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Promoting Decision-Making Competence in Older Adults Through Online Metacognitive Training: A Feasibility Study

Luca Bianchi
Università Cattolica del Sacro Cuore
Chiara Barbara Dadà
Università Cattolica del Sacro Cuore
Paola Iannello
Università Cattolica del Sacro Cuore
Laura Colautti
laura.colautti1@unicatt.it

Università Cattolica del Sacro Cuore

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Abstract

Decision-making is essential for maintaining autonomy and quality of life in later adulthood, yet interventions specifically targeting decision-making skills in older adults remain limited. *Scegliere bene* is a self-paced digital training programme based on a strategic-metacognitive approach, designed to promote decision-making competence and metacognitive awareness related to the decisional process in older adults. This study primarily aimed to assess the feasibility, acceptability, and usability of the intervention, and secondarily to explore preliminary changes in decision-making and metacognitive skills following training. Twenty-five older adults (14 women; mean age = 67.2 ± 7.01 years; mean years of education = 13.4 ± 3.37) completed a six-week online training programme. Decision-making competence and metacognitive awareness were assessed online before and after the intervention to explore possible pre-post changes. All participants completed the training and assessments, resulting in a 100% retention rate. Participants reported a moderately positive experience, with mean ratings of 2.96/5 for pleasantness and 2.88/5 for usefulness. Qualitative feedback indicated increased awareness of decisional processes and perceived transfer of acquired strategies to everyday situations. Secondary exploratory analyses showed significant improvements in some decision-making parameters, as well as in metacognitive awareness. Overall, *Scegliere bene* appears feasible and acceptable, with promising preliminary indications of improvements in everyday decision-making competence and metacognitive awareness concerning the decisional process. These findings support further refinement of the programme and larger controlled studies to evaluate its efficacy.

Introduction

Preserving decision-making abilities is increasingly recognized as one of the major challenges of healthy ageing. Older adults are frequently required to make complex decisions concerning healthcare, financial management, independent living, and family matters. These decisions often involve uncertainty, multiple alternatives, and potentially long-term consequences, making decision-making competence a key determinant of autonomy, wellbeing, and quality of life in later adulthood. Decision-making is a complex cognitive process involving the acquisition and evaluation of information, the comparison of available alternatives, and the selection of the option most likely to achieve one's goals (Colautti et al., 2022; Kahneman & Tversky, 1979). Because individuals make dozens of decisions every day, ranging from routine choices to highly consequential ones, maintaining effective decision-making abilities is essential for successful everyday functioning. Successful decision-making relies on the coordinated functioning of several cognitive processes, including attention, memory, executive functions, reasoning, and problem-solving abilities. Consequently, age-related changes affecting these cognitive systems may directly influence the quality of everyday decisions (Strough & Bruine de Bruin, 2020).

From a life-span perspective, decision-making abilities undergo significant changes, reflecting a dynamic balance between cognitive vulnerabilities and adaptive resources that tend to be preserved over time. In old age, the decline in specific cognitive functions, such as processing speed, working memory, inhibition, flexibility, and other executive functions can impair individuals' ability to select decisional

strategies that support the effective use of available information. As a result, older adults may experience greater difficulty managing complex decisions and making advantageous choices (Colautti et al., 2025; Park & Reuter-Lorenz, 2009). However, decision-making during ageing cannot be interpreted solely in terms of deficits, as older adults can draw on a wealth of experiential knowledge, and effective emotional regulation skills, which facilitate adaptation to the decisional demands of daily life. Consequently, decision-making in later life reflects a process of adaptation and reorganization rather than a simple cognitive decline (Strough & Bruine de Bruin, 2020).

Many decisions in later life concern particularly consequential domains, including healthcare, financial, management, and family issues. Thus, maintaining and enhancing decision-making skills is crucial for preserving autonomy and quality of life (Iannello & Colautti, 2022). From this perspective, it is essential to consider the cognitive and metacognitive mechanisms that underpin decision-making, in order to develop targeted and effective interventions for older adults (Schraw et al, 2006).

Accordingly, recent literature suggests that effective choices depend on the flexible coordination of intuitive and analytical processes, rather than from the exclusive dominance of either system. While intuitive processes allow rapid responses based on experience and heuristics, analytical processes support more deliberate and effortful reasoning. The ability to appropriately regulate and balance these modes of thinking is particularly important when individuals face novel, uncertain, or high-stakes situations (Evans & Stanovich, 2013). The quality of decision-making therefore depends not only on cognitive abilities per se, but also on individuals' capacity to monitor whether the selected strategy is appropriate for the specific decisional context. Within this framework, metacognition, defined as “knowledge and cognition about cognitive phenomena” (Flavell, 1979), represents one of the key mechanisms supporting adaptive decision-making. Beyond simply possessing cognitive resources, individuals need to monitor their reasoning, evaluate the adequacy of their judgments, detect potential errors, regulate the balance between intuitive and analytical processing, and flexibly modify their strategies when necessary. Greater awareness regarding the cognitive processes as they occur has been associated with a better ability to recognize potential biases, evaluate the quality of available information, and adjust decision strategies according to task demands (Ackerman e Thompson, 2017).

Building on this theoretical framework, training programmes based on metacognitive strategies have been developed as a promising approach to enhance decision-making abilities in older adults. A landmark contribution in this field was provided by Rosi et al. (2019), who developed one of the first strategic-metacognitive interventions specifically aimed at fostering a more aware and effective use of decision-making strategies among older adults. The intervention consisted of four in-person group sessions, each lasting around 90 minutes, aimed to enhance decision-making and metacognitive skills involved in the decision-making process in everyday situations. The study’s results provided significant empirical evidence, showing that a structured metacognitive intervention can bring substantial improvements in older adults’ decision-making skills, both in tasks directly practiced during the training and in new, unpracticed tasks, highlighting a generalization effect of the skills acquired. Furthermore, the training led to an enhancement of metacognitive awareness regarding the decision-making process,

confirming the central role of metacognitive strategies in promoting more adaptive decision-making in later life.

More recently, researchers have started investigating whether the benefits of metacognitive interventions can be maintained when transferred from traditional settings to digital environments. Preliminary evidence suggests that this is feasible. In particular, Pikouli et al. (2023) demonstrated that an online metacognitive training programme, focused on the use of analytical thinking in everyday decision-making situations, led to significant improvements in decision-making abilities in patients with mild amnestic cognitive impairment, with effects that are sustained over time. Overall, these findings support the possible value of metacognitive training programmes, including digital ones, as effective tools for supporting and enhancing decision-making in older adults.

Notwithstanding this evidence, interventions specifically designed to enhance decision-making in older adults remain limited and are often delivered through traditional face-to-face methods, resulting in barriers to access. These barriers may include mobility-related difficulties, logistical constraints, and limitations in sustained participation over time. There is therefore a need to develop targeted online interventions, designed considering the cognitive and motivational characteristics of the older population in mind. In particular, structured digital programmes that are accessible in a self-paced way may offer important advantages, allowing users to (i) access materials flexibly and repeatedly, (ii) adapt the intervention to their individual needs, and (iii) overcome constraints related to physical presence. Self-paced digital interventions appear particularly promising for older adults, combining flexibility, accessibility and evidence-based principles, in line with what has already been demonstrated for the enhancement of other cognitive abilities (Corbett et al., 2015). This flexibility may be particularly valuable in ageing populations, where considerable inter-individual variability exists in cognitive functioning, familiarity with technology, daily schedules, and learning speed. Further evidence supporting the effectiveness of cognitive interventions delivered remotely comes, for example, from the ACTIVE programme (Advanced Cognitive Training for Independent and Vital Elderly; Jobe et al., 2001), which demonstrated significant improvements in cognitive functions supporting decision-making in older adults, such as processing speed, working memory and problem solving abilities, highlighting how accessible and flexible delivery methods can promote adherence to and continuity of the intervention, even in the presence of physical or logistical limitations.

Taken together, the available evidence suggests that metacognitive interventions represent one of the most promising approaches for enhancing decision-making in later life. Nevertheless, important challenges remain concerning their accessibility, scalability, and implementation. Developing self-paced digital interventions may represent an important step toward overcoming these limitations by combining evidence-based metacognitive principles with flexible and accessible delivery methods. Before testing their efficacy on a larger scale, however, it is essential to establish whether these interventions are feasible, acceptable, and usable for older adults.

Aim

The primary aim of the study is to assess the feasibility of *Scegliere bene* (“Making good choices”), a self-paced digital training programme grounded in strategic-metacognitive principles and specifically designed to enhance decision-making abilities in older adults. Consistent with recommendations for feasibility studies of complex behavioural interventions (Eldridge et al., 2016; Orsmond & Cohn, 2015), the primary aim was to evaluate the feasibility of the programme by examining participants’ adherence, acceptability, and usability of *Scegliere bene*. Establishing these aspects represents an essential prerequisite before conducting larger studies aimed at testing the intervention efficacy.

As a secondary objective, the study explored preliminary changes in decision-making competence and metacognitive awareness following completion of the programme. These exploratory analyses were not intended to provide evidence of efficacy, but rather to offer preliminary indications of the potential cognitive outcomes associated with the intervention and to inform the design of future controlled studies.

Methods

The training

S*cegliere bene* was developed as an online adaptation of the original, in-presence version of the strategic-metacognitive training proposed by Rosi et al., previously presented and described elsewhere (see Rosi et al., 2019 for more details regarding the original training version). For this study, the training has been adapted to a digital format, with structural changes introduced to improve its accessibility and usability for older adults. In particular, the training has been transformed from a face-to-face, group-based intervention into a self-paced, individual online programme, allowing participants to access the content independently and flexibly, at their own place. Furthermore, the training materials were restructured into six weekly sessions, to facilitate a more gradual acquisition of the content and reduce the cognitive load. The strategic-metacognitive approach was maintained throughout the adaptation process. Accordingly, the training emphasized the development of metacognitive awareness and the use of reflective decision-making strategies. An additional strength of this approach lies in its transferability, as the acquired skills can be applied across different decision-making contexts, including everyday and more complex situations. Participants were encouraged to monitor their reasoning, recognize potential cognitive biases, systematically evaluate available information, and deliberately consider alternative solutions.

The six units were organized according to a logical and conceptual progression aimed at the gradual development of decision-making and metacognitive skills (see Table 1 for more details concerning the training structure and the contents of each session).

Each unit included multimedia materials, practical exercises based on realistic scenarios and hints for personal reflection, with the aim of promoting active learning and the transferability of skills to different

decision-making contexts. Examples of the exercises and activities included in the training are provided in the Online Resource (Supplementary Figs. SI 1–SI 7).

Table 1
Summary of the training structure and the main content of the modules

Unit	Title	Main objectives	Contents/Activities
Unit 1	*The decision-making process*	Introduction to decision-making.	Introduction to the dual-process theory (System 1 and System 2); examples of intuitive decision-making errors; identification of decision alternatives; reflection on intuitive versus analytical decision-making; discussion forum.
Unit 2	*The meta-decision*	Develop metacognitive awareness.	The cognitive, emotional and social dimensions of decision making; introduction to metacognition and meta-decision; guided analysis of decision problems; practical exercises based on everyday situations.
Unit 3	*Analysis of the decision-making process*	Structured analysis of decisions.	Identification of relevant information, decision alternatives and possible consequences; guided analysis of realistic scenarios; practical exercises and review activities via a concluding video.
Unit 4	*Implement the decision*	Apply the decision-making model.	Application of the structured decision-making process to complex situations; evaluation of available options and consequences; practical exercises and guided review.
Unit 5	*To simplify the decision-making process*	Learn decision strategies.	Presentation of decision-making strategies (e.g., intuitive, elimination-by-aspects, lexicographic, satisficing, and value-based strategies); practical exercises applying different strategies to everyday scenarios; guided revision.
Unit 6	*"Scegliere bene" everyday*	Consolidate and apply decision-making skills.	Integrated application of decision-making processes, decision-making strategies and metacognitive skills to real-life scenarios (e.g., decisions relating to healthcare, economics and everyday life); final exercises; comprehensive review; concluding reflection and the awarding of a certificate of attendance.

The organization of the training content on the online platform was designed taking into account both the cognitive characteristics (and changes) associated with ageing and the principles of multimedia learning proposed by Mayer (2005). Together, these theoretical foundations have guided the development of a structured, accessible and cognitively sustainable digital training programme, designed to optimize information processing, reduce cognitive overload and promote the effective use of participants' cognitive resources.

In line with the principles of multimedia learning, the training content has been developed by applying the 12 principles proposed by Mayer, organized into three categories relating to the management of cognitive load (Mayer & Moreno, 2003). To reduce extraneous cognitive load, the principles of coherence,

signaling, redundancy, and spatial and temporal contiguity were adopted, limiting the presence of superfluous elements, guiding the user's attention and effectively coordinating verbal and visual information. To minimize intrinsic cognitive load, the principles of segmentation, pre-training and modality were applied, structuring the content into short weekly units, accompanied by preliminary explanations of key concepts and a combination of images and audio narration, thereby distributing processing across the visual and auditory channels. Finally, to promote relevant cognitive load, the principles of multimedia, personalization, voice and imagery were applied, facilitating the construction of mental models through the integration of words and images and the adoption of a clear, direct and learning-oriented communication style.

The digital platform

The digital platform used to deliver the training was organized into three main functional sections. The Home section served as the central learning environment and gradually provided access to the six training units. The training followed a sequential structure, with each unit becoming available only after completion of the previous one, in order to support a gradual acquisition of the contents and facilitate the consolidation of the targeted decision-making and metacognitive skills. The Contacts section included the research team's contact details and was designed to offer support to participants in the event of technical difficulties or the need for clarification. Finally, the Forum section was conceived as a space for interaction and discussion amongst participants, divided into subsections corresponding to the individual units, encouraging the sharing of reflections, questions, and discussions on the content covered. An overview of the three main sections of the platform is provided in the Online Resource (Supplementary Fig. SI 1).

Participants

Twenty-five older adults (14 women and 11 men; age range: 60–84 years; mean age: 67.2 ± 7.01 years; mean years of education: 13.4 ± 3.37; range: 8–21 years) took part in the study (see Table 2 for more details). They were recruited from two regions in Northern Italy (Piedmont and Lombardy), through Universities of the Third Age and via direct and indirect contacts.

Table 2
Main characteristics of the participants (n = 25)

Gender	**N**	**%**
Female	14	56%
Male	11	44%
Employment status		
Retired	13	52%
Employed	12	48%
Health condition		
No relevant medical conditions	25	100%
	M	**SD**
Age	67.2	7.01
Education	13.4	3.37
Cognitive Function Instrument	2.58	1.70

All participants included in the study had to meet the following inclusion criteria: age 60–85 years, presenting good general health conditions, being able to use a computer, and having access to a stable Internet connection (necessary requirements for taking part in the online training). Individuals with diagnoses of (or undergoing diagnostic assessment for) neurodegenerative diseases, cognitive impairments, significant neurological, and/or psychiatric conditions were excluded. To avoid the inclusion of participants with early changes in cognitive functioning and cognitive impairments, the self-report version of the screening tool Cognitive Function Instrument (CFI; Chipi et al., 2017) was administered online during the pre-intervention assessment phase.

As the primary aim was to assess the feasibility of the intervention rather than its efficacy, no formal sample size calculation was conducted, consistently with the definition of a feasibility study (e.g., Eldridge et al., 2016; Orsmond & Cohn, 2015).

Procedures

Data were collected from June 2025 to July 2025. All participants read and provided informed consent. Recruitment took place approximately one month before the start of the intervention, by sending an information email outlining the aims of the study, the structure of *Scegliere bene* and the main information required to participate in the study and to understand what it involved.

The study was approved by the Ethics Committee of BLINDED FOR REVIEW and was conducted in accordance with Good Clinical Practice guidelines, the ethical principles established by the Declaration of Helsinki, and current legislation on the protection of personal data.

Participants were randomly assigned to one of two groups (Group A and Group B), although the study did not include a control group. This division was not intended to compare different experimental conditions, as both groups received the same training, but was adopted to allow for the counterbalancing of the parallel versions of the questionnaires administered during the pre- and post-intervention assessment phases (T0 and T1, respectively). Group A comprised 13 participants (mean age 65.6 ± 5.59 years; mean years of education:13.1 ± 3.01). Group B comprised 12 participants (mean age: 68.9 ± 8.18 years; mean years of education:13.8 ± 3.81).

The experimental protocol was carried out over a period of eight weeks. The first week was devoted to the T0 assessment, during which participants completed a single-session battery of assessments online via the Qualtrics platform, using a link sent by email. This battery included the Cognitive Function Instrument (CFI; Chipi et al., 2017), used as a cognitive screening tool, and three measures assessing decision-making competence and metacognitive awareness in decision-making: Applying Decision Rules (ADR; Del Missier et al., 2010), Everyday Decision-Making Competence (EDMC; Rosi et al., 2019) and Metacognitive Decision-Making Scenarios (MDMS; Colautti & Iannello, 2022).

Subsequently, participants took part in six consecutive weeks of self-paced digital training, completing one training module per week. Each module took between 30 and 60 minutes to complete and was made available every Monday morning via a dedicated digital platform. Participants automatically received a link to the new weekly module via email and had one week to complete it. Access to the training and assessment questionnaires was granted via a personal identification code assigned to each participant, which was used both to access the training content and to ensure the anonymity and traceability of the data collected in the T0 and T1 assessments. Participants were also advised to use a computer to access the content, in order to ensure better readability of the multimedia materials and to promote a higher level of concentration compared to using mobile devices.

During the T1 assessment, carried out one week after the training was completed, participants completed online, via the Qualtrics platform, the parallel versions of the Applying Decision Rules (ADR; Del Missier et al., 2010), Everyday Decision-Making Competence (EDMC; Rosi et al., 2019) and Metacognitive Decision-Making Scenarios (MDMS; Colautti & Iannello, 2022). The post-intervention questionnaire also included three open-ended questions designed to gather a qualitative assessment of the training experience and the perceived usefulness of the training. At the end of the study, each participant was sent a certificate of participation in recognition of their commitment and to acknowledge the value of the experience.

Throughout the training programme, participants were supported on a weekly basis by the research team via email and telephone, using the contact details provided when they enrolled in the study.

Overall, the study followed a three-phase protocol consisting of a T0 assessment (week 1), six weeks of self-paced digital training (weeks 2–7), and a T1 assessment (week 8).

Instruments

Sociodemographic and cognitive features

Ad hoc sociodemographic questionnaire: A sociodemographic questionnaire specifically developed for this study was administered to collect information on participants' sociodemographic and personal characteristics. The questionnaire collected data on gender, age, date of birth, highest educational qualification attained, total years of formal education, current place of residence, retirement status, current occupation or occupation prior to retirement, and the presence of any diagnosed neurological conditions or cognitive impairments. The questionnaire was administered exclusively at T0.

Cognitive Function Instrument (CFI; Chipi et al., 2017): It is a questionnaire developed for detecting early changes in cognitive and functional abilities in individuals without overt clinical impairment. It consists of 14 items assessing the subjective perception of cognitive difficulties experienced over the past year, with particular reference to activities of daily living that require attention, memory, orientation, and executive functions. Responses are given on a three-point scale (Yes = 1; Perhaps = 0.5; No = 0) and the total score, obtained by summing the items, ranges from 0 to 14, with higher values indicating a greater perception of cognitive difficulties. It was proposed only in T0.

Decision-making abilities

Applying Decision Rules (ADR; Bruine de Bruin et al., 2007; Del Missier et al., 2010): It is one of the tasks included in the Adult Decision-Making Competence battery and represents one of the most used validated measures to assess the ability to correctly apply decision-making rules in structured problems. It comprises 10 decision-making problems, in which participants are asked to make a choice based on the stated needs of a hypothetical consumer. To balance the parallel versions, in T0, Group A completed problems relating to the purchase of a computer, whilst in T1 the questions concerned the choice of a television; Group B followed the reverse order. Each problem presents multiple choice alternatives, and the answer is considered correct only when it complies with the decision rule or the interest expressed by the hypothetical consumer. The total score ranges from 0 to 10, with higher scores indicating a greater ability to correctly apply the decision rules.

Everyday Decision-Making Competence (EDMC; Rosi et al., 2019): It assesses decision-making competence in everyday situations. The task is based on inductive reasoning problems developed in the studies by Kokis et al. (2002) and Fong et al. (1986). The instrument comprises 12 decision-making problems, each presenting four response options; participants are asked to select the option they consider most advantageous. The items cover three everyday decision-making domains, allowing the calculation of the Daily, Health Care, and Economic subscales. In addition, the problems are grouped into

two cognitive subscales: Task Analytical-Based Problem, which assesses decision making based on analytical reasoning and deliberate information processing, and Task Experiential-Based Problem, which evaluates decisions based on the integration of experiential and statistical information. Responses are scored according to the quality of the decision, with higher scores reflecting more advantageous choices. A Total Score is calculated by summing the scores across all 12 items, with higher values indicating better everyday decision-making competence.

Metacognitive Decision-Making Scenarios (MDMS; Iannello & Colautti, 2022): It is a self-report questionnaire developed to address the lack of tools specifically designed to assess metacognitive awareness associated with decision-making processes in older adults. The instrument was designed to investigate how individuals reflect on their own decision-making in typical everyday situations. The MDMS comprises scenarios, representing everyday situations with increasing levels of cognitive and emotional complexity. They are equally organized into three thematic areas: medical and healthcare, financial, and interpersonal and family. For each scenario, participants are asked to make a decision and subsequently answer six standardized questions concerning different aspects of the decision-making process. The questionnaire provides scores for the Confidence, Time, Support, Medical Reflectiveness, Economic Reflectiveness, and Relational Reflectiveness subscales, as well as an overall Total Reflectiveness score obtained by combining the reflectiveness scores across the three thematic areas. Higher scores indicate greater metacognitive awareness of one's own decision-making process.

Participants’ experience

Ad hoc overall experience: A final questionnaire was designed to investigate crucial areas of feasibility and participants' experience. Specifically, it assessed several domains, including the perceived pleasantness and usefulness of the training, participants’ perception of changes in their decision-making following the intervention, difficulties experienced during the training programme, and additional comments, observations, and suggestions collected through open-ended questions. The questionnaire was administered exclusively at T1.

Data analysis

The statistical analyses were performed by using Jamovi (version 2.7.24, The jamovi project, 2024).

Descriptive statistics were used to describe participants’ sociodemographic characteristics and feasibility outcomes. Adherence was shown in terms of programme completion and participation in the training activities; Acceptability and usability were summarized using frequencies, percentages, mean, and standard deviations.

Secondary analyses, aimed at exploring potential changes following the training, encompassed descriptive statistics and the inspection of skewness and kurtosis values and the Shapiro-Wilk test. As the assumption of normality was not met, the Wilcoxon signed-rank test was used to explore possible

differences in decision making and awareness. Statistical significance was set at $p < .05$. Effect sizes were estimated using the rank-biserial correlation.

Results

Feasibility data

A total of 25 older adults were enrolled in the study, and all participants completed both the training and the T0 and T1 assessments. No participants withdrew from the study, resulting in a 100% retention rate and no drop-outs. These findings provide support for the feasibility of the intervention in this population, particularly in terms of participants' adherence and ability to complete the full training.

Participants' evaluations also provide information on the acceptability of the programme. Overall, participants reported a moderately positive perception of the experience with the intervention. The mean rating for training pleasantness was 2.96/5, indicating that the programme was generally perceived as acceptable and reasonably pleasant. Similarly, the mean rating for perceived usefulness was 2.88/5, suggesting that participants considered the programme to be moderately useful. In both cases, the majority of participants selected the midpoint of the response scale ("Quite pleasant" and "Quite useful"), supporting the overall acceptability of the intervention while also indicating room for improvement.

Qualitative responses provided further insight into participants' perceived experiences and perceived impact of the training. Specifically, in response to the question "Compared with before starting the training, did you notice any changes in the way you make decisions?", several participants reported greater awareness of their own decision-making processes, particularly a greater tendency to take more time to reflect before making decisions. Representative comments included: *"I take more time before making decisions", "Yes, I think more carefully about my choices,"* and *"Yes, I reflect more on the decisions I have to make."* Other participants highlighted increased attention to the factors involved in decision-making, reporting comments such as *"A more careful consideration of all the factors involved in the decision-making process"* and *"It helped me identify different types of decisions"*.

Participants also provided several suggestions for improving the programme. These comments offered useful information on the usability and implementation of the intervention. The most frequent observations concerned aspects that may have affected engagement and ease of use, particularly the length and, occasionally, the repetitiveness of some training units, as reflected in comments such as *"Only the length of some units"* and *"It should be less repetitive".* Some participants also suggested technical improvements to the platform, such as the possibility of saving their progress and resuming the training later from where they had left off. Others expressed a preference for complementing the online format with occasional face-to-face sessions to encourage interaction with other older adults.

Preliminary changes in cognitive performance measures

Wilcoxon signed-rank tests were performed to compare pre-post scores in ADR, EDMC, and MDMS.

Results showed no significant pre–post differences in ADR performance (W = 78.0, p = .158, effect size = − .257), despite a slight increase in scores following the intervention.

Regarding the EDMC, results revealed a significant improvement in the daily domain following the intervention (W = 51.0, p = .038, effect size = .463). A significant increase was also observed for the total EDMC score (W = 64.0, p = .038, effect size = .446). No significant changes were found in remaining domains.

Regarding the MDMS, results revealed significant improvements in the Reflectiveness subscale, specifically in scores concerning the medical (W = 35.0, p = .041, effect size = .485) and economic domain (W = 24.0, p = .018, effect size = .600), as well as in the total Reflectiveness (W = 49.5, p = .034, effect size = .479). No significant changes were observed in the relational domain or in the other subscales.

See Table 3 for more details.

Table 3
Pre- and post-intervention performance on decision-making and metacognitive measures

Test	Pre-training M (SD)	Post-training M (SD)	W	*p*	*Effect size*
ADR	7.96 (3.10)	8.48 (2.84)	78.0	.158	.257
EDMC					
Task experiential-based problem	15.80 (3.19)	16.90 (2.32)	109.5	.196	.207
Task analytical-based problem	17.50 (3.11)	18.60 (1.98)	86.5	.059	.373
Daily	10.90 (2.40)	11.90 (1.27)	51.0	**.038**	.463
Economic	10.70 (2.10)	11.30 (1.86)	98.5	.115	.286
Health care	11.80 (1.76)	12.20 (1.59)	75.5	.218	.205
Total score	33.30 (4.82)	35.40 (3.18)	64.0	**.038**	.446
MDMS					
Confidence	9.96 (2.17)	10.12 (1.81)	68.5	.136	.279
Time	4.56 (1.76)	5.12 (2.09)	49.0	.056	.427
Support	0.84 (0.90)	1.12 (1.17)	35.5	.144	.324
Medical Reflectiveness	2.24 (1.33)	2.68 (0.95)	35.0	**.041**	.485
Relational Reflectiveness	2.28 (1.21)	2.32 (0.99)	66.0	.468	.029
Economic Reflectiveness	2.12 (1.05)	2.60 (1.00)	24.0	**.018**	.600
Total Reflectiveness	6.64 (3.04)	7.60 (2.47)	49.5	**.034**	.479

Note. Statistically significant p-values are shown in bold.

M = mean; SD = standard deviation; W = Wilcoxon signed-rank statistic; ADR = Applying Decision Rule task; EDMC = Everyday Decision Making Competence task; MDMS = Metacognitive Decision-Making Scenarios.

Discussion

The present study was developed to address some gaps identified in the literature regarding the promotion of decision-making abilities, which are fundamental for maintaining autonomy and quality of life in older adulthood. Despite their recognized importance, interventions specifically designed to promote and enhance decision-making skills in older adults remain limited. In this context, metacognition plays a particularly important role, as it fosters greater awareness and monitoring of

one's own cognitive processes and represents a key mechanism for facilitating the generalization of the effects of intervention effects to everyday life (Schraw et al, 2006). Considering the characteristics of ageing and the need to develop accessible and sustainable interventions for this population, digital programmes specifically tailored to older adults may represent a promising approach to support successful ageing and preserve autonomy over time. On this basis, *Scegliere bene* was developed as a self-paced digital training programme based on a strategic-metacognitive approach and derived from interventions previously shown to be effective in the literature, with the aim of making these strategies accessible to older adults through an autonomous and remotely delivered digital format.

Feasibility of the intervention

The primary aim of the present study was to evaluate the feasibility, acceptability, and usability of the *Scegliere bene* training programme. Overall, the feasibility of the intervention was supported by the absence of drop-outs, suggesting that the proposed digital format was sustainable and well accepted by participants. This is particularly relevant because digital intervention targeting older adults may be limited by technological barriers and reduced familiarity with online platforms. In the present study, however, participants were able to complete the six weekly modules, suggesting that a carefully structured and accessible online format can be implemented with older adults.

Qualitative feedback further supported the acceptability and perceived usefulness of the programme. Several participants reported that the strategies acquired during the training were perceived as useful beyond the learning context and could be applied to everyday decision-making. In particular, participants described increased awareness of their decision-making processes and a greater tendency to reflect on and carefully consider the factors involved in everyday choices. Some participants also reported applying the strategies learned during the training to situations encountered in their daily lives, suggesting a perceived transfer of the acquired strategies beyond the training context. These findings suggest that the intervention was perceived as a practical resource for promoting more reflective and informed decision-making in everyday contexts and provide preliminary evidence of the potential transferability of the trained strategies to daily life.

Decision-making and metacognitive skills: a preliminary insight

Although the primary aim of the present study was not to test efficacy, exploratory analyses were also conducted to examine preliminary changes in decision-making competence and metacognitive awareness following the intervention. Overall, the quantitative findings suggest selective improvements, particularly in measures assessing everyday decision-making competence and metacognitive reflectiveness.

Specifically, the improvements observed in the EDMC task suggest that the training may have enhanced participants' ability to deal more effectively with everyday decisions. This interpretation can be supported by the significant increase in both the Total Score and the Daily subscale, which assesses

decision-making in concrete and familiar everyday situations. Similarly, the results obtained with the MDMS showed a significant increase in Total Reflectiveness, accompanied by improvements in the Medical Reflectiveness and Economic Reflectiveness subscales. These findings suggest that the intervention may have promoted greater metacognitive reflectiveness and a more careful evaluation of information, possible alternatives, and the consequences of decisions, particularly in domains that are highly relevant to maintaining autonomy in older adulthood.

It is plausible that these findings reflect the specific characteristics of the training itself, which was primarily designed to promote metacognitive reflection and the application of decision-making strategies to everyday-life situations. Consequently, the intervention may have had a greater impact on everyday decision-making competence and awareness of one's own decision-making process than on highly structured and formal decision-making abilities.

Consistent with this interpretation, no statistically significant changes were observed in the ADR task or in the remaining MDMS dimensions. The ADR assesses the ability to apply formal decision-making rules through complex executive processes, including the systematic comparison of alternatives, inhibition of irrelevant information, and continuous updating of relevant information. These abilities may require longer or more intensive interventions to produce measurable changes. Furthermore, the high level of cognitive functioning of the sample, as indicated by the low scores on the CFI, together with the relatively high baseline scores on the decision-making measures, may have limited the possibility of detecting further improvements, resulting in a potential ceiling effect.

Overall, these exploratory findings should be interpreted with caution. They derive from a relatively small sample and from a pre-post design without a control group. Therefore, they should be considered preliminary insights rather than clear definitive evidence of efficacy. Nevertheless, they (i) provide encouraging indications regarding the potential of the training programme to promote decision-making competence and metacognitive skills relevant to older adults' everyday lives, and (ii) support future controlled studies aimed at testing the effectiveness of the intervention considering larger samples.

Strengths of the training

Beyond the overall feasibility of the intervention, the present study highlighted several strengths that may inform the future development of the training programme. A first strength concerns the adaptation of a strategic-metacognitive intervention to a fully digital self-paced format. When specifically designed to accommodate the cognitive characteristics of older adults, this format may represent a sustainable and acceptable approach. The modular structure of the training, the use of realistic scenarios, and the gradual progression of activities may have supported participants’ engagement and facilitated the application of the acquired strategies to everyday situations. A further strength of the training lies in its versatility and transferability. The skills acquired are not limited to the tasks specifically practiced during the training, but can be applied to a wide range of decision-making contexts. This may translate into concrete benefits in several areas of daily life, particularly in decisions relating to health, financial resources, and the organization of daily activities.

Limitations

Alongside these strengths, the study also identified limitations that deserve consideration. Several participants reported that some training modules and assessment questionnaires were excessively long, and that certain contents and exercises were repetitive. These factors may have increased cognitive load and reduced engagement throughout the intervention. Additional difficulties concerned the usability of the digital platform, particularly the inability to interrupt an activity and resume it later, as well as the perceived lack of intuitiveness in the organization of the training modules. Finally, although an online discussion forum was available, it was not used by the participants. Instead, several participants expressed a preference for face-to-face opportunities to interact with their peers, suggesting that the relational component (that can be translated in synchronous online sessions in further studies) may represent an important element even in digital interventions targeting older adults.

Beyond these training-related aspects, several methodological limitations should also be considered when interpreting the findings of the present study. First, the relatively small sample can represent a limitation in terms of generalizability. However, it is important to emphasize that the primary aim of the study was to evaluate the feasibility and acceptability of the *Scegliere bene* training programme rather than to provide a definitive evaluation of its effectiveness. In this context, the sample size can be considered adequate for obtaining preliminary information regarding the sustainability and potential usefulness of the intervention. Moreover, given the encouraging results emerging from the exploratory analyses of decision-making competence and metacognitive aspects, future studies should include larger and adequately powered samples, where pre-post changes will be considered as a primary outcome, including appropriate control conditions.

An additional limitation concerns the procedure used to identify cognitively healthy participants. Cognitive screening was conducted through self-report measures that, although including questions referring to specific clinical conditions and the presence of ongoing diagnostic assessments, cannot be considered equivalent to a comprehensive clinical or neuropsychological evaluation conducted in person. Therefore, future research should integrate objective measures of cognitive functioning and standardized neuropsychological assessments in order to obtain a more accurate characterization of participants' cognitive profiles.

Finally, the quasi-experimental design adopted in the present study, characterized by the absence of a control group and follow-up assessment, although it is adequate for the primary aim of our study, limits the possibility of fully interpreting the effects of the intervention on decision-making abilities. In particular, the lack of a control group does not allow the complete exclusion of alternative explanations for the observed changes, such as practice effects related to repeated testing, spontaneous changes over time, or other uncontrolled factors, reducing the possibility of attributing the improvements exclusively to participation in the training programme. Moreover, the absence of a follow-up assessment prevents determining whether the effects observed after the intervention are maintained over time. Now that the acceptability of the training has been verified in a sample of older adults, future studies should

adopt more rigorous experimental designs, including control groups and follow-up assessments, in order to evaluate the possible maintenance of the training effects over time and identify which components of decision-making competence and metacognitive awareness are most likely to be consolidated over time.

Future directions

Based on the findings of this preliminary feasibility study, future revisions of the training programme could benefit from the adoption of a blended format combining the flexibility of online learning with opportunities for online, synchronous interaction between participants and trainers. Although the research team remained continuously available via email and telephone to provide support and clarification throughout the intervention, participants' feedback highlighted a desire for greater opportunities for direct discussion and experience sharing. Regular online videoconference meetings could facilitate discussion of the training content, peer interaction, clarification of doubts, and guided application of decision-making strategies, thereby promoting deeper metacognitive processing and facilitating the transfer of acquired skills to everyday life. At the same time, maintaining the digital component would preserve the advantages of accessibility, flexibility, and autonomy that characterized the intervention.

Overall, these findings provide a useful basis for refining the training programme and support the implementation of larger controlled studies aimed at evaluating its effectiveness in promoting decision-making competence and metacognitive awareness among older adults.

Conclusions

This study assessed the feasibility of *Scegliere bene*, a self-paced digital training programme designed to enhance decision-making skills in older adults through a strategic-metacognitive approach. The intervention combines the evidence available in the literature with the need to develop programmes specifically designed to address the unmet needs of the older adult population.

The results indicate that *Scegliere bene* was feasible, well accepted by participants and associated with promising early improvements in decision-making skills in everyday life and in metacognitive reflection to support the decision-making process.

Although this is a preliminary feasibility study, the results provide an initial contribution to the development of online interventions aimed at enhancing decision-making skills in older people. These findings may serve as a useful starting point for researchers and professionals working in the fields of ageing and cognition, offering guidance for the design of programmes that are increasingly accessible, inclusive and responsive to the needs of this population. From this perspective, interventions such as *Scegliere bene* could represent a promising tool for supporting decision-making autonomy, promoting active ageing and fostering psychological well-being and quality of life in later life.

Declarations

Author Contribution

Conceptualization: L.C., C.B.D., and P.I.; Methodology: L.B., L.C., C.B.D., and P.I.; Formal analysis and investigation: L.B., L.C., and C.B.D.; Writing - original draft preparation: L.B. and L.C.; Writing - review and editing: C.B.D. and P.I.; Supervision: P.I.

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Data Availability

Data are available upon reasonable request by sending an email to the corresponding author, according to the Ethical Committee of Università Cattolica del Sacro Cuore.

References

1. Ackerman R, Thompson VA (2017) Meta-reasoning: Monitoring and control of thinking and reasoning. Trends Cogn Sci 21(8):607–617. https://doi.org/10.1016/j.tics.2017.05.004
2. Chipi E, Frattini G, Eusebi P, Mollica A, D'Andrea K, Russo M, Parnetti L (2018) The Italian version of Cognitive Function Instrument (CFI): Reliability and validity in a cohort of healthy elderly. Neurol Sci 39(1):111–118. https://doi.org/10.1007/s10072-017-3150-z
3. Colautti L, Antonietti A, Iannello P (2022) Executive functions in decision making under ambiguity and risk in healthy adults: A scoping review adopting the hot and cold executive functions perspective. Brain Sci 12(10):1335. https://doi.org/10.3390/brainsci12101335
4. Colautti L, Iannello P (2022) Metacognitive Decision-Making Scenarios (MDMS): Proposta di uno strumento per valutare la consapevolezza nei processi decisionali. Ricerche Psicol 45(3):1–43. https://doi.org/10.3280/rip2022oa15308
5. Colautti L, Zambelli M, Antonietti A, Tagliabue S, Iannello P (2025) The relationships between cognitive functioning and decision making under value-based conditions in older adults: Findings based on a psychometric network analysis. Curr Res Behav Sci 8:100194. https://doi.org/10.1016/j.crbeha.2025.100194
6. Corbett A, Owen A, Hampshire A, Grahn J, Stenton R, Dajani S, Ballard C (2015) The effect of an online cognitive training package in healthy older adults: An online randomized controlled trial. J Am

Med Dir Assoc 16(11):990–997. https://doi.org/10.1016/j.jamda.2015.06.014

7. Del Missier F, Mäntylä T, Bruine de Bruin W (2010) Executive functions in decision making: An individual differences approach. Think Reason 16(2):69–97. https://doi.org/10.1080/13546781003630117
8. Eldridge SM, Lancaster GA, Campbell MJ, Thabane L, Hopewell S, Coleman CL, Bond CM (2016) Defining feasibility and pilot studies in preparation for randomised controlled trials: Development of a conceptual framework. PLoS One 11(3):e0150205. https://doi.org/10.1371/journal.pone.0150205
9. Evans JSBT, Stanovich KE (2013) Dual-process theories of higher cognition: Advancing the debate. Perspect Psychol Sci 8(3):223–241. https://doi.org/10.1177/1745691612460685
10. Flavell JH (1979) Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. Am Psychol 34(10):906–911. https://doi.org/10.1037/0003-066X.34.10.906
11. Fong GT, Krantz DH, Nisbett RE (1986) The effects of statistical training on thinking about everyday problems. Cogn Psychol 18(3):253–292. https://doi.org/10.1016/0010-0285(86)90001-0
12. Jobe JB, Smith DM, Ball K, Tennstedt SL, Marsiske M, Willis SL, Kleinman K (2001) ACTIVE: A cognitive intervention trial to promote independence in older adults. Control Clin Trials 22(4):453–479. https://doi.org/10.1016/S0197-2456(01)00139-8
13. Kahneman D, Tversky A (1979) Prospect theory: An analysis of decision under risk. Econometrica 47(2):263–291. https://doi.org/10.2307/1914185
14. Mayer RE (ed) (2005) *The Cambridge handbook of multimedia learning*. Cambridge University Press, Cambridge.
15. Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational psychologist*, *38*(1), 43–52. https://doi.org/10.1207/S15326985EP3801_6
16. Orsmond GI, Cohn ES (2015) The distinctive features of a feasibility study: Objectives and guiding questions. OTJR (Thorofare N J) 35(3):169–177. https://doi.org/10.1177/1539449215578649
17. Park DC, Reuter-Lorenz P (2009) The adaptive brain: Aging and neurocognitive scaffolding. Annu Rev Psychol 60:173–196. https://doi.org/10.1146/annurev.psych.59.103006.093656
18. Pikouli FA, Moraitou D, Papantoniou G, Sofologi M, Papaliagkas V, Kougioumtzis G, et al (2023) Metacognitive strategy training improves decision-making abilities in amnestic mild cognitive impairment. J Intell 11(9):182. https://doi.org/10.3390/jintelligence11090182
19. Rosi A, Vecchi T, Cavallini E (2019) Metacognitive-strategy training promotes decision-making ability in older adults. Open Psychol 1(1):200–214. https://doi.org/10.1515/psych-2018-0014
20. Schraw G, Crippen KJ, Hartley K (2006) Promoting self-regulation in science education: Metacognition as part of a broader perspective on learning. Res Sci Educ 36(1):111–139. https://doi.org/10.1007/s11165-005-3917-8
21. Strough J, Bruine de Bruin W (2020) Decision making across adulthood. Annu Rev Dev Psychol 2(1):345–363. https://doi.org/10.1146/annurev-devpsych-051120-010038
22. The jamovi project. (2022). *jamovi* (Version 2.7.24) [Computer software]. https://www.jamovi.org

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