Research Letter

Intergenerational Digital Learning and Relational Outcomes in Junior-Senior Dyads: Exploratory Dyadic Intervention Study

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Abstract

This study sought to examine whether and how an intergenerational learning mentorship program could be linked to individual and relational benefits. Outcomes studied through the actor-partner interdependence model (APIM) included social connectedness across generations, socioemotional gains, digital confidence, and well-being among junior partners and senior partners.

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Keywords: digital literacy; digital inclusion; intergenerational interaction; intergenerational communication; socioemotional well-being; dyadic analysis

Introduction

Age-related digital divides increasingly affect older adults' access to information and services (eg, health resources), with implications for their autonomy and psychological well-being [1]. Previous research has shown that digital literacy interventions have been associated with psychosocial adaptation for older adults, including not only functional competency but also confidence development, empowerment, and the provision of new avenues for social support [2-4]. Intergenerational digital learning, where younger individuals support older adults in acquiring everyday digital skills, may therefore support not only skill acquisition but also relational connectedness through a socially embedded learning process.

Intergenerational learning occurs through relational exchanges, where outcomes are shaped by individuals' own experiences as well as their partner's perceptions and behaviors. Emotional engagement and reciprocal interaction between junior partners and senior partners may therefore also influence connectedness and relational experiences across dyads in addition to targeted learning outcomes. Hence, we used the actor-partner interdependence model (APIM) [5] as a useful framework for examining both individual (actor) and cross-partner influences within junior-senior dyads. This research contributes to dyadic research on intergenerational communication by examining the association between participation in a structured digital learning program and psychosocial and relational outcomes within junior-senior dyads in the Asian context, where societies typically hold reverence for older adults.

Methods

We conducted an exploratory intervention study examining the individual and dyadic effects of an intergenerational digital learning program in which junior partners mentored senior partners in developing digital literacy skills. We recruited 42 participants (21 junior partners and 21 senior partners), who were either socially close (ie, family and friends) or socially distant (ie, strangers). In total, 16 socially close and 5 socially distant pairs were recruited through convenience sampling. Given the exploratory nature and limited sample size of this study, dyads were analyzed collectively.

Junior partners were aged 12 to 24 years, resided in Singapore, and were familiar with the digital applications used in the digital literacy intervention, while senior partners were aged 60 to 85 years, also resided in Singapore, and owned their own smartphones. The intervention consisted of two sessions covering communication and social media (eg, making audio and video calls, posting content) and privacy management (eg, managing security configurations, blocking suspicious calls), and a pre- and postsurvey administered before and after the intervention. Through the APIM [5], we assessed how individual outcomes could influence junior partners' and senior partners' personal well-being, as well as their dyadic partner's relational experiences.

Paired-samples *t* tests were conducted individually for junior partners and senior partners using SPSS software (version 29.0.20; IBM Corp) to examine pre-post changes. APIMs were estimated using the *lavaan* package in R (version 0.6-20; R Foundation for Statistical Computing) to evaluate cross-partner effects. The following items were measured pre- and postintervention: digital literacy (ω_y=.83; ω_s=.84); media use (ω_y=.87; ω_s=.56); eHealth literacy [6] (ω_y=.78; ω_s=.90); community involvement (ω_y=.89; ω_s=.81); intergroup empathy (single-item measure); intergenerational bonding (α_y=.55; α_s=.79; ω was not computed due to the 2-item structure); intergenerational relationship (ω_y=.80; ω_s=.88); social attraction as 2 distinct factors, a factor of positive social attraction (ω_y=.82; ω_s=.77) and a factor of negative social attraction (ω_y=.87; ω_s=.84); and knowledge exchange (ω_y=.76, ω_s=.91).

Ethical Considerations

Informed consent was obtained from all participants, and the study was approved by Nanyang Technological University's ethics board (IRB-2022-072).

Results

Paired-sample analyses indicated an increase across several digital and socioemotional outcomes. Senior partners demonstrated gains in digital literacy, eHealth literacy, and positive social attraction, while junior partners showed favorable changes in media use, relationship quality, and knowledge exchange (Table 1).

At the dyadic level, partner effects were generally limited, with the clearest effects observed for intergenerational bonding, where junior partners' bonding perceptions were positively related to senior partners' relational experiences (Table 2).

Table 1. Pre-post comparisons for senior partners and junior partners (paired *t* tests, including marginal results) in 21 dyads (42 participants).

Construct	Group	Mpre[a]	Mpost[b]	*t* test (20)	*P* value	Cohen *d*	Interpretation
Digital literacy	Senior	3.08	3.42	–2.74	.01	0.60	↑[c] moderate
eHEALS[d] literacy	Senior	3.42	3.71	–2.65	.02	0.58	↑ moderate
Social attraction (positive)	Senior	3.67	3.90	–2.23	.04	0.49	↑ small–moderate
Intergenerational empathy	Senior	3.29	3.48	–1.75	.09	0.35	↑ trend[e]
Media use	Junior	3.05	3.27	–5.59	<.001	1.22	↑ large
Relationship quality	Junior	3.80	3.85	–2.09	.049	0.46	↑ small–moderate
Knowledge exchange	Junior	3.96	4.00	–2.91	.009	0.64	↑ moderate
Digital literacy	Junior	4.26	4.23	1.91	.07	0.42	↓[f] trend

[a]Mpre: mean score preintervention.
[b]Mpost: mean score postintervention.
[c]Indicates improvement.
[d]eHEALS: eHealth Literacy Scale.
[e]*P*<.10.
[f]Indicates reduction.

Table 2. Summary of actor-partner effects across actor-partner independence models.

Predictor	Actor (junior)	Partner (senior→junior)	Actor (senior)	Partner (junior→senior)	Interpretation
Digital literacy					Weak, noncoupled trends
Unstandardized coefficient	0.009	–0.263	–0.276	0.190	
P value	.95	.23	.3	.25	
Bonding					Junior partners' bonding positively relates to senior partners' closeness
Unstandardized coefficient	0.115	–0.363	–0.729	0.216	
P value	.71	.13	.001	.02	

Predictor	Actor (junior)	Partner (senior→junior)	Actor (senior)	Partner (junior→senior)	Interpretation
Community involvement					Marginal junior self-effect
Unstandardized coefficient	0.255	–0.283	0.063	0.02	
P value	.1	.17	.78	.9	

Discussion

Principal Findings

Participants in both age groups appeared to receive positive benefits from the program in complementary ways. Senior partners primarily demonstrated gains in digital competencies, while junior partners reported an increase in relational outcomes and knowledge exchange. These findings are consistent with previous research showing that digital skills can support senior well-being [7] and that sustained intergenerational interaction promotes bonding [8].

At the dyadic level, the APIM revealed limited but meaningful partner effects, primarily from junior partners to senior partners. Beyond functional skill acquisition (eg, digital literacy), intergenerational learning may also function as a psychosocial process involving emotional reciprocity and social connectedness between generations. The observed partner effects suggest that the quality of relational engagements could contribute to the learning experiences within junior-senior dyads. Similarly, a study found that the enthusiasm and commitment of a highly skilled mentor can influence the outcomes of intergenerational learning programs [9,10]. In aging societies where access to communication, health resources, and everyday services is increasingly digital, relational approaches may be particularly useful in helping senior partners to bridge this digital divide.

Considering the nature of our study and associated limitations related to the sample size, intervention duration, and measures with weaker reliability coefficients, these results should be considered exploratory. Future studies can (1) recruit larger pairs to improve statistical power, (2) consider a longitudinal structure to observe digital literacy, well-being, and relational satisfaction over time, (3) include follow-up assessments to determine relational outcomes postintervention, (4) examine how cultural contexts and communication styles may influence intergenerational learning, and (5) understand how preexisting relationship closeness impacts learning outcomes and partner effects.

Conclusions

Overall, our findings suggest that intergenerational digital learning is promising in supporting digital inclusion, psychological well-being, and social connectedness across generations. By adopting a dyadic perspective, this study suggests that reciprocal intergenerational interactions could be a positive contributing factor for encouraging digital adaptation among older adults.

Generative AI Use

The authors used ChatGPT (OpenAI) for proofreading, text editing, and language polishing.

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Data Availability

Data are available upon request by contacting the corresponding author, subject to the university's data management guidelines.

Authors' Contributions

MOL provided overall supervision, leadership, conceptualization, mentoring, guidance, writing, and presentation of the published work. PJS provided conceptualization, mentorship on data analysis using relevant analytical methods, writing, and presentation of the published work. VY provided conceptualization and writing of the original draft, data analysis, processing of data, data cleaning, and responding to comments and feedback. GVME provided conceptualization, writing of the original draft, responding to comments, feedback, and implementing revisions during the subsequent stages leading to paper acceptance and publication.

Conflicts of Interest

None declared.

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Abbreviations

APIM: actor-partner independence model

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