A Framework for Digital Technology to Foster Intergenerational Bonds at Home

Hongxin Xu(✉), Mathieu Gielen, and Wilhelm F. van der Vegte

Faculty of Industrial Design Engineering, Technology University of Delft, Delft, Netherlands
xinxh9@gmail.com, {M.A.Gielen,W.F.vanderVegte}@tudelft.nl

Abstract. Intergenerational relationships, crucial for emotional support and stability, can be significantly enhanced through technology. While existing research mainly explores long-distance connections, the potential for technology to foster bonding during regular physical meetups between grandparents and grandchildren remains largely untapped. This study addresses the gap in families with regular intergenerational interactions. We conducted participatory card-based interviews with grandparents and children, analyzing the data with mixed methods including sentiment analysis, mapping the influencing factors of bonding, and thematic coding. This informed a framework for designing technology to support intergenerational connections. Two key contributions of the study are a novel mixed-methods approach that analyzes the same interview data to yield diverse results, and an expansion of the current understanding of intergenerational interaction through a layered model, which was validated by five design experts and tested with three additional families.

Keywords: Intergenerational Relationships · Child-Grandparent Connection · Technology in Family Bonding · Design and Family Dynamics

1 Introduction

Intergenerational relationships, particularly between grandparents and grandchildren, are crucial in emotional support and family stability. Recent demographic shifts have increased multigenerational living arrangements, leading to more frequent interactions between these groups [8]. However, the quality of these interactions is as important as their frequency in fostering strong bonds.

Technology has a dual impact on family dynamics [24]. It can facilitate communication and shared activities, potentially strengthening intergenerational bonds [2,3]. However, differing digital skills and communication preferences between generations can create tensions [25]. Leveraging technology's benefits while mitigating its drawbacks requires thoughtful design, with co-use of technology emerging as a promising strategy [11–13], where both generations engage in activities together. Examples include collaborative gaming [9,11], sharing and

D. Singh et al. (Eds.): IHCI 2024, LNCS 15558, pp. 215–228, 2025.
https://doi.org/10.1007/978-3-031-88881-6_18

exchanging [9,12], and storytelling [13], which have been shown to enhance child-grandparent connectedness.

Existing research frequently focuses on technology solutions for improving long-distance relationships or resolving issues caused by technology use. However, a gap exists in understanding how technology can enhance in-person interactions between generations. Moreover, many technological solutions target a single activity without addressing different user preferences. Identifying which activities provide a strong foundation for technological enhancement is essential for creating effective tools to strengthen intergenerational connections.

To address this gap, our study investigates how technology can enhance face-to-face interactions between grandparents and grandchildren. Building on a literature review and identifying 14 potential activity types, we conducted individual interviews with 5 grandparents and 5 grandchildren to explore their preferences and shared experiences. Exploring these can inform the development of a guideline framework for designing technologies that strengthen intergenerational connections. By focusing on activities that foster bonding, the study lays the groundwork for future research and design efforts to enhance in-person interactions through targeted technological solutions.

2 Related Work

Research indicates that in relationships between children and grandparents, both groups perceive benefits in using technological devices for connection, primarily through calls and video meetings [24]. Additionally, co-viewing media and co-playing video games have been linked to increased closeness [2,3]. Researchers are actively exploring the use of technology to bond children and grandparents, using it as a tool for engagement and creating meaningful experiences [9,11,12]. However, technology can also disrupt family dynamics [4]. Young people often favor social networking services for sharing personal content, while older adults generally prefer direct conversation or phone calls [19]. Studies have highlighted frustrations, such as parents' concerns about children prioritizing social media over family time [15]. Grandparents sometimes feel responsible for regulating children's media consumption [20], which can lead to tensions. They also experience communication challenges due to unfamiliar technology language [16].

Tammisalo et al. [25] classified technology use in families into four categories: (a) individual use of technology tools; (b) technoference, or the use of technology for personal reasons in the presence of family members; (c) technology-mediated communication among family members; and (d) collaborative/collective technology use within the family. Their research found that only the co-use of technology consistently led to positive impacts. This aligns with building shared experiences to foster strong relationships between grandparents and grandchildren.

Existing research has explored various approaches to facilitate grandparent-grandchild (GP-GC) relationships through co-use of the technology: **1. Games:** Games between grandparents and grandchildren have been explored in various forms: Vanden Abeele et al. [10] with mini-games and Carlsson et al. [6] through

quilting and circuits. **2. Sharing and exchanging:** G2G [12] is a calendar-sharing system for connecting grandparents and grandchildren and Davis et al. [9] tested a gift exchange 'magic box,'. **3. Storytelling:** Amaro et al. [1] observed grandmother-granddaughter pairs using NotesHD for family tree storytelling, and Vutborg et al. [26] proposed drawing and photo sharing to facilitate storytelling. **4. Other activities:** Some designs involved children and grandparents in activities such as drawing [13] and gardening [22].

These studies highlight activities that facilitate bonding between children and grandparents through technology, focusing mainly on overcoming geographical distance. However, previous studies have predominantly focused on the potential conflicts that technology could introduce when grandparents and grandchildren share the same space, rather than exploring its potential benefits. Moreover, technology's success in enhancing traditional activities, like storytelling, depends on users' intrinsic interest. If neither party enjoys storytelling, its technological enhancement won't strengthen their bond. Therefore, it's crucial to understand user preferences and motivations for shared experiences, and identify opportunities for meaningful technology integration in intergenerational interactions.

To understand how technology can enable meaningful shared experiences and facilitate child-grandparent bonding in in-person settings, two research questions emerged: **RQ1:** What shared experiences are favored by children and grandparents, and what underlying factors within these activities influence their connectedness? **RQ2:** How can technology-based solutions be developed to strengthen bonding in intergenerational shared experiences?

3 Methods

3.1 Interview and Analysis

Building on the previous literature review, we identified 14 shared activities that foster connections between grandparents and grandchildren. Using Pedell et al.'s [21] intergenerational fun model, we organized these activities into inclusive and balanced categories: **games**, **telling/reading**, **sharing context**, and **making/creating**. This categorization ensured each category captured a similar scope and relevance. We designed activity cards to represent each activity. The complete list of categories and activity cards can be found in this graduation thesis [27].

We recruited 10 participants from the Netherlands, consisting of 5 grandmothers (aged 57–78) and 5 children (aged 9–11), who were not necessarily related. Each participant, meeting the criteria of regularly visiting with a grandchild or grandparent, was interviewed individually for 40–50 min, using the activity cards as prompts. Four questions were posed for each card, focusing on recounting scenarios, distinguishing emotions during shared activities, reasons for the feelings, and favorite aspects of the activity. We ensured data saturation with an iterative recruitment and immediate post-interview analysis. In this study, five participants from each age group provided a sufficient sample size.

To answer **RQ1**, we employed a mixed-method approach—including sentiment analysis, mapping the influencing factors of bonding, and thematic coding—to identify participants' preferred shared activities and uncover the factors influencing intergenerational connectedness. Initially, we asked participants to rate the activities, but when these ratings proved unreliable, we switched to sentiment analysis as a more robust method for quantifying positive and negative emotions linked to the activities.

Sentiment Analysis: To quantify participants' emotions toward shared activities, we analyzed interview transcripts using Orange data mining software and the Multi-lingual Sentiment lexicon [7]. The software assigned sentiment values ranging from −100 (negative) to +100 (positive) through automated preprocessing and analysis. This approach provided a measurable dimension to the qualitative data, reducing individual biases compared to subjective scoring.

Mapping the Influencing Factors of Bonding: Following the procedure of Statement Card Analysis [23], we collected meaningful interview quotes, grouped similar ones into themes, and aggregated these into overarching meta-themes. This approach helped reveal factors contributing to or hindering bonding during shared activities.

Thematic Coding: We conducted a thematic analysis using Atlas.ti software, following an inductive approach to develop codes from the interview data. The coding process involved grouping these codes into categories. Recurring codes that appeared at least three times were included in the larger category. Less frequent codes were reviewed by two additional designers; only those agreed upon by all three designers were included. This approach allowed for a granular examination of the data, revealing intricate patterns and relationships between codes related to elements that contribute to successful bonding.

This analysis led to the development of the design framework for intergenerational bonding through shared activities, detailed in the results Sect. 4.1.

3.2 Framework Design and Concept Selection

To answer **RQ2**, which focuses on creating solutions to strengthen generational bonding through shared experiences, two creative sessions were conducted, using the design framework for intergenerational bonding developed in 3.1 to inform idea generation. The first session, using the Creative Diamond 2.0 model [14], involved four design students from Delft University of Technology, who reviewed interview insights and generated ideas through various steps. The second session, with three other students, used inverse brainstorming from the Co-design with Kids toolkit [18] to encourage unconventional thinking. These sessions produced eight design proposals, visualized as storyboards with generative AI (DALL-E 3). One example is shown in Fig. 1, more can be found in the thesis [27].

Five experts from diverse backgrounds rated the quality of design proposals on a 7-point Likert scale, ranging from 'ineffective for bonding' (1) to 'very effective for bonding' (7). The evaluation applied comprehensive criteria encompassing all elements from the design framework of intergenerational bonding

(Table 1). Following this, experts assessed each of the framework's four layers to determine how well these layers aligned with their decision-making, aiming to verify the validity of each layer within the framework. Based on their feedback, the design proposals were refined into four final concepts for further family testing.

Fig. 1. Visualized storyboard for the proposal "dreaming cotton candy machine."

3.3 Evaluation (Family Test)

Three mixed-gender grandparent-grandchild pairs, with grandparents aged 70–82 and grandchildren aged 8–12, were recruited through TU Delft networks. These participants were different from those in previous interviews. Participants were introduced to the research context and presented with four storyboards illustrating design concepts. After each concept presentation, discussions were facilitated to gather feedback on likes, dislikes, and potential enhancements. Sessions were audio-recorded, transcribed, and analyzed thematically to assess the designs' impact on intergenerational experiences and relationships.

4 Findings

4.1 Interview and Analysis

Sentiment Analysis: We analyzed sentiment values from 10 participants across 13 activities, totaling 130 data points. VR/AR games were excluded due to participants' inexperience. Sentiment values indicated general sentiment towards each activity: larger positive values reflected stronger positive emotions. Figure 2 indicates a significant divergence between children's and grandparents' preferences. Grandparents predominantly favor storytelling, sharing family stories, and handcrafting, whereas children prefer cooking and games.

Mapping the Influencing Factors of Bonding: Table 1 shows positive and negative factors fostering connections presented in order of their frequency of

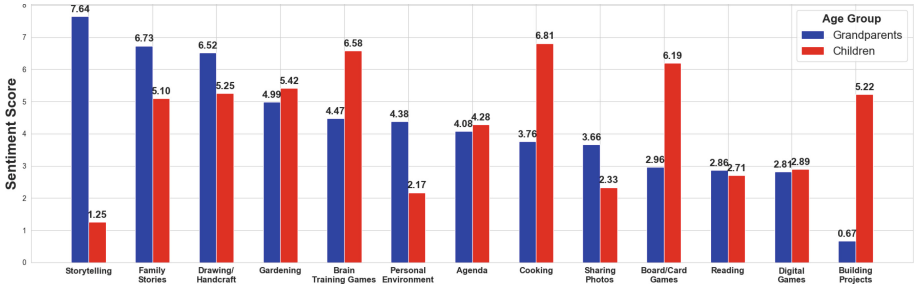

Fig. 2. Sentiment scores and thematic network

being mentioned by participants. Positive factors in fostering bonding include balancing the interests of children and grandparents. Grandparents often prioritize their grandchildren's preferences but guide them toward mutually enjoyable activities. Both groups experience joy and fulfillment when they can actively contribute and feel valued. Other important factors include the educational value of activities, children's personal growth, and practical skills like cooking. Challenges arise from grandparents' lack of confidence, slower reactions, and limited tech skills, leading to frustration and reduced participation. Another difficulty is keeping up with children's changing interests. Additional obstacles include time constraints, passive involvement, and boredom, especially when children find the activities less engaging.

Table 1. Positive and negative factors of intergenerational bonding

Positive Factors	Frequency	Negative factors	Frequency
Balance of Interest	22	Incapability	24
Individual Contribution	18	Dynamic of Interests	15
Educational Value	16	Time Constraints	11
Emotional Connection	15	Passive Involvement	10
Inclusive and Challenging	15	Boring	10

Thematic Coding: We synthesized codes into broader themes. For example, 'emotional guidance,' 'encouragement,' 'patience,' and 'supportive presence' were merged into 'Support.' Relationships between themes were identified, such as how 'physical and tangible interactions' contribute to 'engagement'.

Thematic Network: The analysis organized interview codes to highlight both frequency and thematic connections. Larger codes indicate broader themes that group related interaction qualities. Positioning of themes reflects semantic relationships, with similar or co-occurring qualities placed close together. This organization reveals how certain qualities interlink to strengthen intergenerational

bonds; for instance, a "justified challenge" frequently contributes to a "positive experience," while the "manifestation of talents and skills" fosters "attention and affection." Such interconnected qualities play a crucial role in enhancing intergenerational bonding.

Four-Layer Design Framework: By investigating the relationships between themes, larger categories were defined based on their contributions to successful intergenerational bonding. These categories include **Prerequisites** (Ensure activities are accessible to all participants.), **Techniques** (Implement specific, actionable methods to connect generations.), **Strategies** (Apply broader approaches for achieving desired outcomes), and **End Goals** (Create desired impacts on intergenerational relationships). This structured framework guides the design of technology for intergenerational connections, progressing logically from foundational elements to meaningful outcomes. Detailed explanations of these components are provided in Table 2.

4.2 Concept Selection

The ideation workshops produced eight distinct proposals aimed at enhancing intergenerational interactions (see Table 3). Five design experts evaluated these concepts on a 7-point Likert scale, which we translated to a 0–100 scale for easier interpretation. Mean scores reflect overall expert preference, with higher values indicating greater satisfaction and perceived potential of the concepts.

Concept Ranking: *Home Scavenger* ranked highest with a mean score of 80.00% and a low standard deviation (6.67%), indicating a strong consensus on its personalization through family artifacts, which enhances intergenerational understanding and education. *Co-plant* followed closely with a mean score of 76.67% (SD 13.33%), valued for promoting sustainability and mutual learning in plant care. *Dreaming Cotton Candy Machine* scored 73.33% (SD 17.00%), appreciated for fostering language development and connection through food, though with some concern over health impacts. *Silent Storytelling* had a mean score of 70.00% (SD 12.47%), praised for combining traditional storytelling with interactive shadow play, supporting open-ended narratives that engage both generations. These four designs stand out, receiving notably higher scores compared to others. See Fig. 3(a) for details.

Evaluation of the Design Framework: Experts assessed the framework's coherence and utility by evaluating how well each layer's components aligned with their scoring criteria. They rated the overall effectiveness of each layer on a single scale at the end. As in Fig. 3 (b), the prerequisite layer scored an average of 73.33%, with a higher standard deviation (34.32%) reflecting a range of opinions on its influence. In contrast, the technique, strategy, and end goal layers scored averages of 70.00%, 83.33%, and 90.00%, respectively with low SD. This indicates these layers effectively guided evaluations and were considered highly influential in the success of the design concepts. The framework, particularly its higher layers, proved to be a valuable tool in assessing and developing intergenerational technology designs.

Table 2. Explanation of the components in the framework

Framework layer	Components	Explanation
Prerequisite	Inclusivity	Accommodate a wide age range
	Low threshold of participation	Easily understandable, not require excessive resources
Techniques	Attention and affection	Attention and recognition from each other
	Fairness in competition	Perceived fairness during competition makes people feel engaged and valued
	Genuine achievement	Enable a sense of accomplishment, fostering pride and a shared sense of success
	Manifestation of talents/skills	Showing talent or skills provides a natural path toward collaboration or education
	Laughing and humor	Create a light-hearted atmosphere, encouraging joyful feelings
	Physical and tangible interactions	Tangible elements strengthen the sense of physical togetherness and connection
	Justified challenge	Appropriate challenges can increase engagement, not frustration
Strategies	Exploration	Freedom of exploration fulfills curiosity and willingness to discover
	Education and learning	Mutual learning, and skill sharing between children and grandparents
	Support	Grandparents make them available to give any level of support that children request
	Collaboration	Children and grandparents both invest and contribute in their own ways
	Habituality	Children and grandparents develop the interaction into a habit or ritual between them
End goals	Engagement	Capture the interest of children and grandparents, maintaining their involvement and interaction throughout
	Mutual enjoyment	Enjoyable for both parties, for similar or different reasons
	Positive Experience	Leave both children and grandparents with pleasant memories and a desire to engage in future interactions

Table 3. Concepts explanation

Concept Number	Name	Explanation
1	The Activity Generator	A machine generates activities that cater to both grandparents' and children's interests
2	Home Scavenger	A treasure hunting system that hints children to explore stories behind objects at grandparents' home
3	The Rumor Machine	A machine printed funny fake reports to facilitate debate and discussion between generations
4	"Silent" Storytelling	A shadow play system allows users to control the animal shadows with body movement and react to narrative stories
5	Fun Battling	Unconventional game triggers humorous competition between grandchildren and grandparents
6	"Dreaming" Cotton Candy Machine	A machine changes people's dreams and stories into different flavors and colors of cotton candies
7	Mini Detective	Puzzle-solving game for children to play as detectives and grandparents play as judges
8	Co-plant	A planting system connects grandparents and grandchildren through real plants and digital plants

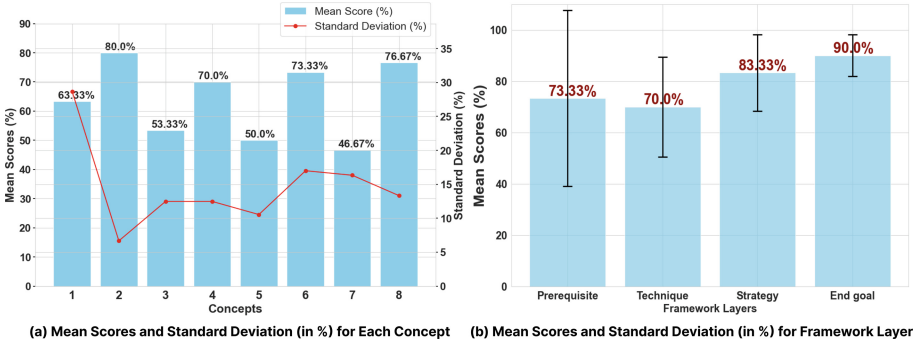

Fig. 3. Mean score and standard deviation of concepts and the design framework

4.3 Testing the Framework with Families

Our scenario-based storyboards successfully stimulated rich discussions with the grandparents and grandchildren interviewed. Participants demonstrated an ability to understand and relate to the four design proposals, envisioning potential uses within their own families. Their responses highlighted opportunities for future technology designs to improve intergenerational experiences. Four key themes emerged. First, **Facilitating Conversations:** participants valued concepts that naturally encouraged dialogue, with Grandparent P3 describing Home Scavenger as *"more concrete than just a conversation"* and Dreaming Cotton Candy enhancing storytelling through food. Second, **Promoting Shared Responsibilities:** activities like plant care fostered mutual engagement, as Grandchild P1 noted, *"the grandmother knows what she's doing is going to her grandchild,"* creating a shared bond. Third, **Encouraging Creativity:** both Silent Storytelling and Dreaming Cotton Candy facilitated free-form creative expression, with Grandchild P2 appreciating the freedom to *"create anything"* and others enjoying the ability to use the cotton candy's color, shape, and flavor to construct unique stories. Finally, **Health and Well-being** emerged as a consideration, particularly concerning screen time and sugar intake. Grandchild P1 commented that *"cotton candy is made out of pure sugar,"* while both Home Scavenger and Co-plant raised concerns about overreliance on technology potentially impacting physical interactions.

Family tests provided further insights, as no single concept emerged as universally preferred, indicating the diversity of user needs and preferences. User values aligned closely with our framework components: (1) "Engaging conversation" corresponded to the framework's "engagement" goal. (2) Shared responsibility reflected the "collaboration" aspect. (3) Creativity emerged as a significant factor, supported by expert reviews and previous studies [18]. However, the tests also revealed important considerations: (1) Health concerns: It's better to avoid promoting unhealthy eating habits. (2) Technology balance: Technology should enhance, not replace, direct engagement.

5 Discussions

Our study aimed to develop insights into how technology can bond grandparents and grandchildren during physical meetings. The findings reveal several key points that contribute to the understanding of intergenerational relationships and technology design.

Main Findings: Our interviews revealed a significant attitude gap between children and grandparents in shared activities. Grandparents favor storytelling, consistent with prior studies [4], while children prefer cooking and games. For children, cooking represents cultural continuity and practical knowledge beyond the school curriculum, especially with family recipes, aligning with research linking cooking to warm intergenerational relationships [17]. Both groups value the

'fun' element in games, yet a competence gap can cause dissatisfaction, as grandparents tend to let younger children win, while older children seek fair competition. This divergence underscores the challenge of designing 'one-size-fits-all' solutions, leading us to elements within activities that could benefit bonding.

Theoretical Implications: Our framework advances the field beyond broad themes like "communication" and "leisure activities" often found in intergenerational studies. While the Intergenerational Solidarity Model [5]emphasizes shared activities, our work provides practical guidance for improving these interactions. By incorporating detailed, actionable components, our framework offers a nuanced understanding of the factors influencing intergenerational bonding, particularly in the context of technology-mediated interactions.

Methodological Contribution: Our approach utilized multiple analytical methods on the same dataset, showing that combining various techniques can yield rich insights despite the small sample size. Each method provided a unique subset of insights: Sentiment analysis revealed a misalignment in activity preferences between grandparents and children, suggesting a need to move beyond traditional activities and innovate new options. Mapping the influencing factors of bonding generated insights that inspired idea exploration. Thematic analysis produced a structured framework offering detailed guidance to refine design concepts. Beyond their individual outcomes, these methods provided complementary perspectives. For instance, when sentiment and thematic analyses aligned, they not only highlighted which activities were favored or unfavored but also uncovered the reasons behind these preferences. Conversely, when quantitative and qualitative data diverged, this approach revealed valuable design insights. For example, the discrepancy between preferences for cooking and time constraints suggested the possibility of time-efficient and cooking-related solutions. This dual lens—examining both alignment and discrepancy between data types enabled a more nuanced understanding of user needs and potential design directions.

Practical Implications: The concepts, reflecting the content of the framework, were tested with design experts and family groups. Experts noted a strong alignment between their selection criteria and the framework, indicating that concepts incorporating more framework qualities are more likely to foster intergenerational connections. Additional insights beyond the framework include the importance of environmentally conscious design, the potential to share cultural knowledge, and a preference for "novelty" and "creativity." Certain experts expressed a preference for concepts that facilitate the creation of new memories, as opposed to those with a retrospective focus. Additionally, designs allowing for flexibility and imaginative interaction were favored.

These findings highlight the complexity of designing for intergenerational relationships. While our framework provides a foundation, designers should also consider sustainability, cultural relevance, and health impacts. The framework was evaluated through expert and family testing, showing that concepts incorporating more framework qualities were more effective at fostering connections.

Our study's primary limitations include the small sample size and specific cultural context. The framework development was based on a limited set of activities and validated by a small group, potentially excluding relevant activities and broader perspectives. Future research should continue to adopt a mixed-method approach, as it enables a comprehensive understanding of intergenerational design needs. To build on our findings, we recommend (1) including larger, more diverse samples for broader generalizability, (2) developing and testing physical prototypes for richer insights, (3) validating the framework across varied contexts, and (4) conducting longitudinal studies to assess the long-term impact of technology-enhanced intergenerational activities.

6 Conclusions

This study explores how technology can enhance meaningful interactions between grandparents and grandchildren during in-person meetings. Using a mixed-method approach, we captured nuanced preferences and underlying reasons, even with a small data set, enabling a framework based on desired interaction qualities to guide design proposals. Key findings emphasize the importance of engaging conversation, shared responsibilities, and creativity, while also highlighting concerns around health and screen time. Our research offers valuable insights for designing technologies that foster meaningful, shared experiences between generations, especially through the guideline framework for intergenerational bonding presented in Table 2 (Sect. 4.1). Future work should focus on larger-scale studies, prototype development, and long-term impact assessment to advance intergenerational HCI. The challenge lies in balancing technological integration with direct human interaction, ensuring technology enhances rather than overshadows natural bonding experiences.

Acknowledgements. We would like to thank all the participants who joined our study. This study was approved by the Human Research Ethical Committee of TU Delft (number 3722).

References

1. Amaro, A.C., Oliveira, L., Veloso, A.I.: "let's build our family tree!": grandparents and grandchildren using tablets together. Procedia Comput. Sci. **100**, 619–625 (2016)
2. Aponte, R.: The communications revolution and its impact on the family: significant, growing, but skewed and limited in scope. Marriage Fam. Rev. **45**(6–8), 576–586 (2009)
3. Baldassar, L., Nedelcu, M., Merla, L., Wilding, R.: ICT-based co-presence in transnational families and communities: challenging the premise of face-to-face proximity in sustaining relationships. Global Netw. **16**(2), 133–144 (2016)
4. Barrie, C.K., Bartkowski, J.P., Haverda, T.: The digital divide among parents and their emerging adult children: intergenerational accounts of technologically assisted family communication. Soc. Sci. **8**(3), 83 (2019)

5. Bengtson, V.L., Roberts, R.E.: Intergenerational solidarity in aging families: an example of formal theory construction. J. Marriage Fam., 856–870 (1991)
6. Carlsson, I., Choi, J., Pearce, C., Smith, G.: Designing eBee: a reflection on quilt-based game design. In: Proceedings of the 12th International Conference on the Foundations of Digital Games, pp. 1–10 (2017)
7. Chen, Y., Skiena, S.: Building sentiment lexicons for all major languages. In: Proceedings of the 52nd Annual Meeting of the Association for Computational Linguistics (Volume 2: Short Papers), pp. 383–389 (2014)
8. Cohn, D., Horowitz, J.M., Minkin, R., Fry, R., Hurst, K.: The demographics of multigenerational households (2022). https://www.pewresearch.org/social-trends/2022/03/24/the-demographics-of-multigenerational-households/. Accessed 27 Oct 2024
9. Davis, H., Vetere, F., Francis, P., Gibbs, M., Howard, S.: "I wish we could get together": exploring intergenerational play across a distance via a 'magic box'. J. Intergenerational Relat. **6**(2), 191–210 (2008)
10. De Schutter, B., Vanden Abeele, V.: Designing meaningful play within the psychosocial context of older adults. In: Proceedings of the 3rd International Conference on Fun and Games, pp. 84–93 (2010)
11. Derboven, J., Van Gils, M., De Grooff, D.: Designing for collaboration: a study in intergenerational social game design. Univ. Access Inf. Soc. **11**(1), 57–65 (2012)
12. Forghani, A., Neustaedter, C., Vu, M.C., Judge, T.K., Antle, A.N.: G2G: the design and evaluation of a shared calendar and messaging system for grandparents and grandchildren. In: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems, pp. 1–12 (2018)
13. Gomes, C.A., Ferreira, S., Gouveia, T., Rito, P., Morais, N., Sousa, B.: Intergenerational participatory design: contributions to the development of an app. In: 2018 International Symposium on Computers in Education (SIIE), pp. 1–6. IEEE (2018)
14. Heijne, K.: Road map for creative problem solving techniques: organizing and facilitating group sessions. Boom uitgevers Amsterdam (2019). https://books.google.nl/books?id=QecsxQEACAAJ
15. Hiniker, A., Schoenebeck, S.Y., Kientz, J.A.: Not at the dinner table: parents' and children's perspectives on family technology rules. In: Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing, pp. 1376–1389 (2016)
16. Ivan, L., Nimrod, G.: Family conflicts and technology use: the voices of grandmothers. Fam. Relat. **70**(1), 104–119 (2021)
17. Kenner, C., Ruby, M., Jessel, J., Gregory, E., Arju, T.: Intergenerational learning between children and grandparents in east London. J. Early Child. Res. **5**(3), 219–243 (2007)
18. Klapwijk, R., Gielen, M., Schut, A., van Mechelen, M.: Your turn voor de leerkracht: Handleiding: maak real-life ontwerplessen voor leerlingen van 9 tot 14 jaar (2021)
19. Muñoz, D., Cornejo, R., Gutierrez, F.J., Favela, J., Ochoa, S.F., Tentori, M.: A social cloud-based tool to deal with time and media mismatch of intergenerational family communication. Futur. Gener. Comput. Syst. **53**, 140–151 (2015)
20. Nimrod, G., Lemish, D., Elias, N.: Mediating grannies: caring for young grandchildren who use digital media. ESSACHESS–J. Commun. Stud. **13**(2(26)), 41–58 (2020)
21. Pedell, S., Vetere, F., Miller, T., Howard, S.: Tools for participation: intergenerational technology design for the home. Int. J. Des. **8**(2) (2014)

22. Qiu, R., Xu, Z., Xu, W.: CoRoot: a collaborative planting system to strengthen intergenerational relationships. In: Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems, pp. 1–6 (2023)
23. Stappers, P., Sleeswijk Visser, F., Van der Lugt, R.: Teaching contextmapping to industrial design students. Proc. Include **2007**, 1–6 (2007)
24. Tadpatrikar, A., Sharma, M.K., Viswanath, S.S.: Influence of technology usage on family communication patterns and functioning: a systematic review. Asian J. Psychiatr. **58**, 102595 (2021)
25. Tammisalo, K., Rotkirch, A.: Effects of information and communication technology on the quality of family relationships: a systematic review. J. Soc. Pers. Relat. **39**(9), 2724–2765 (2022)
26. Vutborg, R., Kjeldskov, J., Pedell, S., Vetere, F.: Family storytelling for grandparents and grandchildren living apart. In: Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries, pp. 531–540 (2010)
27. Xu, H.: Design for togetherness at home: integrating technology to bond children and grandparents through shared experiences (2024). https://repository.tudelft.nl/record/uuid:09a0ef1d-9c35-4817-b515-e025a9ab837f. Accessed 27 Oct 2024