

Learning across ages: the role of intergenerational engagement in elderly education

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ABSTRACT

Intergenerational learning (IGL) has gained increasing attention as a strategy to address the limited effectiveness of elderly education, particularly in the context of digital literacy and lifelong learning. Despite growing research, the field remains fragmented, with limited synthesis translating evidence into actionable educational strategies. This study aims to systematically examine how IGL enhances elderly learning ability and to identify strategic directions for its implementation. A bibliometric-driven analytical approach was employed using Scopus-indexed publications from 2021 to 2025. The top ten most-cited articles were identified through performance analysis and subsequently analyzed using a strengths, weaknesses, opportunities, and threats (SWOT) framework. The findings reveal that IGL significantly improves digital literacy, cognitive engagement, and social well-being among elderly learners. However, challenges such as internalized ageism, low learning confidence, and the absence of structured and scalable frameworks remain critical barriers. The study also highlights opportunities for integrating IGL into formal education and community-based programs, while identifying threats related to technological change and policy limitations. This study contributes a bibliometric-informed strategic synthesis that advances understanding of IGL and provides actionable insights for educators, program designers, and policymakers in elderly education.

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1. INTRODUCTION

Intergenerational learning (IGL) is an educational approach that promotes meaningful interaction between individuals from different age groups through the reciprocal exchange of knowledge, skills, and experiences. Grounded in social constructivism and transformative learning theories, IGL emphasizes collaboration, dialogue, and shared meaning-making across generations [1], [2]. This approach not only strengthens intergenerational relationships but also contributes to social cohesion and cultural continuity, making it increasingly relevant in contemporary educational and community contexts [3], [4]. In light of global demographic shifts and the rapid growth of ageing populations, there is an urgent need to develop inclusive learning models that support lifelong learning among the elderly. In this context, IGL has gained recognition as a promising strategy for enhancing elderly learning ability.

Despite its recognized potential, the implementation of IGL in elderly education remains limited and inconsistent across formal and community contexts. Many existing programs are small-scale, lack pedagogical structure, and demonstrate varying levels of effectiveness, particularly in improving digital literacy among elderly learners. In addition, current research remains fragmented, with limited integration of psychological, pedagogical, and technological dimensions into a coherent framework for practice. While bibliometric studies have mapped trends and strengths, weaknesses, opportunities, and threats (SWOT) analyses have been applied in educational contexts, there is still a lack of a comprehensive synthesis that translates high-impact research into actionable strategies for program design and policy development. This highlights a critical gap in both knowledge integration and practical application within IGL research.

The significance of IGL for the elderly extends beyond knowledge acquisition to encompass psychological, social, and cognitive well-being. Participation in intergenerational programs has been associated with improved self-esteem, a stronger sense of purpose, and enhanced quality of life [1], [5]. Through engagement with younger generations, the elderly can maintain active social connections, thereby reducing isolation and loneliness [6]. Moreover, many IGL initiatives incorporate digital learning elements, enabling elderly learners to acquire essential technological skills and bridge the digital divide [6], [7]. These opportunities not only foster independence but also support active participation in an increasingly digital society.

IGL also contributes to cognitive and emotional development among the elderly [8], [9]. Collaborative activities such as storytelling, discussion, and problem-solving stimulate memory, attention, and critical thinking, while fostering empathy and mutual respect between generations [10], [11]. These outcomes align with the principles of active ageing, which emphasize continued engagement, autonomy, and well-being in later life [5]. As such, IGL is increasingly viewed as a valuable pedagogical approach for promoting holistic development among elderly learners.

Despite its potential, several challenges hinder the effective implementation of IGL. Technological barriers remain a key concern, as many elderly individuals struggle to adapt to digital tools due to limited experience, reduced self-efficacy, and age-related cognitive changes [12], [13]. In addition, negative societal attitudes, including age-related stereotypes, may undermine the older adults' confidence and participation [11], [12]. Furthermore, existing programs often lack flexibility and inclusivity, with limited adaptation to the diverse needs and learning preferences of elderly participants [4], [7]. Emotional factors such as anxiety and fear of failure may also affect their engagement in intergenerational settings [14].

Furthermore, while bibliometric studies have been widely used to map research trends [15], [16], they often lack strategic interpretation that can inform practice and policy. Similarly, SWOT analysis is commonly applied in educational research but rarely integrated with bibliometric evidence. This study addresses this gap by combining both approaches, offering a novel bibliometric SWOT (BSWOT) perspective that not only identifies influential studies but also translates findings into strategic insights for implementation [17]. Given these gaps, there is an urgent need for a structured, strategic evaluation of IGL that goes beyond descriptive analysis. This study employs a BSWOT approach to analyze high-impact literature and generate actionable insights. By linking empirical findings to strategic dimensions, the study provides direct implications for educational practice, program design, and policy development in the implementation of IGL. This study is guided by the following research questions:

- What are the most influential studies shaping IGL in elderly education?
- What SWOT characterize current IGL research?
- How can these findings inform structured and scalable approaches to elderly education?

Beyond methodological integration, this study contributes new strategic insights by identifying recurring integrative patterns across high-impact IGL research. Specifically, the findings reveal that successful IGL implementation depends on the interaction of three interconnected dimensions: psychological readiness, pedagogical structure, and technological adaptability. These dimensions have often been examined separately in previous studies but rarely synthesized into a unified strategic perspective [4], [12]. Thus, this study proposes that effective elderly learning initiatives require balanced integration across these dimensions rather than isolated intervention approaches.

2. METHOD

This study adopts a bibliometric-driven analytical design, integrated with a qualitative SWOT framework, to examine IGL as a means of enhancing elderly learning ability [18]. The research follows a sequential approach, with bibliometric performance analysis serving as the basis for subsequent qualitative interpretation, ensuring that insights are grounded in high-impact scholarly evidence [17]. To enhance transparency and replicability, the selection of influential publications was based on citation counts derived from Scopus performance analysis. Only the top 10 most-cited articles were included, as they represent

high-impact contributions shaping the field’s intellectual structure [19]. This purposive sampling ensures that the SWOT analysis is grounded in authoritative and widely recognized studies. The evidence in this study is based on citation-driven bibliometric data and qualitative thematic synthesis, ensuring that interpretations are grounded in high-impact scholarly contributions.

Nevertheless, the authors acknowledge that citation-driven selection may introduce bias by prioritizing highly visible publications over emerging studies with lower citation counts [18]. As such, the findings should be interpreted as reflecting dominant and influential scholarly perspectives rather than representing the entirety of IGL research [15]. It is important to note that this study adopts an exploratory strategic synthesis approach. The selection of the top ten most-cited articles is grounded in the bibliometric assumption that highly cited publications represent influential knowledge sources that shape the intellectual development of a field [20], [21]. These studies often serve as foundational references, guiding subsequent research directions, theoretical discussions, and practical applications.

The first phase utilizes the Scopus database to retrieve relevant literature, given its comprehensive coverage of peer-reviewed publications [22], [23]. A structured search string is applied, followed by data screening to remove irrelevant and duplicate records. A document analysis is then conducted to identify the most influential studies in the field [24], [25]. Citation counts are used as indicators of scholarly impact, enabling the selection of the top ten most cited articles, which represent foundational contributions to IGL and elderly education [20].

In the second phase, a qualitative SWOT analysis is performed based on the selected articles [26]. The SWOT framework categorizes findings into strengths, weaknesses, opportunities, and threats, allowing for a structured evaluation of both internal characteristics (pedagogical effectiveness, learner engagement) and external factors (technological trends, societal attitudes) influencing elderly learning [27], [28]. A thematic extraction process is employed to code and synthesize key insights across the articles. The SWOT categorization was conducted through a thematic coding process [19]. Key findings, discussions, and conclusions from each selected article were systematically extracted and coded into SWOT. Cross-validation was performed by comparing patterns across studies to ensure consistency and reduce subjective bias. By integrating bibliometric performance analysis with SWOT-based analysis, this study provides a systematic, evidence-informed overview of the field [29]. The approach highlights key trends, identifies research gaps, and offers strategic insights for improving IGL practices and policies for elderly learners [30].

2.1. Search strategy

The inclusion criteria for this bibliometric analysis, as presented in Table 1, were carefully defined to ensure the selection of relevant, high-quality, and recent studies on IGL and elderly education [21]. The data were retrieved exclusively from the Scopus database, given its comprehensive coverage of peer-reviewed literature [23]. The search was limited to publications between 2021 and 2025 to capture the most current developments in the field. A structured search string was applied within the TITLE-ABS-KEY fields using the keywords (“intergeneration*”) AND (“learn*” OR “teach*”) AND (“elder*” OR “old*”) to ensure conceptual relevance. Only journal articles written in English were included to maintain academic rigor and consistency. Additionally, the selection was restricted to open-access publications, enabling full-text access for detailed analysis and ensuring transparency in the bibliometric and subsequent SWOT evaluations.

Table 1. Inclusion criteria for bibliometric analysis

Scopus database	All
Time period	2021 to 2025
Search field	TITLE-ABS-KEY
Search keywords	(“intergeneration*”) AND (“learn*” OR “teach*”) AND (“elder*” OR “old*”)
Document types	Article
Language	English
Open access	All open access

Table 1 outlines the structured inclusion criteria applied in this study, ensuring the selection of recent, relevant, and high-quality publications. The criteria reflect a deliberate focus on contemporary developments in IGL and elderly education, particularly in peer-reviewed, accessible research. The article selection process followed the preferred reporting items for systematic reviews and meta-analyses (PRISMA) flowchart to ensure transparency and systematic filtering. Initially, 1,505 records were identified from the Scopus database. After applying the time frame criterion (2021-2025), 1,011 records were excluded. The remaining 494 records were screened based on document type, resulting in the exclusion of 39 non-research articles. Subsequently, 455 full-text articles were assessed for eligibility. During this stage, 193 articles were

excluded for not meeting language (non-English) or open-access requirements. Finally, 262 studies were included in the bibliometric analysis. This systematic screening process ensured that only relevant, accessible, and high-quality studies were retained for further analysis. Figure 1 illustrates the systematic screening process, demonstrating the rigorous filtering of publications based on predefined inclusion criteria. The reduction from 1,505 initial records to 262 final articles highlights the specificity and relevance of the dataset used for analysis.

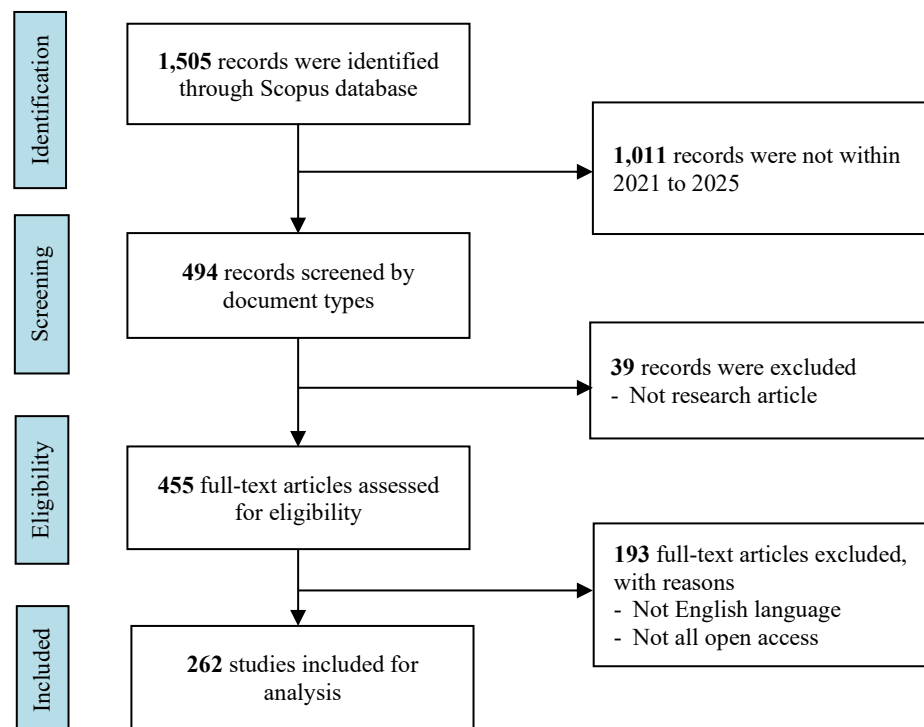


Figure 1. PRISMA flowchart

3. RESULTS AND DISCUSSION

3.1. Performance analysis

The performance analysis identified the top 10 most cited articles. Table 2 reflects the most influential contributions to IGL and elderly education research. The most cited study by Köttl *et al.* [31] (129 citations) highlights internalized ageism as a critical psychological barrier to technology adoption among the elderly, indicating the importance of addressing self-perception in learning contexts. Other studies [32], [33] further emphasize the role of structured educational approaches, particularly in integrating geriatric education and intergenerational strategies to bridge the digital divide. This pattern indicates that current research is strongly oriented towards addressing both psychological (ageism) and technological (digital divide) barriers, suggesting a dual focus that defines the contemporary trajectory of IGL research.

Table 2 presents the most influential studies by citation count, highlighting the foundational works shaping the field. These studies serve as the empirical basis for the subsequent SWOT analysis, ensuring that the findings are grounded in high-impact scholarly contributions. Several studies focus on the broader social and well-being impacts of intergenerational engagement. Campbell *et al.* [34] provide a comprehensive mapping review demonstrating the positive effects of intergenerational programs on mental and social well-being, while Pit *et al.* [35] highlight the need for adaptive learning in response to global challenges such as COVID-19. Additionally, Miller *et al.* [36] present empirical evidence on the effectiveness of community-engaged digital literacy training for low-income elderly.

Other highly cited works extend the understanding of intergenerational influence beyond direct learning contexts. For instance, Ma *et al.* [37] establish a link between offspring education and elderly cognitive outcomes, while Biswas [38] and Jones and Lucas [39] highlight the emerging role of younger generations as knowledge contributors. Although Pingault *et al.* [40] adopt a genetic perspective, it reinforces the significance of intergenerational influence. Collectively, these studies demonstrate that IGL is multifaceted, encompassing psychological, educational, social, and contextual dimensions.

The overlay visualization, as shown in Figure 2 generated using VOSviewer reveals the temporal evolution of research trends in IGL and elderly education. Earlier studies (indicated by darker colors) primarily focused on foundational issues such as ageing, cognition, and social interaction, reflecting initial concerns about elderly well-being [31], [37]. More recent publications (highlighted in lighter colors) demonstrate a clear shift towards themes such as digital literacy, technology adoption, IGL, and social inclusion, indicating the growing importance of technological engagement among the elderly [33], [36].

Additionally, emerging topics related to community-based interventions and youth involvement reflect an increasing emphasis on applied and participatory learning approaches [34], [38]. Overall, the overlay trend illustrates a transition from general ageing concerns to more targeted, solution-driven research that addresses the digital divide and enhances elderly learning through intergenerational strategies. This shift reflects a transition from descriptive ageing studies to solution-oriented, intervention-based research, highlighting the growing importance of applied intergenerational strategies for addressing real-world learning challenges.

Table 2. Top 10 most cited documents

No.	Author(s)	Title	No. of citations
1.	Köttl <i>et al.</i> [31]	“But at the age of 85? Forget it!”: Internalized ageism, a barrier to technology use	129
2.	Masud <i>et al.</i> [32]	A scoping review of the changing landscape of geriatric medicine in undergraduate medical education: curricula, topics and teaching methods	51
3.	Cheng <i>et al.</i> [33]	Bridging the digital divide for rural older adults by family intergenerational learning: a classroom case in a rural primary school in China	45
4.	Campbell <i>et al.</i> [34]	Non-familial intergenerational interventions and their impact on social and mental wellbeing of both younger and older people—A mapping review and evidence and gap map	43
5.	Pit <i>et al.</i> [35]	COVID-19 and the ageing workforce: global perspectives on needs and solutions across 15 countries	41
6.	Pingault <i>et al.</i> [40]	Genetic nurture versus genetic transmission of risk for ADHD traits in the Norwegian mother, father and child cohort study	40
7.	Biswas [38]	Letting teach: Gen Z as socio-political educators in an overheated world	38
8.	Jones and Lucas [39]	‘Listen to me!’: Young people’s experiences of talking about emotional impacts of climate change	38
9.	Ma <i>et al.</i> [37]	Offspring educational attainment and older parent cognition in Mexico	37
10.	Miller <i>et al.</i> [36]	Digital literacy training for low-income older adults through undergraduate community-engaged learning: single-group pretest-posttest study	36

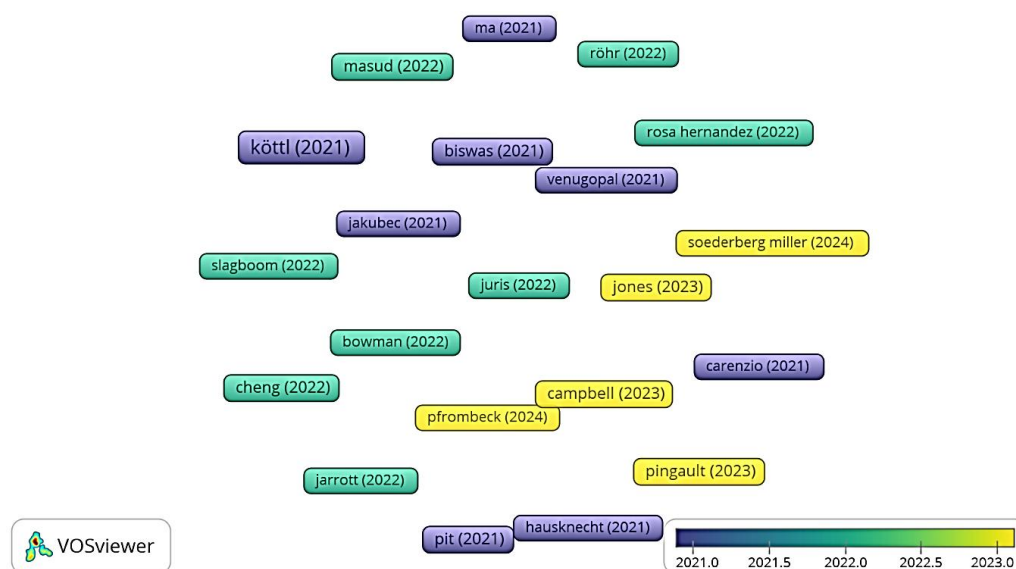


Figure 2. Overlay visualization (VOSviewer)

3.2. SWOT analysis

A SWOT analysis was conducted based on the top 10 most-cited articles identified through bibliometric analysis to examine IGL in enhancing elderly learning ability. This approach evaluates internal factors (strengths and weaknesses) and external factors (opportunities and threats) influencing IGL

implementation, as shown in Table 3. By synthesizing high-impact studies, the analysis highlights key benefits such as improved cognitive and social outcomes, while identifying limitations including psychological barriers and design challenges. The SWOT framework provides a structured, strategic lens for understanding current developments and informing future directions for elderly learning initiatives. Table 3 synthesizes key findings from the selected studies into strategic dimensions, providing a structured overview of the internal and external factors influencing the implementation of IGL. This matrix enables a deeper understanding of both the strengths and limitations of current research.

Table 3. SWOT matrix

No.	Ref.	Focus of study	Strengths	Weaknesses	Opportunities	Threats
1.	[31]	Internalized ageism affecting elderly technology learning	Identifies key psychological barrier influencing learning engagement	Limited intervention strategies proposed	Basis for designing confidence-enhancing IGL programs	Persistent ageism reduces participation and learning outcomes
2.	[32]	Geriatric education in formal curricula	Highlights structured educational integration for ageing populations	Focuses on medical education, less on elderly learners directly	Integration of IGL into formal education systems	Institutional resistance to curriculum change
3.	[33]	Family-based IGL to bridge digital divide in rural elderly	Strong empirical evidence of IGL effectiveness in digital literacy	Context-specific (rural China), limited generalizability	Expansion to community and cross-cultural IGL programs	Infrastructure limitations and digital inequality
4.	[34]	Non-familial intergenerational programs and wellbeing	Comprehensive synthesis of IGL benefits for both age groups	Broad mapping limits depth of causal mechanisms	Scaling community-based IGL interventions	Sustainability and funding constraints
5.	[35]	Ageing workforce adaptation during COVID-19	Highlights adaptability and resilience of older adults	Not focused on structured learning models	Workplace-based intergenerational training programs	Rapid technological shifts outpace elderly adaptation
6.	[40]	Intergenerational transmission (genetic vs environmental)	Reinforces importance of intergenerational influence	Not directly linked to learning or education	Expands conceptual understanding of intergenerational impact	Misinterpretation outside educational context
7.	[38]	Gen Z as educators in socio-political contexts	Highlights youth as active knowledge facilitators	Limited focus on elderly learners	Leveraging youth in IGL for digital and social learning	Generational value conflicts
8.	[39]	Youth communication on climate emotional issues	Emphasizes youth voice and intergenerational dialogue	Not directly focused on elderly learning	Promotes intergenerational communication frameworks	Emotional and generational disconnect
9.	[37]	Offspring education impact on elderly cognition	Strong empirical link between intergenerational influence and cognition	Indirect learning mechanism	Supports family-based IGL models	Socioeconomic inequality affecting outcomes
10.	[36]	Digital literacy training via intergenerational engagement	Provides strong intervention-based evidence for IGL effectiveness	Limited sample and context scope	Replication in wider educational/community settings	Sustainability and scalability challenges

3.2.1. Strengths

a. Enhancing digital and lifelong learning skills

IGL plays a critical role in improving digital literacy and lifelong learning among the elderly by leveraging younger generations as informal educators. Studies demonstrate that structured intergenerational programs effectively bridge the digital divide, particularly in underserved or rural communities, where elderly learners benefit from guided, hands-on exposure to technology [33]. This reciprocal learning environment allows the elderly to acquire practical skills while remaining actively engaged in modern society. Furthermore, IGL supports lifelong learning by creating accessible, less intimidating learning spaces, thus reinforcing continuous personal development and adaptability among the elderly [37].

b. Promoting cognitive and social well-being

IGL significantly contributes to the cognitive and emotional well-being of the elderly through active engagement and meaningful interaction. Participation in intergenerational activities stimulates memory, attention, and communication skills, while also fostering emotional connections that reduce loneliness and social isolation. Research indicates that strong intergenerational ties, particularly within families, are associated with improved cognitive outcomes among the elderly [37]. Additionally, such programs encourage mutual respect and empathy across generations, enhancing psychological well-being. These outcomes align with active ageing frameworks, positioning IGL as a holistic approach that integrates learning with social and emotional enrichment.

3.2.2. Weaknesses

a. Internalized ageism and low learning confidence

One of the major weaknesses affecting IGL effectiveness is the presence of internalized ageism among elderly learners. Many elderly people perceive themselves as incapable of learning new skills, particularly in technologically advanced contexts, which reduces their motivation and willingness to participate [31]. This self-perception is often reinforced by societal stereotypes that portray ageing as a period of cognitive decline. As a result, even well-designed IGL programs may face resistance or low engagement from elderly participants. Addressing this psychological barrier is essential to ensure that IGL initiatives achieve their intended learning outcomes.

b. Limited scalability and lack of structured frameworks

Another key limitation of IGL is its context-dependent nature, as many existing programs are small-scale, localized, and difficult to replicate across different settings. For instance, successful interventions in rural or community-based contexts may not easily translate into urban or institutional environments [33]. Additionally, there is a lack of comprehensive frameworks or standardized models guiding the design, implementation, and evaluation of IGL initiatives. This results in inconsistent program quality and outcomes. Without clear guidelines and scalable structures, the broader adoption and impact of IGL remain constrained.

3.2.3. Opportunities

a. Integration into formal and informal education systems

There is a growing opportunity to embed IGL within formal education systems, particularly through curriculum innovation and geriatric education initiatives. Expanding educational frameworks to include intergenerational components can enhance both students' and the elderly's learning experiences, promoting inclusivity and lifelong learning [32]. Additionally, informal settings such as community centers, non-governmental organizations (NGOs), and social programs provide flexible platforms for implementing IGL at a larger scale. The integration of formal and informal learning environments enables broader reach and sustainability, positioning IGL as a key strategy for addressing ageing-related educational challenges.

b. Leveraging youth as knowledge facilitators

The increasing role of younger generations, particularly Gen Z, as active contributors to knowledge exchange presents a valuable opportunity for IGL development. Young people possess strong digital, social, and adaptive skills that can be effectively transferred to the elderly through structured interaction [38]. This dynamic not only enhances elderly learning but also empowers youth as educators and change agents. Moreover, non-familial intergenerational programs have shown potential to strengthen community cohesion and promote shared learning experiences [34]. Harnessing this intergenerational synergy can significantly expand the impact of IGL initiatives.

3.2.4. Threats

a. Rapid technological advancements and digital exclusion

Rapid technological advancements pose a significant threat to IGL's effectiveness, as the elderly may struggle to keep pace with ongoing changes in digital tools and platforms. This can lead to frustration, reduced confidence, and eventual disengagement from learning activities [35]. The widening digital gap may further marginalize elderly learners if adequate support systems are not in place. Without continuous adaptation of IGL programs to evolving technologies, there is a risk that such initiatives may become outdated or ineffective in addressing current learning needs.

b. Societal stereotypes and structural barriers

External factors such as age-related stereotypes, generational misunderstandings, and limited institutional support can hinder the success of IGL programs. Negative societal perceptions about the learning capabilities of the elderly may discourage participation and reduce program effectiveness [31]. Additionally, structural challenges such as insufficient funding, lack of policy integration, and unequal access to educational resources can limit program sustainability [34]. These barriers highlight the need for supportive policies, inclusive program design, and sustained investment to ensure the long-term viability of IGL initiatives.

3.3. Discussion

The findings from the performance analysis and SWOT synthesis provide a comprehensive understanding of IGL in enhancing elderly learning ability. The prominence of highly cited studies, particularly Köttl *et al.* [31] and Cheng *et al.* [33], indicate that current research is strongly anchored in addressing psychological and technological barriers, such as internalized ageism and the digital divide. These findings align with the identified strengths, where IGL is recognized for its capacity to enhance digital literacy, cognitive engagement, and social well-being among the elderly [37], [41]. The overlay trend further

reinforces this shift towards technology-driven, solution-oriented approaches, highlighting the growing relevance of digital inclusion in elderly learning contexts.

The dominance of digital and psychological themes in recent studies reflects a broader transformation in elderly education, in which learning challenges are increasingly tied to technological participation and self-efficacy rather than merely to access to information [12], [20]. This suggests that future IGL programs must move beyond simple knowledge transfer towards confidence-building, emotionally supportive, and digitally adaptive learning environments [31], [36]. The findings also indicate that intergenerational interaction functions not only as a pedagogical strategy but also as a mechanism for social inclusion and identity reinforcement among older adults [34].

From a theoretical perspective, these findings reinforce social constructivist views of learning, where knowledge is co-constructed through interaction. The prominence of intergenerational engagement suggests that learning in later life is not isolated but socially embedded [42], highlighting the need to reconceptualize elderly education as a relational and participatory process [43]. However, the discussion also reveals critical weaknesses that limit the effectiveness of IGL. The persistence of age-related stereotypes and low self-efficacy among elderly learners continues to hinder participation, as evidenced in the most cited works [31]. Additionally, the lack of scalable, structured frameworks across studies suggests inconsistent program design and implementation [33]. These limitations indicate a gap between theoretical potential and practical application.

Theoretically, this study does not propose a new theory but extends existing social constructivist and lifelong learning perspectives by conceptualizing IGL as a strategically integrated ecosystem encompassing social interaction, technological engagement, and psychological empowerment [1], [5]. The findings suggest that elderly learning effectiveness is shaped not only by instructional interaction but also by learners' self-perceptions and adaptability in digitally mediated environments [31]. This extends current IGL discourse by positioning digital confidence and intergenerational reciprocity as interconnected components of sustainable elderly learning.

While studies frequently highlight positive outcomes such as improved digital literacy, social connectedness, and cognitive engagement among older adults [33], [36], many of these interventions remain context-specific, small-scale, and heavily dependent on local community resources. This raises questions regarding the transferability and sustainability of reported successes. Furthermore, although digital literacy has become a dominant theme within contemporary IGL research, the emphasis on technological competence may inadvertently overshadow broader educational goals such as empowerment, lifelong participation, and social inclusion. The literature, therefore, reveals a conceptual imbalance in which technological outcomes are often more explicitly measured than psychosocial and relational outcomes.

At the same time, emerging opportunities are evident through the integration of IGL into formal education and community-based initiatives [32], [34]. The increasing role of younger generations as facilitators of learning further strengthens the applicability of IGL [38]. Nevertheless, external threats such as rapid technological changes and limited institutional support may undermine sustainability if not strategically addressed [35]. Overall, the findings suggest that while IGL holds strong potential, its future impact depends on addressing structural and psychological barriers through inclusive and adaptive strategies.

The findings of this study extend beyond descriptive mapping by providing a strategic interpretation of IGL in elderly education. The integration of bibliometric evidence with SWOT analysis demonstrates that IGL is not only a supportive learning approach but a critical mechanism for addressing digital exclusion, social isolation, and cognitive decline among the elderly. However, the lack of structured frameworks and scalable models suggests that the field has yet to fully translate research into practice. This highlights the need for future studies to develop validated frameworks and intervention models that integrate pedagogical, psychological, and technological dimensions. Based on the synthesis, this study proposes that effective IGL for elderly education is most sustainable when psychological support, structured pedagogy, and digital adaptability are integrated simultaneously [31], [32]. The absence of any of these dimensions may reduce program effectiveness and limit long-term participation among elderly learners [34], [36]. Thus, this integrative perspective provides a conceptual foundation for future framework development and offers a more holistic understanding of how IGL can be designed to support sustainable elderly education.

3.3.1. Implications

This study contributes to the theoretical advancement of IGL by integrating bibliometric performance analysis with SWOT, providing a structured lens for interpreting the field. The findings extend existing theories, such as social constructivism and lifelong learning, by positioning IGL as a reciprocal and adaptive learning mechanism rather than a unidirectional knowledge-transfer process [44]. The identification of strengths, such as cognitive and social enhancement, supports the argument that learning in later life is socially mediated and context-dependent [37]. At the same time, the presence of weaknesses, particularly internalized ageism, highlights the need to incorporate psychological constructs into IGL models [31].

This suggests that future theoretical frameworks should integrate socio-emotional and motivational dimensions alongside cognitive learning processes [45]. Additionally, the study extends intergenerational theory by demonstrating the role of younger generations as active knowledge facilitators [38], thereby reinforcing the dynamic, bidirectional nature of learning across age groups.

From a practical perspective, the findings provide clear guidance for designing and implementing effective IGL programs for the elderly. The identified strengths indicate that IGL can be utilized as a powerful tool to enhance digital literacy and social engagement among the elderly [46], particularly when younger individuals are involved as facilitators [33]. However, practitioners must address key weaknesses such as low self-confidence and resistance to learning among elderly participants by incorporating supportive, inclusive, and confidence-building strategies [31]. The opportunities identified suggest that IGL can be integrated into community programs [47], educational institutions [48], and digital literacy initiatives [49] to expand its reach [34]. Program designers should also adopt flexible and adaptive learning approaches to accommodate diverse learning needs [50].

In operational terms, effective IGL curriculum design should include collaborative digital tasks, peer-assisted technology training, storytelling-based activities, and small-group intergenerational problem-solving sessions [10], [48]. For digital literacy programs, gradual scaffolded instruction, repeated guided practice, and simplified technological interfaces are particularly important for elderly learners with low confidence [12], [49]. Community-based implementation may also benefit from structured mentor pairing, where younger participants serve as digital facilitators and emotional support partners for older adults [34], [47].

From a policy perspective, the findings support the need for national and institutional frameworks that formally integrate IGL into lifelong learning strategies [5]. For educators, the results highlight the importance of designing structured IGL-based curricula that incorporate digital literacy training, collaborative learning activities, and confidence-building mechanisms for elderly learners [32]. For program developers, the study provides evidence to support the development of scalable, community-based interventions that leverage youth as facilitators. These practical applications ensure that IGL can move beyond small-scale initiatives towards sustainable and impactful educational practices.

3.3.2. Limitations of the study

This study has several limitations that should be acknowledged. First, the analysis relied exclusively on the Scopus database, which may have excluded relevant studies indexed in other databases such as Web of Science or Google Scholar [22], [23]. Second, focusing only on the top 10 most-cited articles may overrepresent established studies while overlooking emerging, potentially significant research with lower citation counts [19], [20]. Third, the inclusion of only open-access and English-language publications may have limited the diversity of perspectives represented in the analysis [21]. Additionally, citation counts do not necessarily reflect methodological quality, as highly cited studies may gain visibility due to broader disciplinary influence rather than direct relevance to IGL [18], [29]. Future studies should therefore incorporate multiple databases, broader datasets, and empirical validation approaches to strengthen generalizability and analytical depth.

4. CONCLUSION

In conclusion, this study highlights the growing significance of IGL as a strategic approach to enhancing elderly learning ability within contemporary, digitally driven societies. Through bibliometric performance analysis and SWOT synthesis, the findings reveal that IGL offers substantial strengths in promoting digital literacy, cognitive engagement, and social well-being among the elderly. However, persistent challenges such as internalized ageism, low self-efficacy, and the lack of structured frameworks continue to limit its full potential. The study also identifies promising opportunities, particularly in integrating IGL into formal education systems and community-based programs, while acknowledging external threats such as rapid technological change and limited policy support.

Importantly, the findings align closely with sustainable development goal 4, which emphasizes inclusive and equitable lifelong learning opportunities for all. IGL serves as a practical pathway to achieving this goal by fostering inclusive learning environments that bridge generational divides and empower elderly learners. Moving forward, the success of IGL depends on the development of adaptive, inclusive, and policy-supported frameworks that address both psychological and structural barriers. Overall, this study advances knowledge and practice in lifelong learning, reinforcing the role of intergenerational collaboration in building more inclusive and sustainable educational ecosystems. Hence, this study positions IGL as a strategic educational approach with the potential to transform elderly education, offering a foundation for future model development and policy-driven implementation.

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Khairul Annuar		✓			✓		✓			✓		✓		
Abdullah														
Zuraidy Adnan	✓			✓	✓		✓			✓				
Muhammad Farhan		✓		✓		✓				✓	✓			
Nordin														

C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : Writing - **O**riginal Draft

E : Writing - Review & **E**diting

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

The authors state no conflict of interest.

DATA AVAILABILITY

Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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