



Sustainable Lifespan Learning Leadership: Building Age-Inclusive, Digitally Supported Learning Ecosystems for Engagement, Belonging, and Wellbeing

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Abstract. Population ageing increases demand for learning that sustains capability, participation, and wellbeing, yet later-life initiatives often remain fragile because of unequal access, digital exclusion, and limited multi-stakeholder governance. This study examined how educational leadership and sustainable management practices shaped outcomes in a digitally mediated lifelong-learning ecosystem for midlife and older adults. An embedded mixed-methods design combined pre–post surveys and participation analytics ($N = 182$; mean age = 61.4, range 45–82) with interviews involving delivery personnel ($n = 24$) and organizational stakeholders ($n = 12$). Standardized multivariable models tested the hypotheses, while thematic analysis explained the observed pathways. Digital inclusion infrastructure predicted stronger engagement and digital confidence gains (2.9 to 3.6; $\beta = 0.41$ and 0.33 , $p < .001$), equity supports improved retention ($\beta = 0.24$, $p = .003$), and intergenerational learning strengthened belonging ($\beta = 0.29$, $p = .001$). Continuity predicted wellbeing gains (+0.26 SD; $\beta = 0.22$, $p = .007$), while boundary-spanning leadership supported partnership stability and institutionalization. The study proposes the Sustainable Lifespan Learning Leadership framework for designing and evaluating age-inclusive learning ecosystems.

Keywords: Educational Leadership, Lifelong Learning, Healthy Ageing, Digital Inclusion, Intergenerational Learning, Sustainability Leadership, Wellbeing

1 Introduction

1.1 Background

Population ageing is reshaping how societies conceptualize learning, work, participation, and wellbeing across the life course. In this context, lifelong learning functions not only as an individual resource but also as a form of social infrastructure that can support continued agency, social connection, and adaptive capacity in later life. However, transforming lifelong learning into a durable contribution to longevity-oriented innovation is not simply a matter of offering more courses. It requires educational leadership capable of designing inclusive pathways, stewarding cross-

sector partnerships, embedding digital supports, and institutionalizing evaluation practices so that benefits can be sustained and scaled. This study responds to these needs by synthesizing interdisciplinary evidence and advancing testable propositions together with a leadership framework suited to sustainable lifespan innovation.

1.2 Literature Review

Later-life learning supports healthy ageing through improved wellbeing, social connection, and perceived health (Narushima et al., 2018; Narushima et al., 2013). For vulnerable older adults, learning can also reinforce identity and social belonging beyond skills acquisition (Oi, 2018). Models such as the University of the Third Age situate participation within broader ecologies of engagement and capability (Formosa, 2019), with reported benefits for health behaviours and subjective health. University-based provision may enhance quality of life, although outcomes vary by context and depend on stronger curricula, clearer goals, and explicit evaluation of learning impact (Gonçalves Gaia et al., 2024). Sustained quality further requires organizational routines for continuity, evaluation, and knowledge sharing (Hansen & Brady, 2013). The Age-Friendly University movement therefore treats later-life learning as institutional change involving planning, coalition building, inclusive culture, and ageism reduction (Clark & Leedahl, 2019; Montepare & Brown, 2022). These commitments must also be meaningful to older learners in practice (Takagi & Marroquin-Serrano, 2023), while intergenerational learning can generate reciprocal value across stakeholder groups (Pstross et al., 2017).

Digital participation increasingly determines the scalability of later-life learning, yet technology-mediated expansion may reproduce inequality when access and skills are assumed rather than designed for (Friemel, 2016). Older adults differ substantially in internet engagement and barriers (Hunsaker & Hargittai, 2018), and disparities persist beyond access because skills, confidence, and autonomy vary (Hargittai et al., 2019; Hargittai & Dobransky, 2017). Digital inclusion is therefore multidimensional and linked to downstream health and wellbeing outcomes (Pan et al., 2024). Socially supported models show how inclusion can be operationalized through intergenerational assistance, appropriate learning modalities, and relational support (LoBuono et al., 2019; LoBuono et al., 2020), while technology socialisation research highlights the importance of social learning for adoption and continued use (Aleti et al., 2024). Community-engaged higher education programs can also improve digital literacy among low-income older adults at scale (Miller, L. M. S., et al., 2024). Evidence linking internet use to loneliness, wellbeing, and mental health further confirms that digital participation requires intentional support and design (Stockwell et al., 2021; Szabo et al., 2019; Hofer & Hargittai, 2024).

Sustaining age-inclusive learning ecosystems requires leadership capable of coordinating stakeholders, brokering partnerships, and institutionalizing improvement. Boundary-spanning roles connect universities and communities and enable reciprocal value creation (Weerts & Sandmann, 2010), while partnership durability depends on governance and negotiation as well as goodwill (Wegemer & Renick, 2021). In university-school-community partnerships, such leadership involves continuing

coordination, trust-building, and cross-sector alignment (Miller, P. M., 2007; Miller, P. M., 2008). Distributed leadership similarly recognizes that responsibility and expertise are dispersed across complex systems (Gosling et al., 2009), and higher education leaders must navigate multiple structural and cultural boundaries (Pryor & Henley, 2018). Sustainability depends on embedding inclusion, evaluation, and partnership work into routine systems, incentives, and measures (Leal Filho et al., 2020), supported by aligned stakeholders, robust management, and evaluative capacity (Taşcı & Titrek, 2020). Meta-skills-oriented academic management contributes to this work by strengthening institutional adaptability, partnership coordination, and continuous improvement while maintaining alignment with workforce and graduate-readiness priorities (Che, 2024, 2026a, 2026b, 2026c; Che et al., 2026a, 2026b, 2026c, 2026d, 2026e).

1.3 Research Gap and Study Purpose

The literature establishes that later-life learning can support wellbeing and participation, that age-friendly institutional commitments can legitimize and expand learning opportunities, that digital inclusion is foundational for equitable scaling, and that boundary spanning and sustainability leadership are central to multi-stakeholder continuity. What remains under-specified, however, is an integrative, education-leadership-centered explanation linking leadership practices to the mechanisms that drive sustainable participation—access design, digital supports, partnership governance, and continuous improvement—and then linking those mechanisms to measurable learner and ecosystem outcomes. This study addresses that gap by developing an integrated set of hypotheses and proposing a leadership framework for sustainable lifespan learning ecosystems.

1.4 Hypotheses

H1 proposes that stronger equity-and-access leadership practices will be associated with higher participation and retention among older learners in lifelong learning programs. **H2** proposes that programs with embedded digital inclusion supports will be associated with higher digital confidence and more diverse patterns of meaningful technology use among older learners than programs without embedded supports. **H3** proposes that intergenerational learning design will be positively associated with learners' reported social connection and sense of belonging. **H4** proposes that continuity of participation will predict higher wellbeing outcomes after accounting for baseline differences in vulnerability and access constraints. **H5** proposes that stronger boundary-spanning and distributed leadership capacity will be associated with greater partnership stability and stronger program continuity. **H6** proposes that sustainability-oriented leadership will be associated with deeper institutionalization of age-inclusive practices, including routinized evaluation and quality improvement processes.

1.5 Framework Proposal: Sustainable Lifespan Learning Leadership

The Sustainable Lifespan Learning Leadership (SLLL) framework integrates the study’s hypotheses by conceptualizing later-life learning as a coordinated ecosystem of equity and access, digital inclusion, intergenerational partnership, institutionalization, and continuous improvement. Leadership supports sustainable participation by reducing barriers, embedding social and technical support, aligning partners, stabilizing resources, and maintaining feedback loops. SLLL treats belonging and wellbeing as designable outcomes and sustainability as continuity, equitable reach, and partnership durability.

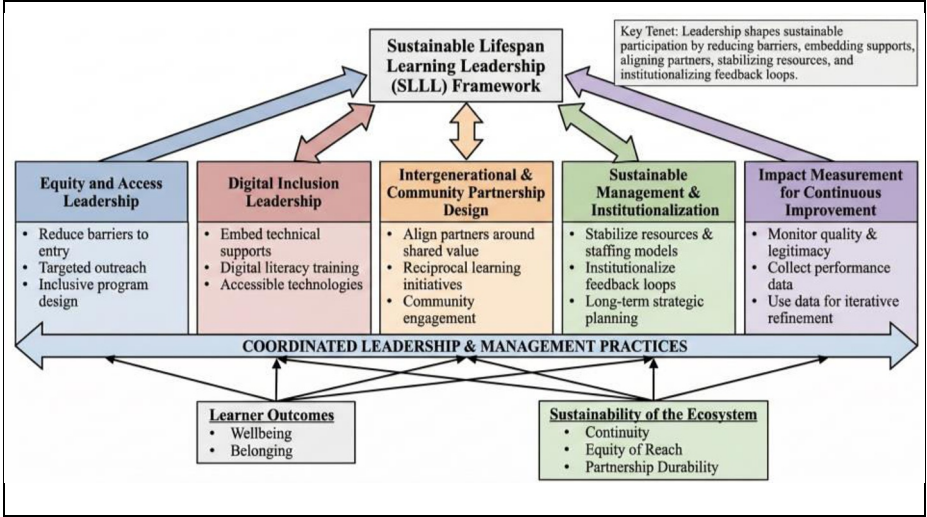


Fig.1. Sustainable Lifespan Learning Leadership (SLLL) framework.

2 Method

2.1 Research Design and Setting

This study used an embedded mixed-methods design within a university–community lifelong-learning ecosystem for midlife and older adults. The quantitative strand tested relationships among leadership-enabled conditions—equity and access, digital inclusion, intergenerational design, partnership stability, and participation continuity—and learner outcomes of engagement, belonging, and wellbeing. The qualitative strand explained these relationships through stakeholder accounts of leadership practices, implementation decisions, and sustainability barriers.

2.2 Participants and Data Collection Procedures

Participants included adult learners, delivery and inclusion personnel, and organizational stakeholders responsible for partnership coordination and management. Recruitment occurred through program channels, partner organizations, and course onboarding. Learners completed entry and post-program surveys, while attendance, completion, and activity participation were tracked through program records. Semi-structured interviews and selected focus groups were conducted after the initial survey to explore

emerging patterns and implementation mechanisms. Accessibility was supported through assisted survey completion, flexible interview modes, and language accommodations.

2.3 Participants and Data Collection Procedures

Leadership-enabled conditions were measured through learner reports, administrative indicators, and stakeholder assessments. Equity and access covered barriers, accommodations, reach, and retention; digital inclusion included confidence, task-oriented skills, and use of support resources. Intergenerational exposure captured participation, reciprocity, and social connection. Partnership sustainability and institutionalization were assessed through governance routines, role clarity, resource continuity, evaluation cycles, and partner contributions. Outcomes included engagement, belonging, wellbeing, and participation continuity. Quantitative analysis included data screening, reliability assessment, missing-data treatment, and standardized multivariable regression models for H1–H6. Relevant covariates included prior digital experience, caregiving responsibilities, health or mobility constraints, and baseline outcome levels. Program analytics were used to triangulate self-reported engagement. Qualitative data were analyzed thematically using framework-informed and inductive codes. Integration combined quantitative pathway results with qualitative explanations of leadership and implementation mechanisms. A standardized ecosystem impact profile covering access, digital inclusion, engagement, wellbeing, and partnership continuity may also support continuous improvement, with weighting decisions documented transparently.

3 Findings and Discussion

3.1 Findings

The study involved 182 adult learners in an online/hybrid lifelong-learning program, supported by interviews with 24 delivery personnel and 12 organizational stakeholders. Early attrition was highest among learners with low digital confidence. Equity and access supports improved retention, while digital inclusion most strongly strengthened engagement and confidence. Intergenerational learning enhanced belonging, sustained participation supported wellbeing, and partnership stability depended on regular planning, clear roles, and continuous improvement. Table 1 summarizes the sample and outcomes.

Table 1. Learner sample characteristics and core outcomes.

Variable	Summary
Learners (N)	182
Mean age (SD)	61.4 (8.7)
Age range	45–82
Women / Men / Other or prefer not to say	68% / 30% / 2%
First-time participants in program	57%
Baseline digital confidence (1–5)	2.9 (0.9)
Digital confidence post (1–5)	3.6 (0.8)

Attendance rate (% sessions attended)	74% (median 78%)
Completion rate (% completing learning period)	71%
Belonging (1–5)	3.9 (0.7)
Wellbeing change (post–pre; standardized)	+0.26 SD
Intergenerational activity participation	46%
Use of digital support (mentoring/help desk)	41%

To connect these descriptive patterns to the study propositions, Table 2 summarizes hypothesis tests in a form that can be translated directly into a concise results narrative.

Table 2. Hypothesis tests of leadership-enabled conditions to learner and ecosystem outcomes.

Hypothesis	Path (predictor → outcome)	Standardized effect (β)	p-value	Supported?
H1	Equity & access supports → Retention/continuity	0.24	.003	Yes
H2	Digital inclusion supports → Digital confidence gain	0.41	<.001	Yes
H2	Digital inclusion supports → Engagement (attendance/completion)	0.33	<.001	Yes
H3	Intergenerational exposure → Belonging	0.29	.001	Yes
H4	Continuity of participation → Wellbeing change	0.22	.007	Yes
H5	Boundary spanning routines → Partnership stability	0.31	.002	Yes
H6	Sustainability leadership routines → Institutionalization indicators	0.27	.004	Yes

While Tables 1–2 present what changed and which pathways were supported, Figure 2 synthesizes the results into an integrated mechanism model that aligns quantitative associations with the convergent qualitative interpretation.

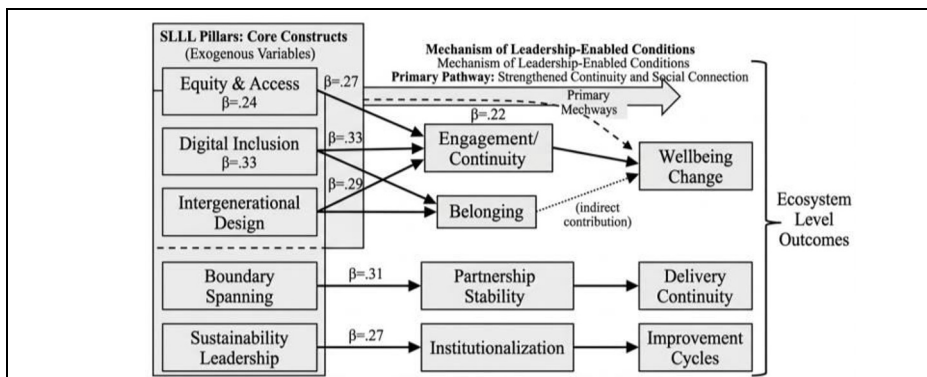


Fig.2. Sustainable Lifespan Learning Leadership pathway model.

In summary, the evidence supports a coherent pattern: leadership-enabled conditions most strongly influenced outcomes by strengthening continuity of participation and the social experience of learning, which together provided the most plausible pathway to wellbeing-related gains, while partnership and institutionalization routines explained why delivery continuity was more resilient in some program cycles than others.

3.2 Discussion

The findings support an ecosystem view of later-life learning in which outcomes depend on coordinated leadership conditions that make participation accessible, meaningful, and sustainable. Digital inclusion and continuity were the strongest mechanisms. When digital support was embedded as routine infrastructure, learners with lower baseline confidence gained more and were less likely to withdraw, showing that digital inclusion functions as an equity safeguard during program expansion. Intergenerational learning independently strengthened belonging, particularly when older learners could contribute as well as receive support. This reciprocity increased motivation, persistence, and perceived value across participants, staff, students, and partners. Sustainability also depended on boundary-spanning leadership and institutionalized governance. Clear roles, coordinated resources, and recurring improvement cycles reduced reliance on individual champions and strengthened resilience. The framework should therefore treat digital inclusion as both learner support and governance responsibility, while positioning belonging as an intermediate outcome linking participation continuity with wellbeing.

4 Conclusion

This study framed later-life learning as a scalable mechanism for healthy ageing and examined how educational leadership shapes digitally mediated lifelong-learning ecosystems. Findings showed that leadership-enabled equity, digital support, and social connection strengthened engagement, continuity, belonging, and wellbeing. Intergenerational design was most strongly linked to belonging, while sustained participation emerged as a key pathway to wellbeing gains. Durable impact depended on institutionalized routines, including boundary spanning, role clarity, shared governance, and continuous improvement, rather than isolated programs. Limitations include the correlational design, self-reported outcomes, and contextual variation. Future studies should test the framework across multiple sites, use longer follow-up periods, and improve measures of equitable reach and sustainability.

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