Empowering Wellness: Design Thinking for Assistive Technology in Long-term Care

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Abstract

This project, a collaboration between Red Deer Polytechnic and Bethany Care Society, aimed to support the well-being of young adult long-term care (LTC) residents by leveraging design thinking principles in a care enhancement initiative integrating meaningful resident consultation and collaboration. Design thinking is a human-centered problem-solving approach which offers a framework for creative engagement and collaboration, allowing residents to become co-creators of their care experience. Design thinking workshops were implemented to facilitate the communication of resident needs and, subsequently, the effective integration of these into assistive technology (AT). Six young adult residents completed standardized assessments of well-being before and after the workshops and subsequent assistive technology integration sessions, in addition to completing an open-ended post-intervention interview. Both quantitative and qualitative results indicated a positive impact on well-being, suggesting that active participation in identifying needs and brainstorming and prototyping solutions contributed to an enhanced sense of autonomy and purpose and improved overall well-being while promoting the effective use of AT. Funding for this project was made available by the Institute for Continuing Care Education and Research (ICCER).

Empowering Wellness: Design Thinking for Assistive Technology in Long-term Care

Quality of life (QoL) of residents in long-term care (LTC) facilities is a crucial outcome of care. This concept is influenced by individuals' physical and mental functioning, values, social relationships, and environment (Kehyayan et al., 2015). It is now widely recognized that a person-centered approach to care in LTC facilities is of central importance to resident QoL as it respects and supports individuals' unique needs, preferences, and values (Davies et al., 2022; Li & Porock, 2014). Person-centered care (PCC) goes beyond the traditional exclusive focus on medical needs, allowing residents in LTC to actively participate in their care plans, valuing their choices, autonomy, and overall well-being, supporting family involvement and ensuring an engaging and fulfilling life within the care facility (Davies et al., 2022

Long-term care typically includes a range of services that help meet the medical and nonmedical needs of people with chronic illnesses or disabilities. While most of the LTC population is 65 and older, adults younger than this make up a substantial part of the LTC population due to complex care needs that cannot be effectively addressed in the community (Hay & Chaudhury, 2013). In 2019, the Organisation for Economic Co-operation and Development (OECD) reported that an average of 26% of people in LTC were aged 65 to 79, 49% were 80 and older, and 25% were younger than 65. In Canada, 2019 data reported that 15% of people in LTC were aged 25-64, and 15% of those were in Alberta (Government of Canada, Statistics Canada, 2022). Thus, while an aging population is a significant driver of LTC use, younger residents represent a substantial and specific level of care needs. These individuals may require assistance due to traumatic injuries such as spinal cord or traumatic brain injuries or illnesses contributing to physical challenges like Multiple Sclerosis, developmental disabilities like Huntington's disease and cerebral palsy or complex medical conditions such as bipolar disorder, morbid obesity and mental health problems like depression (Becker et al., 2012; Hay & Chaudhury, 2013; Shieu et al., 2021).

It is important to note that the long-term care experience for young adults is markedly distinct from that for older adults due to their unique needs, preferences, and social considerations (Kaldy, 2012). In the context of PCC, young adults would benefit from a care environment that considers their particular developmental stage, social interaction interests/preferences, and activities that align with their age group (Hay & Chaudhury, 2013). This might involve a combination of medical treatments, rehabilitation services, social activities, and educational or vocational support to help them lead fulfilling lives despite their health challenges (Harry et al., 2017). Additionally, family involvement and support are crucial in ensuring the well-being of young adults in long-term care (Shieu et al., 2021). Overall, the approach to care should be holistic, addressing both the medical and psychosocial aspects of their well-being (Davies et al., 2022; Li & Porock, 2014).

Person-Centered Care

The PCC model moves away from a one-size-fits-all approach and instead stresses partnership between healthcare professionals, individuals, and their families to make decisions that enhance the individual's QoL (Davies et al., 2022). More specifically, PCC should involve individualized care plans based on preferences, goals, and health needs, requiring a thorough understanding of the person's values, beliefs, and lifestyle versus a standardized care protocol. Erwin and Krishnan (2016, as cited in Melles et al., 2020, p. 38) fittingly express that "The key is to shift our focus from helping people to fit our care delivery system, to one where we design our care delivery system to fit people where they live, work, learn, play, and receive healthcare." The benefits of PCC are delineated by Davies and colleagues (2022), who specify five constructs of intersection between PCC and QoL, including the maintenance of dignity, independence and autonomy, using a holistic view of the person, creating a "homelike" space, cultivating internal and external relationships through support systems including family members, and instituting a culture of caring and compassion. Similarly, observations from other research identify that environment, engagement and maintaining functional abilities, care culture, and dignity were contributing aspects to positive QoL outcomes (Li & Porock, 2014; Shippee et al., 2013; Sköldunger et al., 2020; Thompson et al., 2016).

Central to PCC is the encouragement of individuals to participate actively in their own care decisions, including involving them in discussions about their treatment options, setting goals, and determining the best approach to meet their needs (Davies et al., 2022; Kehyayan et al., 2016; Sköldunger et al., 2020). This approach is empowering, fostering a sense of control and autonomy over their lives, and contributing to improved emotional well-being, self-efficacy and resilience (Davies et al., 2022). A key role of healthcare professionals is to engage with individuals, their families, and their support networks, making decisions collaboratively. Shared decision-making ensures that the person's preferences and values are considered in the decision-making process (Sköldunger et al., 2020). Additionally, care providers should consider individuals' cultural backgrounds, beliefs, and practices when delivering care (Kamrul et al., 2014). This ensures that care is respectful and sensitive to diverse cultural perspectives. Open and regular communication between healthcare providers, individuals, and their families is critical as this helps keep everyone informed, addresses concerns and adjusts care plans while building trust (Davies et al., 2022).

Long-term care residents often face challenges regarding isolation and loneliness and are at elevated risk for depression (Becker et al., 2012; Cano et al., 2023). To address this, PCC inspires social interaction and engagement within the community, promoting a sense of belonging and reducing feelings of isolation. Also, by creating environments that feel more like home and less like traditional institutions, PCC helps lessen the harmful effects of institutionalization (Davies et al., 2022). This can make residents feel more comfortable and at ease, underscoring a positive emotional state and increased happiness.

Another relevant factor is that PCC emphasizes respecting the individual's dignity, autonomy, and rights and seeks to promote and maintain the person's independence and functional abilities to the greatest extent possible (Davies et al., 2022; Kane & de Vries, 2017). A person-centered care approach recognizes that individual needs and preferences may change over time. Therefore, care plans should be flexible and adaptable to accommodate these changes and evolving circumstances (Davies et al., 2022). Focusing on individual needs, PCC is more likely to incorporate preventive measures and health-promoting activities, leading to better physical health outcomes and a higher overall quality of life (Hay & Chaudhury, 2013; Li & Porock, 2014).

Assistive Technology

As mentioned, in LTC settings, residents often face physical and medical challenges impacting their quality of life (Harry et al., 2017; Kaldy, 2012). Assistive technology (AT) which is defined in the *Assistive Technology Act* as "any item, piece of equipment, or product system, whether acquired commercially, modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (Braddock et al., 2004, p. 50; Federici et al., 2014, p. 178), and is a potential means to addressing these challenges (Bartfai & Bowman, 2014; Federici et al., 2014; Scherer, 2014). To be maximally effective, however, AT selection and development should involve a person-centered approach, considering not only functional but also psychosocial needs. The lack of such an approach is disempowering and may result in AT, which functions adequately but is underutilized as it does not take into account needs for personal autonomy and identity, perhaps being perceived as stigmatizing, drawing attention to one's disability. Conversely, as will be discussed below, in accordance with PCC's goals, the effectiveness of AT can be significantly enhanced when residents actively participate in the identification and customization of solutions that align with their wellness goals.

Creativity and Well-being

In short, it has also long been demonstrated that creative experience can enhance wellbeing. Literature encompassing the creative aspects of the design-thinking principles demonstrates that well-being is improved when engaging in creative activities (Connor et al., 2018). Goulding et al. (2018, as cited in Wiles, 2019) depict a relationship between resilience and creative practice to which individuals can pursue unique solutions to challenges and how this union can foster the development of interventions. As such, workshops implementing creative design play a vital role in exploring, designing, and innovating solutions for individuals in LTC, which health professionals have traditionally addressed (Connor et al., 2018) and could be implemented via AT.

Creativity for Purpose – The Integration of Design Thinking into the Creative Process to Identify Need

Design thinking, a human-centered problem-solving approach, offers a framework for creative engagement and collaboration, allowing residents to become co-creators of their care

experience (Melles et al., 2020). This methodology revolves around determining individual needs, designing interventions and products that meet these needs, and changing present conditions into preferred ones. Integrating design thinking into the long-term care environment represents a significant shift toward person-centered care (Bartfai & Bowman, 2014; Federici et al., 2014; Melles et al., 2020; Scherer, 2014).

Creativity design workshops contribute to realizing the potential of AT in LTC through various facets. For instance, user-centered design establishes an understanding of user needs, with the workshops serving as a platform to directly engage with individuals in LTC and recognize their specific challenges and preferences (Melles et al., 2020). Ideation and brainstorming sessions encourage the generation of a wide range of ideas for products and consider traditional and unconventional solutions, while prototyping and iteration facilitate the creation of prototypes, allowing participants to visualize and test concepts quickly and refine and improve them based on real-world needs. The creative workshops lend to the need for personcentered evaluation, which crucially involves user testing of the prototypes and ensuring that the final solution meets the needs and preferences of the users (Federici et al., 2020; Schwartz et al., 2020; Stuckey & Nobel, 2014). This is made more possible with advancements such as manufacturing technology like 3D printing, as evidenced by Schwartz et al. (2020).

Practices like creativity-for-purpose workshops contribute to the overall health and QoL of the individuals involved, and the service of PCC can help shape their sense of self-efficacy and continuous life satisfaction (Connor et al., 2017). Comparatively, numerous studies on the effect of various art therapy methods support the notion that enhanced positive affect is well established through these means (Connor et al., 2017; Stuckey & Nobel, 2014). Findings from Connor et al. (2017) suggest "a particular kind of upward spiral for well-being and creativity" (p.

186), which shows that by participating in creative activities, well-being is higher the following day and, in turn, facilitates more likely participation in creative activity. This reinforces that creative activities serve as positive interventions for QoL. Stuckey and Nobel (2014) also found that art-based interventions, such as music engagement, movement-based creative expression, expressive writing and visual arts therapy, indicated significant positive effects on health and were equally effective in reducing adverse outcomes.

Relatedly, Galassi and her co-authors (2022) executed a scoping review to examine the value of creative arts therapies such as traditional art therapy, music therapy, creative writing and digital storytelling. They found that the outcomes of participating in art therapy workshops were the formation of enhanced confidence, self-efficacy, reduced depression and feelings of well-being. Similarly, Vaartio-Rajalin et al. (2021) linked outcomes of improved cognitive skills, self-esteem, connections with others, self-empowerment, self-efficacy and decreases in anxiety and depression to art therapy activities.

However, incorporating design thinking into the creative process goes further than the immediate creative engagement experience. Creativity design workshops can serve as catalysts for innovation in creating and applying assistive technologies for LTC to empower wellness in populations like young adults in LTC. Likewise, evidence proposes that including design thinking as a fundamental part of the creative process can be valuable for identifying and expressing needs. Creativity for purpose results in the identification of need which can then be integrated into AT.

Person Centred Assistive Technology Development/Modification – Integrating Identified Need With that in mind, Frederici et al. (2014) impart that design sessions emphasize the importance of inclusive design, ensuring that AT caters to diverse needs and abilities and helping participants explore ways to make AT accessible and usable. This practice further leads to technology integration, whereby emerging technologies may be integrated into assistive devices like smart home technology and artificial intelligence (Ding et al., 2023). By empowering residents to participate in identifying and creating solutions using AT actively, caregivers can enhance their overall well-being, foster a sense of purpose, and ensure that their unique needs and goals are met.

Furthermore, the empowerment of AT for this salient cohort plays a significant role in enhancing their accessibility, independence, and overall quality of life (Bartfai & bowman, 2014; Melles et al., 2020). Braddock and colleagues (2004) note that many people with disabilities use AT to enhance independence and functioning in their daily living, such as seating and positioning, mobility, hearing, communicating, controlling the environment, recreation, facilitating reading and learning, etc. The different technologies accompanying these functions include low-tech devices, such as communication boards or modified eating utensils, and highertech devices, like software for speech synthesis or smart home technology. Such AT promotes users' accessibility in various environments, including educational institutions, workplaces and public spaces (Braddock et al., 2004) and promotes social inclusion by breaking down communication barriers and fostering connections among individuals (Federici et al., 2014).

To further empower disabled individuals through AT, ongoing research, development, and advocacy are essential to address evolving needs and ensure widespread access to innovative solutions (Bartfai & Bowman, 2014). However, as depicted by Bartfai and Bowman, not all technologies are equally valuable as some AT is designed for all users but may not be appropriate depending on the impairment. Another determinant is the difficulty in safeguarding quality and long-term use, as the effectiveness of the interventions must be monitored. They also express that repeated evaluations are required for life-long users as individual needs may change, and technology may deteriorate or become obsolete. Nevertheless, the authors present a more positive argument for effective processes in identifying AT through goal-driven assessments and teaching, training and evaluating its use to ensure that these setbacks are addressed, a humancentered design (HCD) sentiment echoed by Scherer (2014). Concurrently, Melles et al. (2020) posit that:

With its systemic humane approach and creativity, HCD can play an essential role in dealing with today's care challenges. 'Design' refers to both the process of designing and the outcome of that process, which includes physical products, services, procedures, strategies and policies. (p. 1)

Collaboration in the development of AT such as this aligns with the ideals of PCC and enhances the appeal of the technology and the participants' feelings of accomplishment and empowerment (Parette & Schere, 2004). The study by Schwartz and colleagues (2020) demonstrates that participants in their AT design intervention were empowered and that "people with disabilities are the best experts on their own needs, having a crucial and valuable perspective to contribute. Subsequently, best practices in AT empower clients in the device selection process" (p. 145).

The Present Study

This cross-disciplinary exploration aims to assess the efficacy of creativity-focused workshops in enabling the communication of young adult resident needs and facilitating effective person-centered collaboration in care by integrating these into AT. The key question to be addressed is whether creativity-for-purpose workshops and AT integration positively impact the QoL of residents in LTC. It is predicted that the amalgamation of PCC into AT selection and design will be an effective means of strengthening the sense of connection to and meaningfulness of these aids, amplifying the likelihood of AT use, and improving the residents' subjective wellbeing. This study hypothesizes that participation in the workshops and creating and using the collaboratively designed AT will increase residents' well-being, meet their unique needs, foster a sense of purpose and improve their QoL.

It is anticipated that by integrating a user-centered method, inspiring unique perspectives, and facilitating collaborative problem-solving, these workshops will contribute to the construction of more effective, user-friendly, and socially inclusive AT solutions. Our perspective is that this approach will inspire a more positive and fulfilling experience for individuals receiving LTC services by emphasizing dignity, respect, autonomy, and holistic well-being. Ultimately, it is hoped that these PCC practices, through fostering a supportive and individualized approach to LTC, will contribute to improved QoL for the residents, increasing their sense of empowerment and autonomy in their daily lives.

Method

Participants

The sample consisted of six young adults residing at the Bethany CollegeSide LTC facility who reported physical or cognitive functional limitations. Eligibility criteria were all residents residing in Bethany CollegeSide's Young Adult unit (under the age of 65) who were given the opportunity to participate in the design thinking workshops and AT integration sessions. Thus, the potential participant pool for this project was the entire population in the unit. Due to complex needs, these residents require 24-hour nursing support in their daily living;

therefore, the researchers worked with the care team staff, who assisted in supporting the participation of all interested residents.

Although no exclusions within the young adult resident population were identified, participation was contingent on the care staff's determination that one-on-one interviewing could occur without risk to the student researcher's safety.

Measures and Materials

Subjective QoL

The Satisfaction with Life Scale (SWLS; Diener et al., 1985) is a brief, five-item questionnaire that indexes perceived QoL (e.g., "In most ways my life is close to my ideal"). Items are rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). A total score out of 35 is calculated using a classification scheme recommended by authors ranging from extremely dissatisfied (5-9) to extremely satisfied (31-35). The SWLS has wellestablished psychometric properties over a wide variety of populations.

Self-Efficacy

The General Self-Efficacy Scale (GSE; Schwarzer & Jerusalem, 1995) is a 10-item scale that indexes perceived beliefs concerning one's general ability to cope with life demands (e.g., "I can always manage to solve difficult problems if I try hard enough"). Items are rated on a 4-point Likert scale ranging from 1 (Not at all true) to (Exactly true). The total score ranges from 10 to 40, with higher scores implying more self-efficacy. The GSE has been extensively used with various populations, showing excellent internal reliability and validity.

Happiness

The Oxford Happiness Scale (Hills & Argyle, 2002) is an 8-item self-report inventory measuring subjective well-being. Items are rated on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). The scale consists of 17 positively phrased points (e.g., "I am well satisfied about everything in my life") and 12 negatively phrased points (e.g., "I don't have a particular sense of meaning and purpose in my life"); the negatively phrased points are reverse scored. A mean score will be calculated with higher means indicating higher happiness levels. It is based on the longer Oxford Happiness Inventory and has well-established reliability and validity.

Person-Centered Care

PCC will be assessed via the Resident Person-Centered Practices in Assisted Living Scale (Resident PC-PAL; Zimmerman et al., 2015), a 49-item self-report scale with four subcategories (Well-being and Belonging-18 items, e.g., "I feel a sense of belonging here;" Individualized Care and Services-12 items, "Caregivers, administrative, and other staff treat me with respect and dignity;" Social Connectedness-10 items, "There are different types of activities that are interesting to do here;" Atmosphere-9 items, "The environment does not feel welcoming") designed to evaluate the extent to which facility practices are person-centered from the resident's perspective. Items are rated on a 4-point Likert scale (1- strongly disagree to 4- strongly agree) and an option for "Don't know." Each subcategory is scored, and an overall score of up to 100 is provided. The higher the score indicates more person-centeredness. This Resident PC-PAL shows robust psychometric data.

Satisfaction with Assistive Technology

The Assistive Technology Usability Questionnaire for people with Neurological diseases (NATU Quest; Masbernat-Almenara et al., 2023) is a 10-item self-report measure designed to

assess user satisfaction with a specific AT (e.g., "I feel comfortable wearing/using my assistive technology"). Items are rated on a 6-point Likert scale ranging from 0 (strongly disagree) to 5 (strongly agree). Scores for each item are categorized into 4-5, usable; \geq 3, slightly usable; < 3, not usable. This scale has established reliability and validity.

Life Satisfaction/Agency, Social Connectedness, Accessibility

One-on-one interviews asked participants about self-perceptions of emotional well-being, interpersonal relationships, personal development, social inclusion, and related questions about the creative product (phase 1) and the selected assistive technology (phase 2). <u>Table 1</u> shows a sample of the main interview questions focusing on life satisfaction, social connectedness and accessibility. For the full interview script, refer to <u>Appendix A</u>. With participant consent, interviews were recorded for transcription using a digital recording device.

Table 1

Life Satisfaction	How do you feel about your ability to make choices in your life at CollegeSide?
Social Connectedness	Are there things that have helped you or made it harder to build social connections?
Accessibility	What can you tell me about your feelings of accessibility at CollegeSide?

Sample Interview Questions

Design

A mixed-method design using quantitative questionnaires and open-ended interview questions was used in the present study. Including qualitative and quantitative measures allows for data convergence, which is especially important given a small sample size. This decision is reinforced by preceding research, indicating that qualitative narratives regarding well-being, QoL and satisfaction are prolific in details relating to physical and psychological needs and can be triangulated and provide context to the quantitative data from the questionnaires, validating the findings by cross-verifying the information (Kołakowski, 2017).

Quantitative data was collected via questionnaires before and after a student-led creative design workshop (phase 1 of intervention) and subsequent complementary AT integration sessions (phase 2 of intervention). Semi-structured interviews were used alongside the questionnaires following the AT integration sessions. This method was selected for its efficacy in eliciting thorough and nuanced descriptions, crucial for investigating the interplay between psychological and physical needs, PCC, and AT (Brinkmann & Kvale, 2015).

Ethics

This study received ethics approval from the Red Deer Polytechnic Research Ethics Board (REB) prior to participant recruitment. All participants were advised of the study's purpose, requirements, risks and benefits before giving informed consent. Furthermore, the participants were apprised of their right to withdraw from the study without any negative consequences to their care, and their anonymity was protected throughout the study. The data analysis omitted potentially identifying information when writing about the participants or using quotes. All materials used in this study were stored securely to protect the confidentiality of the participants and were only available to the research team.

Procedure

The intervention evaluated in this study is a joint initiative involving collaboration between RDP and Bethany CollegeSide. Following approval from the REB, residents at the Bethany CollegSide LTC facility were advised of the proposed creative design workshops and the creation of AT and asked if they expressed interest in participating. Before the commencement of the first workshop, all individuals who wanted to partake were approached individually by the researchers and presented with the opportunity to participate congruently in the project evaluation. Arrangements for participation in the initial data collection session were made at this time.

Design Thinking Workshops and Technology Integration Sessions

Design Thinking Workshops.

(Intervention phase 1): A series of design thinking workshops tailored to adults' unique needs and preferences in LTC. These workshops provided a structured environment for residents to 1) identify personal wellness goals, whether related to mobility, communication, comfort, or other areas; 2) share their challenges and experiences with assistive technology. 3) collaborate with caregivers, technology experts, and peers in brainstorming innovative solutions. The design thinking workshops involved questions, interview protocols, and facilitated discussions about what contributes to happiness and personal well-being for participants. Moreover, the discussions included producing "creative products" and images (drawings, collages, participant photos, or other internet-sourced images) representing visual expressions of happiness and well-being. Faculty and students with visual art and design expertise supported this individualized expression in the creation of Inspiration Boards for use in the next phase of the intervention with the Centre for Innovation and Manufacturing Technology Access Centre (CIM-TAC) engineers and technicians.

Assistive Technology Integration.

(Intervention Phase 2): Once the participating residents completed the inspiration design thinking workshops, they worked closely with the RDP CIM-TAC team and Bethany care staff to

prototype and test the designed AT in real-life situations, ensuring its practicality and effectiveness in addressing the residents' wellness goals. This involved adapting existing technologies or developing new, resident-designed prototypes, depending on their needs and desires. The identification of assistive technologies for prototyping included a series of exploratory discussions between the student design team and residents to define a barrier or improvement to meaningful daily activity. To aid in practices promoting the implementation of AT for LTC residents, the CIM-TAC team used three-dimensional (3D) printing to provide a fast and feasible vehicle for creating efficient and practical prototypes.

A variety of AT modifications and prototypes were developed, including enabling a wheelchair-bound artist with a painting easel which attaches to a wheelchair arm and can accommodate different canvas sizes, as well as holding a container of paints and brushes, providing the resident with the autonomy to take her supplies and paint anywhere. Based on input from another resident, a footrest/massager was designed and developed to help strengthen her feet and ankles, increase blood flow and support her legs during activities. Another participant contributed to the design of a hobby cabinet that allowed her to partake in scrapbooking, which requires specialized storage, and the workspace is now supported with purpose-built storage. Additionally, several personalized wheelchair trays and accessories, such as oversized cup holders, were designed and created based on resident suggestions and collaboration.

Sleep Quality Monitoring

In conjunction with the intervention initiative, a sleep monitoring technology, TochTech Technologies SleepSense Sensors, was provided to all residents of the Young Adult Unit. Piloted at one other Bethany care centre as the first in Alberta, these sensors provided information on various indices of sleep quality such as sleep duration, amount of deep sleep, number of sleep interruptions, etc.

Questionnaires and Interviews

Additionally, quantitative data was collected by administering brief standardized measures as a hardcopy questionnaire before and after the two-phase intervention, preceded by informed consent. The questionnaire package consisted of four scales, preceded by brief demographic questions regarding participant name (collected for collating pre- and post-data), age and gender. A fifth scale was administered once the residents identified a specific AT device, assessing their current satisfaction with that technology and again after Phase 2.

Finally, semi-structured one-on-one verbal interviews took place in a quiet setting at the Bethany CollegeSide facility following the intervention with the assistance of care staff to ensure participants' diverse needs and preferences were accommodated during the interviews as needed. Interviews were structured to collect comprehensive insights into the residents' emotional well-being, interpersonal relationships, personal development, and social inclusion, as well as to retain information regarding the workshops and AT selection. The interviews ranged from 15 to 25 minutes (average: 18 minutes), and the audio recordings were transcribed and anonymized with participant codes before completing the content analysis.

Analysis

Paired-sample *t*-tests were used to examine the effect of the creative workshops' influence and the integration of AT on the outcomes on the dependent variables measured by the questionnaires. Descriptive statistics were calculated, reporting means and standard deviations. Cohen's *d* test was used to determine the effect size of the difference between the pre- and postintervention measures. Thematic analysis of the one-on-one interviews was conducted inductively, following a six-step process: familiarization, coding, theming, reviewing, defining, and reporting. This approach enabled a subtle evaluation of individual perspectives relating to life satisfaction, agency and autonomy, optimization of environment, internal and external relationships, and subjective impact of the workshops.

Results

Participant Characteristics

Six young adults in long-term care (4 women, 2 men) with a mean age of 53 years completed five quantitative questionnaires and answered open-ended questions in one-on-one semi-structured interviews.

Pre and Post-Intervention Comparisons

To examine the efficacy of the creative design workshops and assistive technology integration in enhancing satisfaction with life, general self-efficacy, happiness, perceptions of person-centered care and satisfaction with AT, paired-sample *t*-tests were conducted comparing pre and post-intervention data. As shown in Table 2, the results indicated a significant improvement in life satisfaction after the intervention (p < .01). While significant pre-post differences were not found for the other variables, this may reflect type 2 error given the small sample size. Thus, effect size was also calculated as potentially a more informative assessment of impact. Cohen's *d* (0.2, small effect; 0.5, medium effect; 0.8, large effect) were computed and noted, along with descriptive statistics (*means* and *standard deviations*). As can be seen from Table 2, in addition to the large effect size found for life satisfaction, moderate effect sizes were also found for self-efficacy, person-centered care subcategory 'atmosphere,' and AT satisfaction.

Measure	Pre-Intervention		Post-Intervention		<i>t</i> (5)	n	Cohen's d
meddare	М	SD	М	SD	_ (())	μ	concir s u
Satisfaction with Life	19.33	6.25	24.67	6.06	3.671	.007	1.499
Self-Efficacy	32.00	4.56	33.67	3.01	1.185	.145	.484
Happiness	4.58	0.90	4.53	0.73	.184	.431	.075
Person-Centered Care total score	78.78	17.30	77.98	15.63	.254	.405	.104
Well-Being & Belonging	76.02	16.35	77.44	16.21	.324	.380	.132
Individualized Care & Services	82.85	19.66	81.92	22.65	.145	.445	.059
Social Connectedness	85.23	13.14	84.58	16.69	.190	.428	.078
Atmosphere	72.22	24.09	67.40	25.04	1.183	.145	.483
Assistive Technology Satisfaction	3.17	1.94	4.55	.60	1.805	.065	.737

Means, Standard Deviations, Paired Sample t-Test and Effect Size Statistics for Intervention Data

Note. Mean and standard deviation values for each analysis are shown for the pre and post-intervention (n = 6) and the results of the *t*-tests and effect sizes using Cohen's *d* statistics.

One-On-One Interview Themes

The thematic analysis identified several themes which could be grouped into positive outcomes and ongoing challenges relating to life satisfaction, agency and autonomy, optimizing environment, internal and external relationships, and subjective intervention impact (<u>Appendix</u><u>B</u>).

Positive Impact of Intervention

Subjective Intervention Impact.

All six of the participants had positive feedback concerning the intervention, ranging from social connections ("I really enjoyed it. It kind of brought me closer to one lady that was paired with me during that."- Participant A3) to personal wellness ("It maybe helped me see what I really wanted out of life, or from life, or that I had from life."- Participant A5), attained goals with AT ("It's amazing how accessible the table is to me. And [the engineer] didn't put any thoughts in my head. I just told him what I wanted. And you can see I told him exactly what I wanted."- Participant A4; "I like the fact that I can drive my easel outside and paint. That's something I have not been able to do since I moved here."- Participant A2), and general gratitude for the experience ("From what I could see, it made each of us very happy and feel special . . . Oh yeah. Like, I'm shocked that Bethany wanted to do this. And I feel honoured to be in this study."- Participant A2; "I hope this just spreads out to other colleges and, you know, all over because isn't this fabulous for everybody?"- Participant A3).

Current QoL Status and Ongoing Challenges

Life Satisfaction.

The first theme identified under current QoL and ongoing challenges centered on how satisfied the residents were with life in general. Most participants expressed satisfaction to some degree with their lives at Bethany CollegeSide, except for one who stated they were "not very satisfied" (Participant A5). This is articulated in the following quotes: "I moved in about a year ago, and I felt home. God gives us what we need to be, so I'm here for a reason" (Participant A4), and,

Everything here is pretty much looked after, and I kind of like how [another resident] put it one time, he said, 'It's good, but you know, in some ways, wouldn't it be better if we were out struggling to pay rent?'... sometimes the challenges in life are what's rewarding when we succeed. (Participant A3)

Agency and Autonomy.

The second theme identified the levels of agency and autonomy the participants felt within LTC and revealed mixed reactions. While all participants have their own signing authority, they feel that their level of control varies. Many spoke about the freedom to come and go as they pleased, suggesting they could still engage in social activities outside of the facility and procure some 'normality' in their lives:

Well, I do mostly things on my own . . . I'm independent, so I like to go out with friends and go out with myself just to get out so I'm not stuck in the building all the time. (Participant A1)

On the other hand, others mentioned that even though they had some freedoms, their care was out of their control:

I guess this is the end of the road, right? That's why everybody winds up here. So that really sums up the control of life. It's all of a sudden, you're at the end of the road. Your control is diminished. (Participant A3)

Of course, all residents in LTC have their own personalities, backgrounds, and experiences that impact their attitudes and behaviours when they are in these facilities. In conjunction with those factors, the environment, resources and social engagement they encounter can also contribute to their perceptions of agency and autonomy.

Optimizing Environment.

The third theme emphasized the physical limitations of their environment. Three participants explicitly mentioned their need for space and alone time, as demonstrated by these quotes from Participant A4, "I have my own space that I can relax in, and nobody's using the bathroom," and A3, "My biggest problem is to get people to give me space." Relating to the physical environment, the contrast in sizes of wheelchairs to doorways, halls and the available space in the dining room were highlighted as frustrations as many of the residents at Bethany are confined to them. However, not all of the comments were negative, as Participant A1 expressed gratitude for having a call button in the case of needing help.

Internal and External Relationships.

As social connectedness is a vital component of QoL in LTC, the statements about connections within and outside of Bethany shed some light on the acquisition and maintenance of relationships. Most pointedly, Participant A2 stated, "I miss my husband every day...We've been married twenty-one years, and I still feel like a newlywed." Two other residents spoke about relationships outside of the residence, saying that their friends and family do not like to visit the building, making it difficult to have strong relationships. Participant A1 noted the importance of building trust with other residents and care staff before opening up to them and acknowledged that it can be hard to do but worth it in the end. Regarding personal connections within Bethany CollegeSide, some indicated connections were made due to convenience, while others were based on similarities in lifestyle or demographics, as depicted in the following quotes:

Most of the people I can make friends with. There is the odd few that I will not be friendly with, though, because of their lifestyle choice. They are not in line with the way I live my life now. (Participant A2) Well, I mean, I have bonds with all of them. Umm. There's the one girl has just come into the place so I think I'll get to know her. She's, I think, the right age group. She might not be as old as I am. (Participant A5)

In addition, two of the residents commented that the creative design workshops initiated social connections, both internal and external:

There's so many little benefits that are coming from this stuff . . . So that opened up some neat conversations, but you'd never have guessed that from any of this project. It was never set up to do that, but that's what came out of the art part of it. (Participant A3)

Well, you got to meet people that you didn't know. And you got to feel them out. What are they like? Who are they? What background did they come from? Right? And we got to sit there and talk and tell them what we like. And then they got, they got an idea, and we can open up and make friends at the same time. (Participant A1)

Overall, the qualitative analysis revealed a high level of participant satisfaction with the creative design workshops and integrated AT, as evidenced by the identified themes. This success further supports PCC's platform and underscores its benefits and areas for improvement.

Sleep Quality Monitoring

During the project, the registered nurse provided residents with sleep quality information and led the implementation and monitoring of sensor information. Residents' active participation in the project workshops indicated increased quality of sleep events, with more time observed in restorative sleep stages (REM and deep sleep). Any changes in sleep quality trends were highlighted and discussed with residents, leading to increased resident engagement in setting and monitoring sleep quality goals.

Discussion

The results of this study reveal that implementing creative design workshops and AT integration processes focusing on PCC practices enhances residents' well-being. The data indicates that facilitating the personalization of care to explore, identify and tailor AT to the individual and promoting residents' involvement in their care are strong enmeshed components of PCC and QoL. Furthermore, the application of the PCC approach in these workshops is integral to the use of AT, as they are customized to the fit of specific cognitive, physical, and social characteristics of the residents and the environment, all relative to the efficacy of the AT as this increases the likelihood of user satisfaction and acceptance of the technology (Bartfai & Boman, 2014).

These outcomes have numerous implications for the scholarship of well-being. First, they reinforce the notion that implementing creative activities such as creativity-for-purpose workshops can serve as interventions for enhancing well-being and QoL (Conner et al., 2017). Also, previous quantitative research has discovered that LTC facilities that implement PCC models and focus on resident preferences are correlated with improvements in life satisfaction and self-efficacy, which is supported in this study (Davies et al., 2022).

Through this intervention, the participants were valuable in determining the benefits of the creative design and AT workshops and areas for improvement in future trials and also brought to light claims that challenge PCC, as some residents feel their agency or autonomy is impeded by institutional policies which hinder their capacity to get care catered to their preferences, a similar finding discussed by Donnelly and MacEntee (2016). Much of the literature regarding PCC in LTC comes from the staff rather than the residents, relaying the need for more qualitative studies from their perspectives. Moreover, PCC models should address these approaches on micro (interprofessional/care teams), meso (organizational) and macro (national/jurisdictional) levels, as changes to care at a micro level will influence the greater meso and macro level systems (Melles et al., 2020). This tactic ensures that PCC solutions are holistic and fit the dynamics of the multifaceted environment of which the residents are a part, such as tailoring care plans to meet the needs and preferences of each resident, encouraging them to contribute to decision-making about their daily routines, activities and care, and ensuring empathetic communication between themselves and care staff.

Finally, integrating resident-designed AT via the creativity workshops offers new frontiers for participation, inclusion and enhanced functioning (Federici et al., 2014). These benefits could be sustained by implementing creativity workshops into daily routines, where there is the potential for improved positive affect and flourishing and decreased negative affect, as demonstrated in a study by Conner and colleagues (2017). Their research indicates that everyday creativity improved the well-being of young adults and increased their flourishing and enthusiasm in the following days. By embedding creativity into the culture and daily routines of LTC facilities, residents can benefit from continuous occasions for expression, engagement, and connection. This holistic approach can significantly enhance the QoL and overall well-being of residents.

Moreover, these workshops show benefits to the students and engineers conducting the design workshops. To emphasize this point, in the current study, the creative arts students who were trained in creative design skills in iterative design thinking methodology, bias mitigation, human-centred techniques to solve problems, fostering creativity, and cultivating social and physical environments that nurture the creative capacity for a PCC approach, benefited by learning discipline skills in arts-based research methodology, in the ethical conduct of research,

multiple ways of knowing, data collection, and establishing rapport in addition to skills in time management, communications, community engagement, and knowledge transfer. The creative arts students also benefit from work-integrated learning components and gain transdisciplinary experience related to understanding the unique needs of an individual from a practical application perspective, design thinking and arts-based knowledge aesthetic perspectives, and understanding the value of the arts in the creative sectors outside of the working studio or gallery. Concurrently, these students found the experience gratifying, as it helped someone who didn't have the physical ability to create something that represented them.

Additionally, the CIM-TAC engineering team played a significant role in the ideation and creation of the AT. After meeting with the staff and residents, the AT team then met with each other and other members of CIM-TAC to brainstorm the best solutions for the residents. The brainstorming session also allowed the AT team members to collaborate on projects they were not directly involved in. The AT team considered practical items such as cost, strength, availability of materials, and time to produce the prototype in their design decisions. The non-technical team members provided input on the aesthetics of the AT devices. Many of the products made use of the various 3D printers available in the Centre and included collaboration between the residents and engineers, discussing needs, preferences, abilities, and evaluations of the AT satisfaction outcomes, as seen in the current study, which also lends to the PCC model. A positive unintended consequence was the impact on the CIM-TAC team. Several of the team members commented on how much they enjoyed the project, and the students who participated commented that it was their favourite project of the summer work term. Many of the engineers and technicians enjoyed experimenting with their "artistic" side.

The design process, which resulted in creative expression, was within the context of gatherings and interactions with faculty, students, staff, and residents, which created an important social experience and opportunity for the expression of AT designs. Expression of identity through AT was an explicit goal shared by all project participants, creating unique value for engagement by residents. Resident engagement in health and wellbeing goal setting, considering the impact of active participation in social activity on sleep recovery, further contributes to insights on a more robust approach to enhancing QoL for those living in LTC.

Limitations

While this study did work with the desired population, it was a small convenience sample, which raises issues of generalizability and limited representativeness. Thus, a larger group would be ideal for future studies. Additionally, as with qualitative data and self-report questionnaires, there is always the potential for bias in theming and social desirability bias, respectively. Bias in theming was mitigated through data triangulation, which compares the qualitative data to the quantitative data, iterative coding through the six-step process, and peer review to provide feedback and identify any potential biases. The analysis was initiated by reviewing the participants' transcripts and noting first impressions and keywords in an Excel spreadsheet. This guided the adaptation of codes and, subsequently, the resulting themes. The concept of positive outcomes and ongoing challenges were generated inductively during the reviewing and defining steps.

Conclusion

PCC plays a particularly important role in QoL in LTC facilities. The authentic realization of PCC requires successful communication and shared understanding between

administrators, staff, and residents regarding their individualized needs, preferences, and goals when planning their care. This project aimed to identify whether resident participation in creative design workshops and AT design would increase well-being, meet needs, foster a sense of purpose and improve quality of life. Overall, the creative design workshops and AT integration were successful in this regard, demonstrating a feasible and effective means to enhancing PCC and, ultimately, QoL in LTC environments. Future research should seek to comprehend how these key interlocking elements of PCC and design thinking workshops can be executed while reflecting on context, such as the specific needs and characteristics of the residents, the capabilities and training of the staff and students, the facility's resources and environment, and broader cultural factors to identify what is possible.

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Appendix A

Interview Questions

Life Satisfaction: How in charge do you feel with your life?

- 1) Can you tell me about your life at CollegeSide?
- 2) How satisfied are you with life in general?
- 3) How do you feel about your ability to make choices in your life at CollegeSide?
- 4) Are there things that have helped you or made it harder to make choices?
- 5) Was the creative design workshop helpful in your satisfaction with life at CollegeSide and making choices?
- 6) Could you tell me why you feel this way?
- 7) Is there anything else you want to share about being in charge of your life at CollegeSide?

Social Connections:

- 8) How do you feel about your social connections with other residents here at CollegeSide?
- 9) Are there things that have helped you or made it harder to build social connections?
- 10) How did participating in the creativity workshop and working on your Assistive Technology design affect your social connections?
- 11) Could you tell me why you feel this way?
- 12) Do you want to share anything else about your social connections here at CollegeSide or about the workshops?

Accessibility:

- 13) What can you tell me about your feelings of accessibility at CollegeSide?
- 14) Are there things that you like or dislike? Examples?
- 15) Do you feel you can manage your needs well at CollegeSide?
- 16) How did participating in the creativity workshop and working on your Assistive Technology design affect your accessibility?
- 17) Do you want to add anything else about your accessibility at CollegeSide?
- 18) Do you think the workshop was successful?
- 19) Could you explain why you feel that way?

Appendix B

Table 3

Emergent Themes of One-On-One Interviews

Example Quotes				
"Well, I do mostly things on my own I'm independent, so I like to go out with friends and go out with myself just to get out, so I'm not stuck in the building all the time."				
"I don't feel like I've got any control over my life."				
"I guess this is the end of the road, right? That's why everybody winds up here. So that really sums up the control of life. It's all of a sudden, you're at the end of the road. Your control is diminished."				
"Oh yeah, like I have total freedom. Like I can book an action bus and go anywhere."				
"I can do that. Come and go if I have something to do in my private life. They never say anything about it, so long as I let them know."				
"They're completely in charge, and if something gets changed, the only way I get notified is by them."				
"Lots of times, like, they'll ask me things, but also lots of times they just tell me things."				
"I think they're OK, but we, like everywhere else, we have to fall in with what everybody else finds acceptable."				
"I really enjoyed it. It kind of brought me closer to one lady that was paired with me during that."				
"It maybe helped me see what I really wanted out of life, or from life, or that I had from life."				
"From what I could see, it made each of us very happy and feel special."				
"It showed me what I can do and how I can get along with others."				
"They just kind of brought the tray in, and that was it. Put it on my chair and I was just elated because it is just so nice. Just perfect. They did a fantastic job."				
"Oh yeah. Like, I'm shocked that Bethany wanted to do this. And I feel honoured to be in this study."				
"[Care Services Managers] have let me paint, and sometimes I've				
created quite a mess. Housekeeping cleans it up. And they've never complained."				
"It really kind of made everything really personal and everybody else I've heard here just loves it what was made for them, because of the personal touch "				

Themes	Examples
Subjective intervention impact	"And you know, for the first time, I don't know if I've ever seen a first time anything to be so successful. It's hard to imagine what could be improved upon it, but I'm sure there's always room for
continued	improvement."
	"I hope this just spreads out to other colleges and you know, all over because isn't this fabulous for everybody?""It's just the things they can do are just, it just blows my mind, you know."
	"It's amazing how accessible the table is to me. He [the engineer] was so calm and relaxed. And he didn't put any thoughts in my head. I just told him what I wanted. And you can see I told him exactly what I wanted."
Internal and external relationships	"Well, I mean, I have bonds with all of them. Umm. There's the one girl who has just come into the place, so I think I'll get to know her."
	"I volunteer, like, they have a church that comes and meets here and I volunteer sitting with a resident there, and I think that's a bit of a social connection."
	"I miss my husband every day."
	 "Most of the people I can make friends with. There is the odd few that I will not be friendly with because of their lifestyle choice. They are not in line with the way I live my life now." "So that opened up some neat conversations, but you'd never have guessed that from any of this project. It was never set up to do that, but that's what came out of the art part of it."
	made the decision to go ahead, right? Because you got to get to know the person and you gotta open up to people. And I know it's hard to open up to people."
	"Well, you got to meet people that you didn't know. And you got to feel them out. What are they like? Who are they? What background did they come from? Right? And we got to sit there and talk and tell them what we like. And then they got they got an idea and we can open up and make friends at the same time."
	"Like, most of my friends won't come in here and like, how would I put it? They're in businesses and stuff like like that. Two of my best friends own businesses so they're busy with their businesses. So it's kind of like when there is nothing going on on the business side, then we can get together."
	"My family doesn't really like coming in the building, but they will. They'd rather just pick me up and go out."

Optimizing	"I have my own space that I can relax in, and nobody's using the				
environment	bathroom."				
	"My biggest problem is to try and get people to give me space."				
	"They clean chairs at night. Sometimes, they'll just leave the chairs parked in the middle of the hallway, and you can't get through very easily."				
	"Yeah. Getting into my bathroom is hard."				
	"And strangely enough, I'm really happy that they set up that NA meeting here, so that people with disabilities can come and have a meeting."				
	"Well, they're here to help if you need it, especially if your next-door neighbour needs it. They're here to help if you need it, right? And that's why you have a call button."				
	"Well, the doors could be wider, right? You know the doors can be wider because this building is not made for wheelchair access. But they're trying their best. And they're working with what they've got, right?"				
	"Well, these doors have been measured. And they don't, really, wheelchairs don't fit in them, yeah."				
	"They have more expectations on somebody. Of more accessibility than somebody with less accessibility. And I'm trying to get them to see that we should all be treated equally."				
Life satisfaction	"Life in general. I'm happy."				
	 "Everything here is pretty much looked after and I kind of like how [another resident's name] put it one time, he said, 'It's good, but you know in some ways, wouldn't it be better if we were out struggling to pay rent?' sometimes the challenges in life are what's rewarding when we succeed." "I'm satisfied with my life in general. Considering I, how, how, premature I was born." "Not very satisfied." 				
	"In general, I'm going to say I'm fairly satisfied."				
	"I moved in about a year ago. And I felt home."				
	"God gives us what we need to be, so I'm here for a reason so"				