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Older adults' experiences of a computerised cognitive training intervention: a mixed methods study

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ABSTRACT

Objective: Computerised cognitive training (CCT) is gaining in popularity and has shown evidence of efficacy in improving cognitive function. Older adults' experiences of a CCT intervention were explored using mixed methods, focussing on computer literacy and engagement. **Methods:** Seven older adults completed pre-operative CCT (pre-habilitation) and a 12-week post-operative CCT (rehabilitation) intervention as part of an ongoing clinical trial. Qualitative interviews were conducted post-training to explore CCT experiences and data were analysed using thematic analysis. Three questionnaires were used to characterise participants: Computer Proficiency Questionnaire-12, Short Computer Anxiety Scale, User-Engagement Scale-Short Form. **Results:** Four key themes were identified from the interview data: "I appreciate a challenge", "Persevering through frustration led to accomplishment", "When I start, I finish", and "It's manageable but with support". **Conclusion:** All participants had positive CCT experiences, including those with low computer-literacy skills. CCT interventions should consider utilising regular supervised sessions, and achievable, challenging exercises, while focussing on reducing frustration to improve experiences with CCT.

KEY POINTS

What is already known about this topic:

- (1) Computerised cognitive training (CCT) has demonstrated evidence for improving overall and domain-specific cognitive function in healthy older adults, and older adults with mild cognitive impairment.
- (2) Low adherence is common in CCT interventions, which limits beneficial cognitive outcomes.
- (3) Negative experiences in CCT interventions are major drivers of non-adherence and attrition.

What this topic adds:

- (1) Experiences during CCT often fluctuate, and frustration occurs when participants compare their perceived and actual abilities.
- (2) Recommendations from qualitative interviews include the use of attainable, challenging exercises that can be completed more efficiently with improved skill.
- (3) Support strategies contributed to positive experiences overall and included regular supervised sessions (e.g., once a week), phone numbers to call for assistance, and screen sharing software to resolve computer problems.

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Ageing; cognition; cognitive training; computer literacy; motivation

Introduction

Age-related cognitive decline leads to significant economic, social and health costs (Double & Birney, 2016). To reduce cognitive decline in older adults, cognitive training is gaining popularity and demonstrating evidence of efficacy in improving cognitive function (National Academies of Sciences, Engineering and Medicine, 2017). Cognitive training involves repeated

practice on cognitively challenging exercises and is often complemented by strategies (Gates & Valenzuela, 2010; National Academies of Sciences, Engineering and Medicine, 2017). In meta-analyses of randomised controlled trials, computerised cognitive training (CCT) has demonstrated evidence for improving overall cognitive function with small to moderate effect sizes for healthy older adults (Gates et al., 2020; Lampit

et al., 2014), and older adults with mild cognitive impairment (Gates et al., 2019; Hill et al., 2017). Evidence for improving domain-specific cognitive function with CCT has also been demonstrated, with many domains showing small to moderate effect sizes in healthy older adult samples (Gates et al., 2020; Lampit et al., 2014), and for older adults with mild cognitive impairment (Gates et al., 2019; Hill et al., 2017).

Variability does exist, between CCT intervention studies, with some individual studies reporting negative or null effects. This variability is in part due to quality and risk of bias, limiting the validity of some studies (Livingston et al., 2020). Further, variability also reflects differences in CCT protocols across studies, which utilise different cognitive training session frequencies and durations (e.g., 3x 45-min sessions per week), intervention durations (e.g., 12 weeks), intervention settings (home vs group-based), and follow-up durations (Gates et al., 2019; Livingston et al., 2020). Work is ongoing to determine and optimise CCT protocols (Gates et al., 2019).

Adherence is a well-acknowledged barrier to successful CCT, often expressed as a percentage of the number of sessions completed out of the total number of sessions in the intervention (Coley et al., 2019). No consensus regarding CCT adherence cut-offs has been reached; however, a 66% adherence threshold is commonly employed (Coley et al., 2019). Adherence to home-based CCT is often low, with only 25–30% of participants adhering to at least 66% of CCT-related sessions (Coley et al., 2019; Schoene et al., 2015). Negative CCT experiences, such as frustration, are commonly reported among older adults as a reason for nonadherence (Goghari & Lawlor-Savage, 2018), and are major drivers of non-adherence and attrition (Smith et al., 2009). CCT experiences need to be explored, as increased cognitive benefits have been shown for higher adherers compared to lower adherers (Lam et al., 2015).

Positive beliefs or expectations may lead to commencing CCT, but what motivates and engages participants to complete CCT is unclear (Harrell et al., 2019; Turunen et al., 2019). Engagement with CCT involves active participation and investing effort into completing the intervention exercises, increasingly utilising cognitive processes (Miotto et al., 2018). CCT engagement has been measured in relation to self-reported enjoyment, exercise difficulty, and cognitive improvements (Jaeggi et al., 2011). Previous qualitative research with older adults suggests that to increase engagement and motivation to complete CCT, researchers should allow peer communication, provide real-time feedback, and utilise tailored exercises relating to participants' interests (Haesner et al., 2015). As these recommendations are based on single experiences with a sample of CCT

exercises, older adults' long-term experiences need to be explored to improve future CCT methodology (Haesner et al., 2015).

Computer literacy encompasses a person's ability to use a computer, and feelings and attitudes towards a computer, such as confidence and anxiety (Levine & Donitsa-Schmidt, 1998). Higher previous computer-use in older adults has been positively associated with CCT adherence and was the only non-health related adherence factor in a large sample of older adults undergoing long-term CCT (12-months; Coley et al., 2019; Turunen et al., 2019). CCT studies often recruit only participants who own devices (Kesler et al., 2013), resulting in non-representative samples of the older adult population (Calhoun & Lee, 2019). As part of computer literacy, positive change in attitudes towards computers showed no significant association with adherence but was associated with higher executive function ability after long-term CCT (Lin et al., 2021). Lin et al. (2021) reported that negative attitudes towards computers may relate to lower CCT engagement. Therefore, exploratory research may identify methodological areas to refine with the aim of improving experiences, engagement, and consequently adherence, such as by providing more supervised sessions for less engaged or less computer-literate participants (Gigler et al., 2013).

In summary, home-based CCT is scalable and has the potential to reach large numbers of individuals at risk of cognitive decline. However, low adherence is common (Turunen et al., 2019), which limits beneficial cognitive outcomes (Harrell et al., 2019; Lam et al., 2015). Long-term CCT experiences have not yet been explored in relation to computer literacy and engagement with older adults. The aim of this study was to use qualitative and quantitative methods to explore older adults' experiences of a long-term CCT intervention, to investigate the roles of computer literacy and engagement in those who adhered.

Method

Participants

Data were collected from seven participants (1 female, 6 males), aged 65 years or older ($M_{\text{age}} = 73$, $SD = 6.32$) in an ongoing CCT intervention in coronary artery bypass grafting (CABG) patients (ACTRN12618000799257; Greaves et al., 2020).

Design

This explanatory, sequential mixed methods design utilised baseline and longitudinal data collected

during the ongoing CCT intervention, in addition to quantitative and qualitative data collected post-intervention as part of the current study.

Materials

Computerised cognitive training (CCT)

Participants used their own computer, or equipment (a laptop, mouse, and wi-fi dongle) supplied by researchers. Participants accessed CCT via the website Happy Neuron Inc (2019) and were provided a CCT guide with set-up and login details, as well as a booklet to promote strategy-use for each exercise (Kesler et al., 2013). Assistance was provided as needed with supervised sessions, phone calls, and screen sharing software (TeamViewer).

Qualitative interview

A brief semi-structured qualitative interview was conducted post-intervention and explored the influence of computers on participants' experiences and adherence, and if/why participants were engaged and motivated to complete CCT. Question topics included computer-use and difficulties experienced, motivations to initiate and complete CCT, and which exercises were enjoyed or disliked (Kesler et al., 2013). Interview questions were tested with three volunteers. Prompts were used, and data were audio recorded.

Addenbrooke's cognitive examination-III

The Addenbrooke's Cognitive Examination-III (ACE-III) assessed participants' baseline cognitive function in domains of attention, memory, verbal fluency, language, and visuospatial abilities (Noone, 2015). Total scores range from 0 to 100, with scores of 88 or below indicating signs of mild cognitive impairment, and

scores of 82 or below indicating signs of dementia (Noone, 2015).

Computer proficiency questionnaire-12

The Computer Proficiency Questionnaire-12 (CPQ-12) was used to measure computer proficiency, as part of computer literacy (Boot et al., 2015), across the six subscales: computer basics, printer, communication, internet, calendar, and entertainment skills (Boot et al., 2015). Total scores range from 6 to 30, with high overall internal consistency ($\alpha = .95$) and high concurrent validity involving high and low computer-experienced users (Boot et al., 2015).

Short computer anxiety scale

The Short Computer Anxiety Scale (SCAS) was utilised to measure computer anxiety as part of computer literacy (Lester et al., 2005). Scores range from 6 to 36, with higher scores indicating higher computer anxiety (Lester et al., 2005). Moderate-to-high internal consistency ($\alpha = .78$), and high test-retest reliability after a four-week window ($r = .87, p < .001$) has been shown (Lester et al., 2005).

User-engagement scale-short form

The User-Engagement Scale-Short Form (UES-SF) was used to assess participants' engagement with the CCT website, as part of motivation, using four subscales; focussed attention, aesthetic appeal, perceived usability, and reward (O'Brien et al., 2018). Scores range from 12 to 60, with higher scores indicating higher user-engagement (O'Brien et al., 2018). Individual subscale internal consistency is moderate to high ($\omega = .81$ to $.86$), and construct validity is supported with each subscale correlating to the long-form UES (O'Brien et al., 2018).

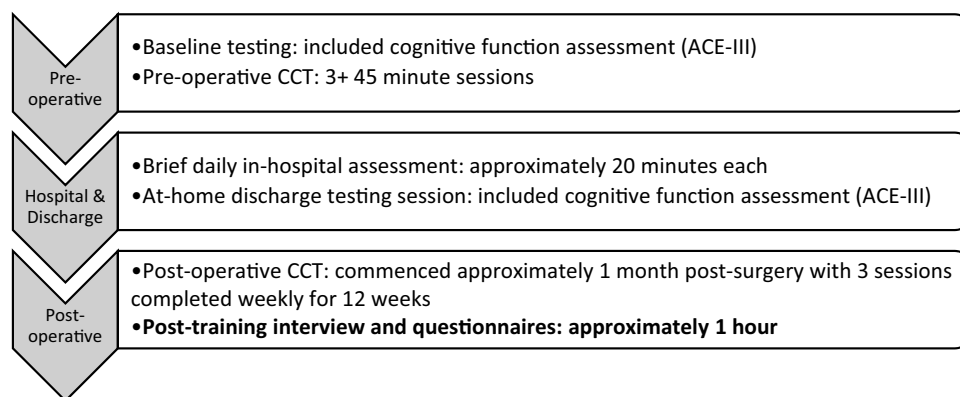


Figure 1. Figure 1 displays study activities from the current study (bold font), study activities from the larger study (non-bold font), and the estimated duration for each activity. Participants underwent elective coronary artery bypass grafting (CABG) surgery. ACE-III = Addenbrooke's Cognitive Examination-III. CCT = Computerised Cognitive Training.

Procedure

Ethical and governance approval was obtained from the Central Adelaide Local Health Network (R20171020) and the University of South Australia (0000034053) Human Research Ethics Committees, abiding by ethical standards in the Declaration of Helsinki (World Medical Association, 2013). As part of the larger trial (outlined in Figure 1), demographic and baseline cognitive function (including ACE-III) data were collected, followed by a pre-operative CCT (pre-rehabilitation) intervention. Within pre-operative CCT, participants aimed to complete a minimum of 3 sessions of CCT. After participants underwent elective CABG surgery, daily in-hospital visits were conducted, and discharge cognitive function data were collected. At one-month post-surgery, a 12-week CCT rehabilitation intervention commenced, with 3 CCT sessions scheduled weekly. Full details are available in the protocol paper (Greaves et al., 2020). Each CCT session was completed a minimum of 24 hours apart and designed to last for at least 45 minutes each (Lampit et al., 2014). Twelve CCT exercise programmes were used post-surgery, which were balanced by cognitive domain classification for each exercise (e.g., attention). Exercises began at level one and could progress to a maximum of level nine.

Participants were required to have completed at least 66% of all planned CCT sessions (minimum of 24 of 36) to be interviewed and included in analyses for the current study (Coley et al., 2019). The 24-session minimum included sessions where all prescribed exercises were completed, and those that lasted at least 30 minutes (Lampit et al., 2014). CCT was ceased if participants were not on-track to completing at least 66% of sessions, in accordance with recommendations from Lampit et al. (2014). Only one participant was excluded from the study based on this criterion.

["CCT was ceased if participants were not on-track to completing at least 66% of sessions, in accordance with recommendations from Lampit et al. (2014). Only one participant was excluded from the study based on this criterion."]

Participant rapport was established during CCT sessions, and participants were approached regarding the current study either face-to-face or via telephone. Informed consent (separate to the larger trial) was obtained face-to-face by the main researcher (KT) prior to commencing data collection. Data were collected from 0 to 22 weeks post-CCT. The questionnaires CPQ-12, SCAS and UES-SF, and interviews were conducted by the main researcher (KT) at participants' homes, in a quiet room with minimal distractions, lasting approximately

25 minutes. Interviews were transcribed verbatim, with pseudonyms added to protect confidentiality.

Data analysis

Thematic analysis

Semi-structured interviews were transcribed verbatim, and inductive thematic analysis was conducted according to Braun and Clarke (2006). NVivo 12 (QSR) was used for data management during coding. Initial notes and preliminary themes were identified (KT) and discussed with an experienced qualitative researcher (MH) to reduce any potential biases. Interview themes were considered in relation to adherence data, and CPQ-12, SCAS, and UES-SF scores, to explore similarities and differences in participant experiences. Computer-use level (high, medium, and low) accompanied each quotation, and was based on self-reported computer-use frequency.

Quantitative analysis

Spearman rank-order correlations were conducted to examine relationships between the percentage of sessions completed, and the CPQ-12 (total and subscale), SCAS, and UES-SF (total and subscale) scores, separately. Bonferroni corrections for multiple comparisons were not made due to the exploratory nature of the study. Tied ranks were accounted for during analysis in IBM SPSS 26.

Results

Table 1 presents individual demographic, adherence and reported computer-use data. Reported computer-use difficulties involved using the mouse, unlocking the computer, and logging into the CCT website. Reported computer technical issues were no internet connection. The individual scores, median, and inter-quartile range for the CPQ-12, SCAS, and UES-SF scores are presented in Table 1.

Spearman rank-order correlation results for scores on the CPQ-12 total and separate subscales, the SCAS, and the UES-SF total and separate subscales, with adherence percentage, are presented in Table 2.

Thematic analysis

Four key themes were identified.

Theme 1: I appreciate a challenge

Participants often determined their exercise preference based on how personally challenging exercises were. Overall, exercises perceived as "too challenging"

Table 1. Demographic information, adherence, computer-use, and questionnaire scores for the seven participants.

	P1	P2	P3	P4	P5	P6	P7	Median	IQR
Demographics									
Gender	M	M	F	M	M	M	M	-	-
Age (years)	71	69	83	75	69	65	79	71	10
Education (years)	11.50	7	11	14	11	11.25	10.75	11	0.75
Baseline ACE-III score	93	62	96	90	87	95	82	90	13
Adherence									
Percentage of sessions completed	100	100	100	94	69	81	100	100	19.4
Number of sessions completed	36	36	36	34	25	29	36	36	7
Length of intervention (weeks)	12.0	12.6	14.0	12.0	12.3	12.6	11.4	12.6	0.6
Computer-use									
Used own computer	Yes	No	No	Yes	No	Yes	No	-	-
Computer-use frequency	Daily	Most days	Most days	Daily	None	Daily	None	-	-
Computer-use	High	Med	Med	High	Low	High	Low	-	-
CPQ-12 total score	30.0	17.0	19.5	25.0	8.5	30.0	9.5	19.5	20.5
Computer basics	5.0	4.0	4.5	4.0	3.5	5.0	4.5	4.5	1.0
Printer	5.0	1.0	1.0	4.0	1.0	5.0	1.0	1.0	4.0
Communication	5.0	3.5	4.0	4.0	1.0	5.0	1.0	4.0	4.0
Internet	5.0	4.0	4.0	4.5	1.0	5.0	1.0	4.0	4.0
Calendar	5.0	2.5	1.0	3.5	1.0	5.0	1.0	2.5	4.0
Entertainment	5.0	2.0	5.0	5.0	1.0	5.0	1.0	5.0	4.0
SCAS score	7.0	27.0	20.0	18.0	17.0	8.0	27.0	18.0	19.0
UES-SF total score	4.33	3.58	3.50	4.00	3.75	3.00	4.00	3.75	0.50
Focussed attention	3.00	3.67	3.66	4.00	3.00	3.66	3.00	3.66	0.67
Perceived useability	5.00	3.00	2.66	3.33	4.00	2.00	3.66	3.33	1.34
Aesthetic appeal	4.33	3.67	3.66	4.33	4.00	2.33	4.33	4.00	0.67
Reward	5.00	4.00	4.00	4.33	4.00	4.00	5.00	4.00	1.00

Note. P1 to P7 = participant one to participant seven. IQR = Interquartile Range. CPQ-12 = Computer Proficiency Scale-12. SCAS = Short Computer Anxiety Scale. UES-SF = User Engagement Scale-Short Form.

Table 2. Spearman correlations for computer proficiency, computer anxiety, and engagement questionnaires with adherence.

	Percentage of sessions completed	
	r_s	p
CPQ-12 total score	.089	.849
Computer basics	.344	.450
Printer	-.198	.671
Communication	.051	.914
Internet	<.001	1.00
Calendar	-.093	.843
Entertainment	.099	.833
SCAS score	.457	.302
UES-SF total score	.268	.561
Focussed attention	-.010	.982
Perceived useability	.059	.900
Aesthetic appeal	.225	.628
Reward	.418	.351

were less enjoyable. Reported challenges involved understanding the computer and completing certain exercises. Although half reported that the intervention was out of their comfort zone, all participants appreciated the challenge of completing CCT: "... I found the whole thing really quite enjoyable and challenging, and I like a challenge ..." (Male, 71, high computer-use).

Thought-provoking exercises were positively experienced by all. One attention exercise, which required looking at images in-depth with no time limit, was the most frequently enjoyed. Favoured exercises had a clearly achievable goal and the speed of completion could be improved with exercise-specific

skill and improved computer skills. Exercise enjoyment was influenced, and often determined by, exercise difficulty. Less challenging exercises were consequently less engaging for some participants: "... the characters that are in the images were a little too simplified ... and it tended to boredom (sic) (Male, 65, high computer-use).

Individual strengths and weaknesses contributed to varied exercise and level of challenge preferences. All participants attempted to complete exercises they perceived as "too challenging", despite being more disengaged as a result: "Even if you try you can't make any sense of it, you can't put the words together ... so I don't think it was very enjoyable to me". (Male, 69, medium computer-use).

Theme 2: persevering through frustration led to accomplishment

Although overall satisfaction for the intervention was high, experiences were diverse. Participants commonly expressed frustration throughout the intervention, arising from exercises not "working" as expected, and from perceived feelings of incompetence to complete exercises: "There was a couple of times where I wanted to throw the computer away, because the frustrations and ... I felt that I wasn't doing it fast enough or I couldn't grasp it" (Male, 65, high computer-use).

Participants reported not utilising the strategy guide at all, or only referring to the guide for specific exercise instructions. Difficulties with completing exercises were based on individual abilities or lack of strategy-use, rather than technical issues: *“The Towers of Hanoi [a specific exercise] was a bit frustrating to just try to remember ... sometimes I forgot what I was aiming for and ... it took twice as long then to get it all back in the right place”* (Male, 71, high computer-use).

As participant’s abilities varied, so did their definition of a challenge. Most participants experienced challenges early into the 12-weeks, and level progression often plateaued in the low to middle-range objective difficulty. Frustration experienced in relation to perceived and actual abilities often developed into accomplishment and pride by improving beyond their original capabilities: *“As you go on and on you pick up more and bang, you[re] better”*. (Male, 69, medium computer-use).

However, select participants experienced challenges near the end of the 12-weeks after reaching high levels in most exercises, resulting in greater frustration and less enjoyment towards the end.

Theme 3: when I start, I finish

Participants expressed a strong desire to complete CCT despite enduring frustration and challenge. The reasons for beginning CCT varied, as some hoped to maintain their cognition due to perceived risks related to their impending surgery. Four out of seven participants reported starting CCT to help others by contributing to research: *“ ... It sounded very interesting and I thought that ... my small contribution would help other people, so that made me feel good”*. (Male, 71, high computer-use).

The want to continue and complete CCT was expressed by all. Motivations often related to enjoyment and positive experiences within the intervention, which may have led to greater engagement: *“I was happy to improve, because I didn’t want my mind the way it was. You know, forgetting things”*. (Male, 79, low computer-use).

Some reported wanting to keep their word with, or “get the better of”, the training. The few participants who continued to participate to meet their own promises, rather than for enjoyment, often adhered less than others: *“ ... I gave my word that I would do it, so I had to see it through”* (Male, 65, high computer-use).

Theme 4: it’s manageable but with support

Persistence to complete exercises in the face of adversity, including potential barriers, was necessary to maintain adherence. Reported barriers included technical and health-related issues, which had a negligible

influence on overall adherence. Time required to complete three CCT sessions weekly was not reported as a barrier, despite sessions often exceeding the intended 45 minutes. Persistence contributed to successful intervention completion, with some exercises taking longer than anticipated: *“ ... when Towers of Hanoi [a specific exercise] came in and I took something like 92 attempts to get it and I still failed the level”*. (Male, 65, high computer-use).

Technology issues were not commonly experienced, even across participants with a wide range of computer-use and abilities. Any technological issues experienced were overcome and did not impact on the overall adherence to CCT: *“ ... Once you’re in it, you can do it”*. (Male, 69, low computer-use).

The support provided by the research team was positive for all, despite varying numbers of supervised sessions and phone calls. Although not always necessary, the ongoing assistance provided reminders to help participants stick to their schedule and maintain adherence. Assistance also made participants feel more comfortable, confident in themselves, and made the experience more personable: *“I always knew you [research staff] were there in the background, and ... that’s good to know”* (Female, 83, medium computer-use). *“Even though I did put the dates on my desktop calendar it was still good to have that contact [from research staff]”* (Male, 65, high computer-use).

Discussion

Qualitative data identified that the use of challenging exercises and support from study investigators were associated with positive CCT experiences. The goal of CCT, to challenge participants cognitively, was reflected in the first theme “I appreciate a challenge” (Lampit et al., 2014). This theme explored methods to improve experiences, including the use of challenging exercises that can be completed more quickly with improved skill, giving participants a sense of accomplishment relative to both exercise accuracy and efficiency (Gigler et al., 2013). The exercise task should also feel attainable to promote positive experiences and engagement. The second theme, “Persevering through frustration led to accomplishment” highlights how CCT experiences fluctuate, with participants commonly experiencing periods of frustration when comparing their perceived and actual abilities. The third theme, “When I start, I finish” emphasises that individual reasons for beginning and continuing CCT may influence how well participants adhere. The fourth theme, “It’s manageable but with support” encourages the

practice of providing regular supervised sessions, which might assist in reducing frustration by promoting strategy-use and engagement with particularly challenging exercises (Gigler et al., 2013). Translating these findings in future CCT interventions could improve user-engagement, experiences, and adherence; in-turn maximising the potential cognitive benefits from CCT.

The second theme, “Persevering through frustration led to accomplishment”, provides insight into how frustration is common, and experiences can fluctuate throughout the intervention (Smith et al., 2009). Experiences were often dependent on participants’ perceived ability matching actual ability, with frustration developing if their expectations were not met. Online support from research staff was utilised in Walton et al. (2019), with the aim of reducing participant frustration. The extensive support strategies utilised in the current study may have increased perceived useability ratings and could explain why no significant association with adherence was found with perceived useability (as part of user-engagement). Although effective methods to reduce frustration in CCT have not yet been established, supervised sessions were positively received and may minimise frustration in participants who have plateaued in level progression. Strategy guides were not often utilised, despite participants experiencing difficulties with completing certain exercises. This means that different methods to maintain strategy-use should also be explored in future studies. Additional supervised sessions may support participants’ ongoing engagement, adherence, and may reinforce strategy-use to promote further level progression (Gigler et al., 2013; Lin et al., 2021).

The third theme, “When I start, I finish”, shows that participants completing CCT to improve their cognitive abilities often reported greater enjoyment than those who wanted to continue to keep their promises. All participants indicated high reward (as part of user-engagement), which may be characteristic in those who adhere (Harrell et al., 2019). As participants’ enjoyment may be influenced by their motivations for completing CCT, participants’ reasons for commencing and continuing future interventions should be determined early to identify those who could be less likely to enjoy CCT (and target support accordingly). This theme emphasises the importance of promoting enjoyment, which may be increased by using challenging exercises where the completion time shortens with improved skill.

The fourth theme, “It’s manageable but with support”, reflects that participants who persevere perceive possible barriers as insubstantial. A time barrier to

completing training was not reported, potentially as participants’ movements were restricted post-surgery. Notably, two participants who screened positive for dementia at baseline ($ACE-III \leq 82$) were able to complete 100% of the training sessions. Positive support strategies to utilise include regular supervised sessions (e.g., once a week), phone numbers to call for assistance, and screen sharing software to resolve computer problems (Jaeggi et al., 2011). Increasing support strategies to improve CCT engagement and computer literacy are supported by Lin et al. (2021) and Gigler et al. (2013), respectively. Regular support methods may potentially be resource intensive; however, they can create lasting positive experiences for participants, and possibly enhance engagement and adherence.

Participants with low computer experience reported positive CCT experiences and overcame any issues (with appropriate external support as needed). This indicates that computer experience should not be deemed a requirement for CCT, and is supported by quantitative data, with computer literacy not statistically significantly relating to adherence (at least in this sample of participants who maintained minimum adherence requirements). Notably, computer proficiency and computer anxiety were not assessed prospectively, which may have influenced results. Assistance described in the theme “It’s manageable but with support” likely contributed to the positive experiences and minimal issues discussed. Although some level of computer literacy would be helpful to overcome any initial issues, qualitative data suggest that participants with low computer-proficiency perceived more benefit to completing CCT.

The major study limitations are sample size, and only interviewing those who achieved a 66% or greater adherence to CCT, although only one participant was excluded due to the adherence cut-off. Interview data quality may have been influenced by the length of time post-intervention when the interviews were conducted (0–22 weeks), as some participants could not recall certain exercises. Theoretical saturation was not reached; however, higher information power for the small sample is supported as the study involved a relatively narrow aim and specific sample (Malterud et al., 2016).

Conclusion

Methodological recommendations to improve experiences, engagement, and adherence for future CCT interventions include incorporating attainable yet challenging exercises and reducing frustration with strategy-use and assistance via supervised sessions

(plus phone calls when needed). Computer literacy did not negatively impact participants' experiences and was not associated with adherence, suggesting that participants with low computer-literacy should be included in future CCT interventions. Translating these methodological recommendations will hopefully increase CCT exposure for those at-risk of cognitive decline, and maximise the potential benefits gained from CCT.¹

Note

1. The present institutional affiliation for Katie Trenorden is Bellberry Limited. Bellberry Limited is not associated with any of the work carried out for this study.

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Disclosure statement

Accounts for the computerised cognitive training website Happy Neuron Inc (2019) were provided free of charge for use as part of the larger clinical trial.

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Data availability statement

The de-identified interview transcripts that support the findings of this study are available from the corresponding author (KT) or A/Prof Hannah Keage (Hannah.Keage@unisa.edu.au) upon reasonable request. Ethical and governance approval for the sub-study (and larger study) was obtained from the Central Adelaide Local Health Network (R20171020) and the University of South Australia (0000034053) Human Research Ethics Committees (Greaves et al., 2020).

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