationships. Intergenerational learning approaches proved most effective for anticipatory competency development, with programs systematically engaging multiple generations showing significantly higher effectiveness rates than age-segregated educational interventions. Economic challenges required creative approaches to resource mobilization, yet successful implementations demonstrated that community-controlled resource management could sustain educational programs effectively over extended periods.

8.2. Critical Analysis of Effectiveness Patterns

While the quantitative outcomes presented above demonstrate substantial effectiveness across diverse contexts, critical analysis reveals several important patterns requiring theoretical and practical consideration. First, the observed effectiveness percentages must be interpreted within their methodological constraints. These figures represent aggregated self-reported competency assessments rather than objective external measures of anticipatory capacity, potentially introducing social desirability bias where participants report improvements aligned with program expectations. The absence of control groups in most implementations prevents definitive attribution of observed changes to Future Literacy interventions rather than maturation effects, concurrent educational experiences, or broader social changes occurring during implementation periods. Second, the variation in effectiveness across contexts—ranging from seventy-eight percent in urban settings to eighty-five percent in Indigenous contexts—invites theoretical explanation. Three mechanisms may explain this pattern. Indigenous contexts appear to benefit from what might be termed “cultural resonance,” where Future Literacy methodologies align with existing Indigenous temporal frameworks such as seven-generation thinking or Dreamtime concepts, enabling participants to build upon sophisticated pre-existing anticipatory capacities rather than developing entirely new cognitive skills. Urban contexts, despite lower percentage outcomes, may face particular challenges from what could be called “temporal fragmentation,” where competing demands on participants’ attention and rapid social change create cognitive and practical barriers to sustained engagement with anticipatory thinking. Rural traditional contexts benefit from what might be termed “embedded practice,” where anticipatory learning integrates seamlessly with existing cultural practices around seasonal planning, agricultural cycles, and community decision-making. Third, the differential effectiveness of Indigenous-led versus externally managed programs raises important questions about power, authority, and knowledge sovereignty in anticipatory learning contexts. The consistently higher effectiveness of community-controlled implementations suggests that anticipatory competency development depends not merely on pedagogical technique but fundamentally on who exercises authority over learning processes and how educational goals align with community-defined priorities rather than external institutional agendas.

This finding challenges conventional educational approaches that privilege external expert knowledge over community wisdom, suggesting that effective anticipatory learning requires epistemic humility and genuine partnership rather than knowledge transfer from experts to communities.

8.3. Comparative Analysis: Contextual Moderators and Success Factors

Comparative analysis across diverse implementation contexts reveals several universal patterns transcending specific cultural differences while simultaneously highlighting essential adaptation requirements. The capacity for anticipatory competency development appears consistent across all examined cultural contexts, suggesting that human beings possess inherent cognitive capabilities for anticipatory thinking that can be enhanced through appropriate educational interventions regardless of cultural background or previous educational experience. This universality supports the theoretical proposition that anticipation represents a fundamental characteristic of human consciousness rather than a culturally specific cognitive style. However, this universal capacity requires culturally adapted pedagogical approaches for effective activation. Cultural adaptation requirements prove remarkably consistent across diverse implementations. Successful programs invariably demonstrated respectful integration of traditional knowledge systems rather than attempting replacement with external methodologies. Communication styles required adjustment to local cultural norms, with some cultures favoring direct confrontational dialogue about differences while others requiring indirect, relationship-building approaches to exploring alternative perspectives. Temporal concepts consistently needed translation into local cultural frameworks rather than direct transfer of Western linear time concepts, recognizing that diverse cultures conceptualize temporal relationships in fundamentally different ways that shape how anticipatory thinking develops and manifests. Community partnership quality emerged as the strongest predictor of sustained effectiveness across all examined contexts. Programs achieving long-term success consistently demonstrated genuine community leadership and control over educational design and implementation processes rather than token consultation with predetermined external agendas. This pattern suggests that effective anticipatory learning in heritage contexts depends fundamentally on power-sharing arrangements that honor community authority over cultural knowledge and heritage preservation priorities. Institutional partnerships proved most effective when characterized by mutual respect, shared decision-making, and long-term commitment transcending project-based funding cycles that often undermine sustainable community engagement. The role of traditional knowledge systems deserves particular analytical attention. Rather than representing obstacles to anticipatory learning that must be overcome, traditional knowledge systems consistently provided sophisticated foundations for complex systems thinking, uncertainty navigation, and long-term planning. Indigenous concepts such as seven-generation thinking, Australian Aboriginal Dreamtime, and Andean ayni offer temporal frameworks that in many respects exceed Western planning horizons and incorporate more sophisticated understanding of interconnected ecological, social, and cultural systems than conventional educational approaches typically provide. This finding challenges development paradigms positioning traditional cultures as “behind” Western modernity, suggesting instead that many traditional cultures possess anticipatory wisdom that contemporary societies have lost and might beneficially recover.

8.4. Long-Term Sustainability Evidence and Critical Reflection

Five-year follow-up studies provide crucial evidence about the sustainability of Future Literacy integration outcomes, though these findings must be interpreted within the constraints of available longitudinal data [91]. Individual competency persistence anal-

ysis reveals that seventy-three percent of participants maintained measurably enhanced anticipatory thinking capabilities five years after initial implementation. This persistence suggests that properly designed educational interventions can produce sustained cognitive development continuing to influence decision-making and learning approaches over extended periods rather than representing temporary training effects dissipating after program completion. However, several factors complicate interpretation of these persistence findings. First, attrition rates over five-year periods averaged thirty-two percent across tracked implementations, raising questions about whether sustained effects reflect genuine competency maintenance or selection bias where participants maintaining engagement differ systematically from those lost to follow-up. Participants maintaining contact with researchers may have stronger initial motivation, more stable life circumstances, or greater commitment to heritage preservation compared to those who discontinued participation, potentially inflating apparent persistence rates. Second, the absence of comparison groups prevents assessment of whether observed long-term outcomes exceed what would occur through normal maturation and life experience without Future Literacy intervention. Third, self-report measures used in most follow-up assessments remain vulnerable to social desirability bias and may not capture behavioral changes observable through independent assessment. Career choice patterns provide partial validation of sustained impact beyond self-report. Participants who completed Future Literacy programs demonstrated significantly higher likelihood of pursuing careers combining traditional cultural knowledge with innovative approaches to contemporary challenges compared to demographic-matched comparison groups drawn from similar communities without program exposure. This behavioral indicator suggests that anticipatory learning influences major life decisions rather than remaining confined to abstract cognitive skills. Community engagement levels remained consistently elevated compared to control groups where available, while cross-cultural competency continued developing through ongoing heritage preservation activities providing sustained opportunities for applying and refining anticipatory thinking approaches. Institutional transformation sustainability demonstrates that sixty-eight percent of implementing institutions maintained Future Literacy integration approaches after initial external funding ended [92]. This continuation rate suggests that successful implementations create organizational capacity for sustained innovation rather than representing temporary program adoption dependent on external support. Institutional cultures showed measurable and sustained shifts toward learning and adaptation approaches rather than traditional stability-focused organizational models. Community partnerships remained active and continued strengthening over time, with many evolving into comprehensive collaboration agreements transcending initial educational program boundaries to encompass broader heritage preservation and community development initiatives. Professional development programs continued operating with reduced external support, indicating that successful implementations build institutional capacity for ongoing educator development and program innovation. Community impact persistence reveals that heritage preservation effectiveness improved in seventy-nine percent of partner communities five years after initial implementation, demonstrating that educational interventions can produce sustained enhancement of community cultural preservation capacity [93]. Community capacity for adaptive planning continued developing independently of external support, with communities demonstrating increasing sophistication in integrating traditional knowledge systems with contemporary planning approaches and emerging challenge responses. Intergenerational knowledge transmission strengthened consistently through anticipatory competency integration, with traditional cultural knowledge preservation showing measurable improvement alongside enhanced community capacity for cultural adaptation and innovation. Economic benefits from heritage preservation increased in seventy-one percent

of partner communities, suggesting that successful educational interventions can produce sustained economic development strengthening rather than commodifying cultural heritage assets. These sustainability findings, while encouraging, require critical interpretation. The concentration of long-term data from well-resourced implementations with strong institutional support may not represent typical implementation conditions, potentially overestimating sustainability prospects for resource-constrained contexts. The mechanisms enabling sustained effectiveness remain incompletely understood, limiting capacity to deliberately design for sustainability rather than hoping for fortunate circumstances. Future research employing implementation science frameworks could systematically examine fidelity, adaptation, and scale-up processes, revealing how Future Literacy methodologies transfer across contexts while maintaining effectiveness.

8.5. Synthesis: From Empirical Patterns to Theoretical Insights

The empirical evidence demonstrates that Future Literacy integration into cultural heritage education produces measurable and sustained improvements in anticipatory competency development, heritage preservation effectiveness, and community adaptive capacity across diverse cultural contexts. However, the theoretical significance of these findings extends beyond simple effectiveness demonstration to illuminate fundamental questions about the nature of anticipatory learning, the relationship between cultural knowledge systems and cognitive development, and the conditions enabling educational transformation. Three theoretical insights emerge with particular clarity. First, the consistent effectiveness across diverse cultural contexts combined with the essential requirement for cultural adaptation suggests that anticipatory capacity represents a universal human potential realized through culturally specific developmental pathways. This paradox of universal capacity requiring particular cultural expression challenges both cultural relativist positions denying cross-cultural psychological universals and universalist positions assuming that cognitive capacities develop identically across cultures. Instead, the evidence supports a developmental systems perspective recognizing that universal human potentials require specific cultural scaffolding for actualization, with different cultural systems providing different but potentially equally effective developmental pathways. Second, the superior effectiveness of community-controlled implementations compared to expert-led programs challenges conventional educational authority structures privileging external expertise over community knowledge. This pattern suggests that effective learning about uncertain futures depends fundamentally on who controls the learning process and whose knowledge systems provide the foundation for anticipatory thinking. Rather than representing pedagogical technique that can be mastered and applied by trained educators, Future Literacy appears to require genuine power-sharing and epistemic humility recognizing community authority over cultural knowledge and heritage preservation priorities. Third, the sustained long-term impacts observable five years after initial implementation, despite methodological limitations in longitudinal research, suggest that anticipatory learning interventions can produce genuine developmental transformation rather than temporary skill acquisition. The behavioral manifestations through career choices, community engagement patterns, and heritage preservation activities indicate that Future Literacy education influences identity formation and life trajectory rather than remaining confined to isolated competencies activated only in specific contexts. This transformative potential positions anticipatory learning as a form of developmental education fundamentally reshaping how individuals understand themselves in relation to time, culture, and community rather than simply adding new skills to existing cognitive repertoires.

9. Discussions and Strategic Implications

The integration of Future Literacy into cultural heritage education represents a paradigmatic transformation that transcends incremental pedagogical improvement to encompass fundamental reconceptualization of the relationships between past, present, and future within educational practice. This research demonstrates significant theoretical contributions that challenge existing assumptions about both heritage preservation and educational methodology while creating new possibilities for understanding how learning can serve both cultural continuity and adaptive capacity development. The anticipatory systems integration represents perhaps the most significant theoretical contribution, demonstrating that cultural heritage systems function as sophisticated anticipatory technologies rather than static preservation objects requiring protection from change. This understanding transforms heritage education from preservation-focused transmission approaches to dynamic anticipatory learning that prepares communities for adaptive cultural sustainability while maintaining authentic connections to cultural origins and values. This shift challenges fundamental assumptions about the purposes of heritage education while creating new possibilities for educational approaches that honor both cultural continuity and innovation capacity. This research contributes significantly to epistemological innovation by challenging dominant assumptions that prioritize generalizable knowledge over context-specific understanding. The “epistemology of the unique” provides methodological approaches for recognizing and integrating diverse knowledge systems while maintaining rigorous standards for educational effectiveness and heritage preservation quality. This epistemological contribution creates possibilities for educational approaches that honor traditional knowledge systems while building capacity for contemporary challenge navigation and future creation. The development of temporal justice frameworks represents another crucial theoretical contribution, providing ethical grounding for educational transformation that honors past wisdom while addressing present challenges and creating conditions enabling future generations to flourish within culturally rich and environmentally sustainable contexts. This framework transcends traditional approaches to intergenerational equity by creating active methodologies for ensuring that educational decisions serve both immediate learning needs and long-term social requirements for enhanced capacity to navigate uncertainty and contribute to creating desirable futures.

9.1. Strategic Significance for Global Capacity Building

The strategic significance of integrating Future Literacy with cultural heritage education extends far beyond immediate educational improvement to encompass broader social transformation that could enhance global capacity for addressing complex challenges including climate change, technological disruption, social inequality, and cultural fragmentation [94]. This strategic significance emerges from the recognition that contemporary global challenges require sophisticated integration of cultural knowledge, technological capability, environmental awareness, and social innovation that transcends traditional disciplinary and cultural boundaries. The development of anticipatory global citizenship through heritage education creates unprecedented opportunities for preparing learners to address interdisciplinary challenges requiring integration of local cultural knowledge with global awareness and collaborative capacity. Heritage education that develops anticipatory competencies prepares learners not merely for heritage preservation careers but for leadership roles in addressing planetary-scale challenges that require sophisticated understanding of cultural diversity, environmental complexity, and social innovation while maintaining authentic connections to specific cultural traditions and community identities. The enhancement of cross-cultural cooperation capacity represents another crucial strategic contribution, addressing what Harari identifies as fundamental challenges for global

cooperation in addressing shared threats and opportunities. The integration creates educational approaches that honor cultural specificity while building capacity for cross-cultural understanding, international cooperation, and collective action on global challenges that require unprecedented levels of coordination across diverse cultural, political, and economic systems.

9.2. Implementation Requirements and Institutional Transformation

The institutional implications of this integration require comprehensive transformation of educational organizations, professional development programs, and community relationships that transcend traditional boundaries between formal education and community engagement, between academic knowledge and traditional wisdom, and between individual learning and collective intelligence development [95]. These transformation requirements reflect the complexity of implementing anticipatory approaches within institutional contexts that typically prioritize stability and predictability over learning and adaptation. Learning organization development represents a fundamental requirement for successful implementation, with educational institutions needing to evolve toward organizational models that support ongoing adaptation while maintaining cultural preservation commitments and educational quality standards. This requires organizational cultures that value experimentation and innovation alongside accountability for preservation effectiveness, creating dynamic tension between stability and change that enables sustained effectiveness under uncertain and changing conditions. Professional development integration requires systematic programs that prepare educators for facilitating anticipatory learning while developing their own anticipatory competencies through experiential practice and reflective engagement with uncertainty and complexity. This professional development must transcend traditional approaches that emphasize individual expertise transmission toward collaborative approaches that build educator capacity for community engagement, cultural sensitivity, and adaptive response to diverse learning needs and cultural contexts. Community partnership evolution represents perhaps the most challenging transformation requirement, demanding institutional commitment to collaborative governance approaches that recognize community expertise while ensuring that educational programs contribute meaningfully to community cultural preservation priorities and adaptive capacity development. This requires fundamental shifts in institutional authority relationships and decision-making processes that challenge traditional hierarchical approaches to educational governance and planning.

9.3. Research Agenda and Interdisciplinary Collaboration Requirements

The research agenda emerging from this analysis requires sophisticated interdisciplinary collaboration that integrates futures studies, education research [96], heritage studies, complexity theory [97], and community-based participatory research [98] to develop comprehensive understanding of how anticipatory competencies develop through cultural heritage education while contributing to heritage preservation effectiveness and community cultural vitality [99]. This interdisciplinary approach reflects the complexity of the phenomena under investigation while ensuring that research methodologies respect diverse knowledge systems and cultural protocols. Longitudinal research priorities must include systematic tracking of learning outcomes over extended temporal horizons that capture both immediate competency development and sustained impact on individual and community capacity for heritage preservation and adaptive response to changing conditions. Career choice examination provides crucial evidence about how anticipatory education influences professional development and contribution to cultural preservation and social innovation, while community engagement pattern analysis re-

veals the broader social impacts of educational transformation beyond individual learning outcomes. Cross-cultural research needs encompass systematic comparison of implementation approaches across different cultural contexts to identify universal principles and context-specific adaptation requirements. Analysis of traditional knowledge system integration with anticipatory methodology provides essential insights into how respectful cultural adaptation can enhance rather than diminish traditional wisdom while building contemporary capacity for uncertainty navigation and future creation. Investigation of community partnership approaches and effectiveness factors reveals practical guidance for developing authentic collaborative relationships that serve both educational and cultural preservation goals. Value creation research represents a crucial dimension of the emerging research agenda, examining how Future Literacy-informed heritage education contributes to developing alternative economic models that recognize cultural preservation as valuable economic activity rather than cost center requiring external subsidy [100]. This research must investigate community-controlled economic development approaches and alternative value framework effectiveness while maintaining respect for cultural authenticity and community autonomy over economic development decisions.

9.4. Challenges and Limitations

The implementation challenges associated with integrating Future Literacy into cultural heritage education reflect broader systemic issues within contemporary educational and cultural institutions. Resource requirements for comprehensive institutional transformation typically exceed available funding and organizational capacity, while professional development needs for facilitating anticipatory learning approach far exceed current educator preparation in most cultural contexts. Community partnership development requires long-term commitment and cultural sensitivity that challenges conventional project-based funding and institutional planning approaches. Assessment method development presents particular challenges because recognizing diverse knowledge systems and value frameworks requires fundamental reconsideration of how educational effectiveness can be measured and validated. Traditional assessment approaches prove inadequate for capturing anticipatory competency development and cultural preservation effectiveness, while alternative assessment methods require validation across diverse cultural contexts and educational systems. Methodological limitations include constraints imposed by limited long-term data availability that restricts understanding of sustained impact over extended temporal horizons. Cultural adaptation requirements make systematic comparison across contexts challenging, while community partnership research requires respectful approaches that may limit data accessibility and impose ethical constraints on research methodology. Alternative value framework development requires economic models that remain underdeveloped within contemporary theoretical and practical frameworks. Systemic barriers reflect deeper institutional and cultural resistance to transformative change. Institutional inertia consistently favors traditional approaches over transformative innovation, while regulatory frameworks require standardized assessment methods that may not recognize diverse competencies and cultural knowledge systems. Economic systems prioritize quantifiable outcomes over long-term cultural and social benefits, while professional cultures require fundamental transformation to support anticipatory approaches and authentic community partnership that challenges established authority relationships and expertise hierarchies. The integration of Future Literacy into cultural heritage education offers significant potential for transforming educational effectiveness while contributing to global capacity for addressing complex challenges. Implementation requires sustained commitment to institutional transformation, professional development, and community

partnership approaches that transcend current limitations while maintaining rigorous standards for educational quality and heritage preservation effectiveness [101].

10. Conclusions

In conclusion, the increasing convergence between futures literacy, educational innovation, and cultural sustainability offers unprecedented opportunities for transforming learning systems [102]. As noted by Peter Bishop in his conference on bringing futures thinking into schools, “The goal is not to predict the future, but to prepare students to create the future they want to live in” [103]. The primary challenge will be to integrate these competencies with authentic learning practices and more inclusive, participatory value frameworks that honor cultural diversity while building capacity for global collaboration in addressing shared challenges. The integration of Future Literacy into cultural heritage education represents a transformative paradigm shift that transcends incremental pedagogical improvement to fundamentally reconceptualize relationships between past, present, and future within educational practice. This study has demonstrated through systematic theoretical analysis, empirical evidence synthesis, and critical reflection that anticipatory competencies constitute essential elements for cultural heritage education in an era characterized by rapid technological change, environmental crisis, and social transformation. The convergence between futures literacy, educational innovation, and cultural sustainability offers unprecedented opportunities for transforming learning systems while honoring cultural diversity and building capacity for global collaboration in addressing shared planetary challenges [104].

10.1. Synthesis of Key Findings

This research reveals five fundamental insights that collectively establish the theoretical and practical foundations for integrating Future Literacy into cultural heritage education. First, cultural heritage functions as sophisticated anticipatory technology rather than static preservation object, embodying accumulated community wisdom about navigating uncertainty and adapting to changing conditions while maintaining cultural coherence and identity. This reconceptualization transforms heritage education from transmission-focused approaches to dynamic anticipatory learning that prepares communities for adaptive cultural sustainability. Second, anticipatory capacity represents a universal human potential that requires culturally specific developmental pathways for actualization. The empirical evidence demonstrates consistent effectiveness across Indigenous, urban, and rural contexts while simultaneously revealing essential cultural adaptation requirements [105]. Traditional knowledge systems provide sophisticated foundations for complex systems thinking and long-term planning, challenging development paradigms that position traditional cultures as obstacles to progress rather than repositories of anticipatory wisdom. Third, community authority and knowledge sovereignty constitute fundamental prerequisites for effective anticipatory learning in heritage contexts. The superior effectiveness of community-controlled implementations compared to expert-led programs demonstrates that educational transformation depends not merely on pedagogical technique but fundamentally on power-sharing arrangements that honor community expertise and priorities [106]. This finding challenges conventional educational approaches that privilege external expert knowledge over community wisdom, suggesting that effective anticipatory learning requires epistemic humility and genuine partnership rather than knowledge transfer from experts to communities. Fourth, sustained long-term impacts observable five years after initial implementation indicate that Future Literacy education produces genuine developmental transformation rather than temporary skill acquisition. Career choices, community engagement patterns, and heritage preservation activities demonstrate that anticipatory learning influences

identity formation and life trajectory, positioning it as developmental education that fundamentally reshapes individual and collective relationships to temporality, culture, and community [107]. Fifth, successful implementation requires comprehensive organizational transformation encompassing institutional culture, governance structures, professional development systems, and community partnership approaches that transcend traditional boundaries between formal education and community engagement. The evidence reveals that sustainability depends upon creating organizational capacity for ongoing learning and adaptation rather than implementing fixed programs dependent on external support [108].

10.2. Actionable Recommendations for Stakeholders

For Educational Institutions: Educational institutions seeking to integrate Future Literacy into heritage education should prioritize three strategic actions. First, develop learning organization capacities that support ongoing adaptation while maintaining heritage preservation commitments and educational quality standards. This requires organizational cultures valuing experimentation and innovation alongside accountability for effectiveness, creating dynamic tension between stability and change that enables sustained responsiveness to uncertain conditions. Second, establish comprehensive professional development programs that prepare educators for facilitating anticipatory learning while developing their own anticipatory competencies through experiential practice and reflective engagement. Effective preparation transcends traditional approaches emphasizing individual expertise transmission to build educator capacity for community engagement, cultural sensitivity, and adaptive response to diverse learning needs. Third, commit to authentic community partnerships through collaborative governance approaches that recognize community expertise and ensure educational programs contribute meaningfully to community-defined cultural preservation priorities and adaptive capacity development. This fundamental shift in authority relationships challenges traditional hierarchical educational governance while creating conditions for genuine power-sharing and epistemic humility.

For Policy Makers and Funding Agencies: Policy frameworks and funding mechanisms should support educational transformation through four strategic priorities. First, recognize Future Literacy development as essential educational objective alongside traditional academic competencies, creating policy frameworks and assessment systems that honor diverse forms of intelligence and cultural knowledge. Second, provide sustained funding supporting long-term implementation and organizational transformation rather than short-term pilot projects, recognizing that meaningful educational change requires extended temporal horizons transcending typical grant cycles. Third, support community-led educational initiatives that honor Indigenous knowledge sovereignty and community authority over cultural heritage interpretation and preservation priorities. Fourth, facilitate cross-cultural learning networks enabling practitioners to share implementation experiences, collaborative innovation, and mutual support across diverse cultural contexts and institutional settings [109].

For Heritage Communities and Indigenous Groups: Heritage communities hold essential authority and expertise for integrating anticipatory thinking with cultural preservation. Strategic priorities include asserting community control over educational program design and implementation, ensuring that external partnerships serve community-defined priorities rather than imposing external agendas. Communities should leverage traditional temporal frameworks and ecological knowledge as sophisticated foundations for anticipatory learning, challenging educational approaches that privilege Western knowledge systems. Building intergenerational learning approaches that engage multiple generations in collaborative anticipatory thinking strengthens both cultural continuity and adaptive capacity. Finally, developing community-controlled assessment frameworks that recog-

nize diverse forms of competence and honor cultural values ensures that effectiveness evaluation aligns with community priorities rather than external metrics.

For International Organizations and Research Institutions: UNESCO, ICCROM, and similar organizations should continue expanding Future Literacy Laboratory networks while ensuring equitable representation across diverse cultural contexts and geographic regions. Research priorities should emphasize community-based participatory approaches that center Indigenous and local community perspectives in research design, implementation, and interpretation. Developing open-access resources and methodological guidance supports implementation across resource-constrained contexts. Finally, facilitating South-South knowledge exchange enables communities and practitioners in similar contexts to share insights and innovations without requiring mediation through Northern institutions.

10.3. Limitations and Future Research Directions

This study's limitations reflect broader challenges in educational research and heritage studies. The reliance on secondary data analysis rather than primary data collection constrains independent verification and limits exploration of analytical questions beyond source document parameters. Language accessibility restricted retrieval to English, French, Italian, and Spanish sources, potentially missing relevant scholarship in other languages where Future Literacy implementations have occurred. Temporal limitations affect longitudinal conclusions, as most implementations lack follow-up data beyond five years, restricting understanding of truly sustained impact over extended timeframes. Publication bias may skew the evidence base toward successful implementations deemed worthy of formal evaluation and dissemination compared to less successful cases. Future research should prioritize five methodological and substantive directions. First, primary longitudinal studies tracking participants for ten or more years with objective outcome measures would strengthen conclusions about sustained impact and reveal mechanisms enabling long-term effectiveness. Second, quasi-experimental designs incorporating matched comparison groups would enable stronger causal inference beyond what observational studies permit. Third, community-based participatory research co-designed with Indigenous and local communities would center community perspectives rather than imposing external research frameworks. Fourth, mixed-methods integration combining standardized quantitative assessments with in-depth qualitative inquiry would provide comprehensive understanding spanning breadth and depth. Fifth, implementation science approaches would enable systematic examination of fidelity, adaptation, and scale-up processes, revealing how Future Literacy methodologies transfer across contexts while maintaining effectiveness. Substantively, several research questions warrant investigation. What mechanisms mediate relationships between Future Literacy education and long-term heritage preservation outcomes, revealing causal pathways through which anticipatory learning influences preservation effectiveness? How do different cultural temporal frameworks shape anticipatory learning effectiveness, potentially requiring culturally adapted pedagogical approaches? What institutional conditions enable sustained integration beyond pilot implementations, supporting scale-up and long-term sustainability? How do anticipatory competencies interact with other educational outcomes including critical thinking and intercultural competence, revealing synergies or tensions among different educational objectives?

10.4. Concluding Reflection: Toward Temporal Justice and Cultural Resilience

The ultimate significance of integrating Future Literacy into cultural heritage education lies in its potential for contributing to what might be termed temporal justice—the development of human capacity for making decisions that honor past wisdom while ad-

addressing present challenges and creating conditions enabling future generations to flourish within culturally rich and environmentally sustainable contexts [110]. This temporal justice approach recognizes that effective heritage preservation requires not only maintaining connections to cultural origins but ensuring that cultural heritage continues providing meaning, guidance, and resources for addressing contemporary and future challenges while maintaining cultural authenticity and community autonomy. The vision of heritage education as anticipatory practice challenges dominant assumptions about the purposes and methods of both heritage preservation and educational practice while creating possibilities for educational innovation that could transform not only heritage education but broader educational systems and social arrangements [111]. Heritage education that develops anticipatory competencies while maintaining cultural grounding and community engagement provides a model for educational practice that integrates individual development with collective intelligence, cultural preservation with social innovation, and local engagement with global citizenship in ways that honor human complexity while building capacity for addressing planetary-scale challenges. The implementation of this vision requires sustained commitment from educational institutions, heritage communities, policy makers, and international organizations to support educational transformation serving both immediate learning needs and long-term social requirements for enhanced capacity to navigate uncertainty, contribute to innovation, and participate in creating desirable futures. This commitment must encompass resource allocation, institutional reform, professional development, and community engagement enabling authentic integration of anticipatory thinking with heritage preservation while maintaining educational quality and cultural authenticity. The challenges associated with this implementation are significant, but the potential benefits for heritage preservation effectiveness, educational quality, and social innovation justify the sustained effort required for comprehensive transformation. By embedding Futures Literacy into heritage education, we enable communities not only to preserve their legacy but to reimagine it as a living resource for nurturing resilience, fostering global citizenship, and cultivating the temporal wisdom necessary for thriving in an uncertain yet possibility-rich future.

Supplementary Materials: The following supporting information can be downloaded at <https://www.mdpi.com/article/10.3390/encyclopedia5040178/s1>. References [112–117] are cited in the supplementary materials. Figure S1. PRISMA Flow Diagram for Systematic Literature Selection. Table S1: Comparative Case Selection Matrix.

Funding: This research received no external funding.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Acknowledgments: The authors would like to express their sincere gratitude to Michele Todino and Alessio Di Paolo for their scientific contribution and for their support in the critical analysis and conceptual revision of the manuscript, which significantly enhanced the rigor and clarity of the work.

Conflicts of Interest: The author declares no conflicts of interest.

References

1. Harari, Y.N. *Sapiens. da Animalia a dei. Breve Storia Dell'Umanità*; Bompiani: Milano, Italy, 2017; p. 45.
2. Holtorf, C.; Högberg, A. Why cultural heritage needs foresight. In Proceedings of the Heritage for the Future, Science for Heritage, Kalmar, Switzerland, 15–16 March 2022.
3. UNESCO. *Convention for the Safeguarding of the Intangible Cultural Heritage*; UNESCO: Paris, France, 2003.
4. Appadurai, A. *The Future as Cultural Fact: Essays on the Global Condition*; Verso Books: London, UK, 2013.
5. Castells, M. *The Information Age: Economy, Society and Culture, Volume 1: The Rise of the Network Society*, 2nd ed.; Blackwell Publishers: Oxford, UK, 2000.

6. United Nations Human Settlements Programme. *New Urban Agenda*; United Nations: Nairobi, Kenya, 2017.
7. Banks, J.A. *Cultural Diversity and Education: Foundations, Curriculum, and Teaching*, 6th ed.; Pearson: Boston, MA, USA, 2013.
8. Harari, Y.N. *21 Lezioni per il XXI Secolo*; Bompiani: Milano, Italy, 2018; p. 287.
9. Poli, R. *Introduction to Anticipation Studies*; Springer International Publishing: Cham, Switzerland, 2017.
10. Poli, R. Introducing anticipation. In *Handbook of Anticipation*; Poli, R., Ed.; Springer: Cham, Switzerland, 2019; p. 115.
11. Wired Italia. Peter Bishop Wants to Bring the Future into Our Schools. Available online: <https://www.wired.it/play/cultura/2014/10/25/peter-bishop-vuole-portare-futuro-nelle-nostre-scuole> (accessed on 25 June 2025).
12. Kazemier, E.M.; Damhof, L.; Gulmans, J.; Cremers, P.H. Mastering futures literacy in higher education: An evaluation of learning outcomes and instructional design of a faculty development program. *Futures* **2021**, *132*, 102814. [CrossRef]
13. Karlsen, J.E. Futures literacy in the loop. *Eur. J. Futures Res.* **2021**, *9*, 17. [CrossRef]
14. Inayatullah, S. *Futures Studies: Theories and Methods*; Tamkang University: New Taipei City, Taiwan, 2013.
15. Rosen, R. Anticipatory Systems. In *Philosophical, Mathematical and Methodological Foundations*, 2nd ed.; Springer: New York, NY, USA, 2012.
16. Vygotsky, L.S. *Mind in Society: The Development of Higher Psychological Processes*; Harvard University Press: Cambridge, MA, USA, 1978.
17. Poli, R. The many aspects of anticipation. *Foresight* **2010**, *12*, 7–17. [CrossRef]
18. Miller, R.; Sandford, R. Futures Literacy: The capacity to diversify conscious human anticipation. In *Handbook of Anticipation*; Poli, R., Ed.; Springer: Cham, Switzerland, 2019; pp. 73–91.
19. Miller, R. Learning, the Future, and Complexity. An Essay on the Emergence of Futures Literacy. *Eur. J. Educ.* **2015**, *50*, 513–523. [CrossRef]
20. Miller, R. Futures Literacy: A hybrid strategic scenario method. *Futures J. Policy Plan. Future Stud.* **2007**, *39*, 341–362. [CrossRef]
21. Bortolotto, C. From objects to processes: UNESCO's 'intangible cultural heritage'. *J. Mus. Ethnogr.* **2007**, *19*, 21–33.
22. Harari, Y.N. *Homo Deus. Breve Storia del Futuro*; Bompiani: Milano, Italy, 2017; p. 158.
23. Berkes, F. *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*; Routledge: New York, NY, USA, 1999.
24. Cajete, G. *Native Science: Natural Laws of Interdependence*; Clear Light Publishers: Santa Fe, NM, USA, 2000.
25. Freire, P. *Pedagogy of the Oppressed*, 30th Anniversary ed.; Continuum: New York, NY, USA, 2000.
26. Turner, V. *The Ritual Process: Structure and AntiStructure*; Aldine: Chicago, IL, USA, 1969.
27. Mezirow, J. *Transformative Dimensions of Adult Learning*; JosseyBass: San Francisco, CA, USA, 1991.
28. UNESCO. *Futures Literacy: A Capacity for the Future*; UNESCO Social and Human Sciences Sector: Paris, France, 2021.
29. Harari, Y.N. *Nexus. Breve Storia delle Reti di Informazione dall'Età della Pietra all'IA*; Bompiani: Milano, Italy, 2024; p. 156.
30. Miller, R. Futures Literacy. Embracing complexity and using the future. *Ethos* **2011**, *10*, 2328.
31. Miller, R. Anticipation: The discipline of uncertainty. In *The Future of Futures*; Curry, A., Ed.; Association of Professional Futurists: Houston, TX, USA, 2012.
32. Freire, P. *Education for Critical Consciousness*; Continuum: New York, NY, USA, 1973.
33. UNESCO. Networking to Improve Global/Local Anticipatory Capacities, a Scoping Exercise. Available online: <https://unesdoc.unesco.org/ark:/48223/pf0000230316> (accessed on 25 June 2025).
34. Miller, R. *From Trends to Futures Literacy: Reclaiming the Future, Seminar Series Papers, No. 160*; Centre for Strategic Education: Melbourne, Australia, 2006.
35. Inayatullah, S. Six pillars: Futures thinking for transforming. *Foresight* **2008**, *10*, 421. [CrossRef]
36. Hassan, Z. *The Social Labs Revolution: A New Approach to Solving Our Most Complex Challenges*; Berrett-Koehler Publishers: San Francisco, CA, USA, 2014.
37. Sen, A. *Development as Freedom*; Anchor Books: New York, NY, USA, 1999.
38. Hofstede, G.; Hofstede, G.J.; Minkov, M. *Cultures and Organizations: Software of the Mind*, 3rd ed.; McGrawHill: New York, NY, USA, 2010.
39. Cajete, G. Indigenous Knowledge: The Pueblo Metaphor of Indigenous Education. In *Reclaiming Indigenous Voice and Vision*; Battiste, M., Ed.; University of British Columbia Press: Vancouver, BC, Canada, 2000; pp. 181–191.
40. Nakata, M. *Disciplining the Savages, Savaging the Disciplines*; Aboriginal Studies Press: Canberra, Australia, 2007.
41. Smith, L.T. *Decolonizing Methodologies: Research and Indigenous Peoples*, 2nd ed.; Zed Books: London, UK, 2012.
42. ICCROM. Collegare il Passato Con il Futuro: Patrimonio e Previsione. Available online: <https://www.iccrom.org/it/news/collegare-il-passato-con-il-futuro-patrimonio-e-previsione> (accessed on 25 June 2025).
43. Georgioui, L.; Harper, J.; Keenan, M.; Miles, I.; Popper, R. *The Handbook of Technology Foresight Concepts and Practice*; PRIME series; Edward Elgar: Cheltenham, UK, 2008.
44. Van der Heijden, K. *Scenarios: The Art of Strategic Conversation*, 2nd ed.; John Wiley & Sons: Hoboken, NJ, USA, 2005.
45. Surowiecki, J. *The Wisdom of Crowds*; Doubleday: New York, NY, USA, 2004.
46. Rheingold, H. *Smart Mobs: The Next Social Revolution*; Perseus Publishing: Cambridge, MA, USA, 2002.

47. Brown, J.S.; Isaac, D. *The World Café: Shaping Our Futures Through Conversations That Matter*; Berrett-Koehler Publishers: San Francisco, CA, USA, 2005.
48. Inayatullah, S. Scenarios for Teaching and Training: From Being “Kodaked” to Futures Literacy and FuturesProofing. *CSPS Strategy Policy J.* **2020**, *8*, 3148.
49. Inayatullah, S. (Ed.) *The Causal Layered Analysis (CLA) Reader: Theory and Case Studies of an Integrative and Transformative Methodology*; Tamkang University Press: Taipei, Taiwan, 2004.
50. Christensen, C.M. *The Innovator’s Dilemma: When New Technologies Cause Great Firms to Fail*; Harvard Business Review Press: Boston, MA, USA, 1997.
51. Tushman, M.L.; O’Reilly, C.A. *Winning Through Innovation: A Practical Guide to Leading Organizational Change and Renewal*; Harvard Business School Press: Boston, MA, USA, 1997.
52. Senge, P.M.; Kleiner, A.; Roberts, C.; Ross, R.; Roth, G.; Smith, B.; Guman, E.C. *Schools That Learn: A Fifth Discipline Fieldbook for Educators, Parents, and Everyone Who Cares About Education*; Doubleday: New York, NY, USA, 2000.
53. Hargreaves, A.; Fink, D. *Sustainable Leadership*; JosseyBass: San Francisco, CA, USA, 2006.
54. Ministry of Higher Education. *Framing Malaysian Higher Education 4.0: FutureProof Talents*; Government of Malaysia: Putrajaya, Malaysia, 2018.
55. Inayatullah, S.; Ithinin, F. *Transformation 2050: The Alternative Futures of Malaysian Universities*; USIM: Bandar Baru Nilai, Malaysia, 2018.
56. Calnan, M. The Future of Value or the Value of the Future: Exploring New Horizons in Creating Value Through Futures Literacy. *J. Creat. Value* **2022**, *8*, 95–101. [[CrossRef](#)]
57. Shakya, M.; Vagnarelli, G. Creating value from intangible cultural heritage—The role of innovation for sustainable tourism and regional rural development. *Eur. J. Cult. Manag. Polic.* **2024**, *14*, 12057. [[CrossRef](#)]
58. Tapscott, D.; Tapscott, A. *Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World*; Portfolio: New York, NY, USA, 2016.
59. Schumpeter, J.A. *Capitalism, Socialism, and Democracy*; Harper & Brothers: New York, NY, USA, 1942.
60. Brown, P. *Right Relationship: Building a Whole Earth Economy*; Berrett-Koehler Publishers: San Francisco, CA, USA, 2009.
61. Korten, D.C. *The Great Turning: From Empire to Earth Community*; Berrett-Koehler Publishers: San Francisco, CA, USA, 2006.
62. Henderson, H. *Building a WinWin World: Life Beyond Global Economic Warfare*; Berrett-Koehler Publishers: San Francisco, CA, USA, 1996.
63. Eisler, R. *The Real Wealth of Nations: Creating a Caring Economics*; Berrett-Koehler Publishers: San Francisco, CA, USA, 2007.
64. Korten, D.C. *Agenda for a New Economy: From Phantom Wealth to Real Wealth*, 2nd ed.; Berrett-Koehler Publishers: San Francisco, CA, USA, 2010.
65. Kuhn, T.S. *The Structure of Scientific Revolutions*, 3rd ed.; University of Chicago Press: Chicago, IL, USA, 1996.
66. Miller, R. Sensing and Making-Sense of Futures Literacy: Towards a Futures Literacy Framework (FLF). In *Transforming the Future: Anticipation in the 21st Century*; Miller, R., Ed.; Routledge: London, UK, 2018; pp. 15–50. Available online: <https://www.taylorfrancis.com/chapters/oa-edit/10.4324/9781351048002-2/sensing-making-sense-futures-literacy-riel-miller> (accessed on 25 June 2025).
67. Scott, J.C. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*; Yale University Press: New Haven, CT, USA, 1998.
68. Capra, F.; Luisi, P.L. *The Systems View of Life: A Unifying Vision*; Cambridge University Press: Cambridge, UK, 2014.
69. Garvin, D.A. *Learning in Action: A Guide to Putting the Learning Organization to Work*; Harvard Business School Press: Boston, MA, USA, 2000.
70. Schein, E.H.; Schein, P. *Organizational Culture and Leadership*, 5th ed.; JosseyBass: San Francisco, CA, USA, 2017.
71. Laloux, F. *Reinventing Organizations: A Guide to Creating Organizations Inspired by the Next Stage of Human Consciousness*; Nelson Parker: Brussels, Belgium, 2014.
72. Holling, C.S. *Adaptive Environmental Assessment and Management*; John Wiley & Sons: London, UK, 1978.
73. Brookfield, S.D. *Becoming a Critically Reflective Teacher*, 2nd ed.; JosseyBass: San Francisco, CA, USA, 2017.
74. DuFour, R.; Eaker, R.; DuFour, R. (Eds.) *On Common Ground: The Power of Professional Learning Communities*; Solution Tree: Bloomington, IN, USA, 2005.
75. Freire, P. *Pedagogy of Hope: Reliving Pedagogy of the Oppressed*; Continuum: New York, NY, USA, 1994.
76. Gaventa, J.; Cornwall, A. Power and Knowledge. In *The SAGE Handbook of Action Research: Participative Inquiry and Practice*; Reason, P., Bradbury, H., Eds.; SAGE Publications: London, UK, 2008; pp. 172–189.
77. UNESCO. *Rethinking Education: Towards a Global Common Good?* UNESCO Publishing: Paris, France, 2015.
78. Jeffrey Sachs Conference. Sustainable Development and Global Cooperation. Available online: <https://www.ghd.pku.edu.cn/English/News/bf710ce88da74321b758b7282f28847e.htm> (accessed on 25 June 2025).

79. Hawkes, J. *The Fourth Pillar of Sustainability: Culture's Essential Role in Public Planning*; Common Ground Publishing: Melbourne, Australia, 2001.
80. Iaione, C.; De Nicolis, E.; Santagati, M.E. Participatory governance of culture and cultural heritage: Policy, legal, economic insights from Italy. *Front. Sustain. Cities* **2020**, *4*, 777708. [CrossRef]
81. University of Edinburgh. Futures Literacy and Cultural Resilience—The Resilience of Living Heritage in Contested Spaces—The Case of Strovilia. 2025. Available online: https://blogs.ed.ac.uk/s2040823_cultural-heritage-futures-kipp-{}-{}-futures-project-2024-25/futures-literacy-and-cultural-resilience/ (accessed on 25 June 2025).
82. Sangwa, S.; Internet Archive. How Do Harari's Proposed Solutions To 21st Century Problems Align With The Globalist Agenda. 2024. Available online: <https://archive.org/details/how-do-hararis-proposed-solutions-to-21st-century-problems-align-with-the-globalist-agenda> (accessed on 25 June 2025).
83. Senge, P.M. *The Fifth Discipline: The Art and Practice of the Learning Organization*; Doubleday: New York, NY, USA, 1990.
84. Tranfield, D.; Denyer, D.; Smart, P. Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *Br. J. Manag.* **2003**, *14*, 207–222. [CrossRef]
85. Miller, R. (Ed.) *Transforming the Future: Anticipation in the 21st Century*; Routledge: London, UK, 2018. Available online: <https://www.taylorfrancis.com/books/oa-edit/10.4324/9781351048002/transforming-future-riel-miller> (accessed on 25 June 2025).
86. Morin, E. *Introduction à la Pensée Complexe*; ESF: Paris, France, 1990.
87. UNESCO. *Indigenous Heritage Education and Anticipatory Capacity: Australia, Canada, New Zealand Analysis*; UNESCO Social and Human Sciences Sector: Paris, France, 2019.
88. Miller, R.; UNESCO FLL Network. *Urban Heritage Education and Anticipatory Capacity: Comparative Analysis Bogotá-Ottawa-Johannesburg*; UNESCO Social and Human Sciences Sector: Paris, France, 2019.
89. ICCROM. *Traditional Knowledge Systems and Anticipatory Learning: Rural Implementation Evidence*; ICCROM: Rome, Italy, 2020.
90. UNESCO. *Longitudinal Impact Study: Future Literacy in Heritage Education 2014–2019*; UNESCO Publishing: Paris, France, 2021.
91. Inayatullah, S.; Miller, R. *Institutional Transformation Through Anticipatory Learning: Five Year Follow up Study*; UNESCO Future Literacy Chair: Paris, France, 2022.
92. Community Heritage Preservation Network. *Adaptive Capacity Development: Longterm Community Impact Assessment*; CHPN: Geneva, Switzerland, 2021.
93. Cultural Economics Research Institute. *Heritage-Based Economic Development: Sustainability Analysis 2015–2020*; CERi: London, UK, 2021.
94. Reason, P.; Bradbury, H. (Eds.) *The SAGE Handbook of Action Research: Participative Inquiry and Practice*, 2nd ed.; SAGE Publications: London, UK, 2008.
95. Israel, B.A.; Schulz, A.J.; Parker, E.A.; Becker, A.B. Review of community-based research: Assessing partnership approaches to improve public health. *Annu. Rev. Public Health* **1998**, *19*, 173–202. [CrossRef] [PubMed]
96. Voros, J. Big History and Anticipation: Using Futures Studies Methods to Create Transformative Learning. *World Futures Rev.* **2017**, *9*, 123–135.
97. Max-Neef, M. *Human Scale Development: Conception, Application and Further Reflections*; Apex Press: New York, NY, USA, 1991.
98. Lundberg, R.; Pink, S.; Pinyon, Z. Interdisciplinary futures: A conceptual approach. *Futures* **2025**, *172*, 103648. [CrossRef]
99. Bishop, P.; Hines, A. *Teaching About the Future*; Palgrave Macmillan: New York, NY, USA, 2012.
100. Intergenerational Equity Research Centre. *Principles of Intergenerational Equity*; University of Melbourne: Melbourne, Australia, 2019.
101. Sterling, S. *Sustainable Education: Revisioning Learning and Change*; Green Books: Totnes, UK, 2001.
102. Cornelius, H. Teaching futures literacy for the heritage sector. In *Routledge Handbook of Sustainable Heritage*, 1st ed.; Fouseki, K., Cassar, M., Dreyfuss, G., Ang, K.K.E., Eds.; Routledge: London, UK, 2023; pp. 527–542.
103. Bishop, P. Presentation at St. Peter's School Conference: How to Bring the Future into Our Schools. Available online: <https://stpeters.es/peter-bishop-invites-our-teachers-to-introduce-the-future-into-our-curriculum-and-use-it-to-empower-our-students/> (accessed on 25 June 2025).
104. Morin, E. *Le Paradigme Perdu: La Nature Humaine*; Éditions du Seuil: Paris, France, 1973.
105. Geertz, C. *Local Knowledge: Further Essays in Interpretive Anthropology*; Basic Books: New York, NY, USA, 1983.
106. Harrison, R.; DeSilvey, C.; Holtorf, C.; Macdonald, S.; Bartolini, N.; Breithoff, E. *Heritage Futures: Comparative Approaches to Natural and Cultural Heritage Practices*; UCL Press: London, UK, 2020.
107. Saxena, K.G.; Rao, K.S. Traditional Knowledge Systems and Sustainable Development. In *Traditional Ecological Knowledge of Resource Management in Asia*; Rai, S.C., Mishra, P.K., Eds.; Springer: Cham, Switzerland, 2022. [CrossRef]
108. Sivakumar, K.; Boon, M. The role of intellectual humility in promoting epistemic fluency for interdisciplinary engineering education. *Front. Educ.* **2024**, *9*, 1395265. [CrossRef]
109. Wired Next Fest Trentino. Tema: Energia e Futuro. Available online: <https://eventi.wired.it/nextfest25-trentino> (accessed on 25 June 2025).

110. Steffen, W.; Richardson, K.; Rockström, J.; Cornell, S.E.; Fetzer, I.; Bennett, E.M.; Biggs, R.; Carpenter, S.R.; de Vries, W.; de Wit, C.A.; et al. Planetary boundaries: Guiding human development on a changing planet. *Science* **2015**, *347*, 1259855. [[CrossRef](#)] [[PubMed](#)]
111. Throsby, D. *Economics and Culture*; Cambridge University Press: Cambridge, UK, 2001.
112. Creswell, J.W.; Plano Clark, V.L. *Designing and Conducting Mixed Methods Research*, 3rd ed.; SAGE Publications: London, UK, 2017.
113. Snyder, H. Literature review as a research methodology: An overview and guidelines. *J. Bus. Res.* **2019**, *104*, 333–339. [[CrossRef](#)]
114. Booth, A.; Sutton, A.; Papaioannou, D. *Systematic Approaches to a Successful Literature Review*; SAGE Publications: London, UK, 2016.
115. Patton, M.Q. *Qualitative Research & Evaluation Methods*, 4th ed.; SAGE Publications: London, UK, 2015.
116. Charmaz, K. *Constructing Grounded Theory*, 2nd ed.; SAGE Publications: London, UK, 2014.
117. Yin, R.K. *Case Study Research and Applications: Design and Methods*, 6th ed.; SAGE Publications: London, UK, 2018.

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.