Digitally-Mediated Learning Environments and Information Literacy for Active Ageing: A Pilot Study

Liliana Vale Costa[1]([✉]), Ana Isabel Veloso[1], and Fernanda Martins[2]

[1] DigiMedia Research Centre, Department of Communication and Art,
University of Aveiro, Campus Universitário de Santigo,
3810-193 Aveiro, Portugal
{lilianavale,aiv}@ua.pt
[2] University of Porto, Via Panorâmica s/n, 4150-564 Porto, Portugal
mmartins@letras.up.pt

Abstract. Over the past few years, the use of Information and Communication Technologies (ICT) in older adults has been an increasing topic of interest within the fields of gerontology and new media. Given the global ageing population, the educational sector has also been challenged in order to meet the learning needs in older adults, age-related changes in cognition and learning, and different learning styles in formal, non-formal or informal contexts. Using the Delphi method with experts to validate the instruments used for data collection, 33 participant surveying and field notes, this study aims to identify the main requirements for designing digitally-mediated learning environments for active ageing. This paper gives an important insight into Educational Gerontology and ICT by understanding the context of the older adult learner and suggesting the following recommendations to enable them to be active constructors of knowledge: (a) combine information delivered in digital devices with face-to-face learning events; (b) intertwine daily-life phenomena with the learning content; (c) offer the possibility to share the learning content with friends and contribute with own content.

Keywords: Digitally-mediated learning environments · Active ageing · Pilot study · Information literacy · Digital inclusion · Learning styles

1 Introduction

In an era of demographic ageing and prevalence of such neurodegenerative diseases as Alzheimer, Parkinson and cerebrovascular diseases [1], there has been an increasingly concern with the genetic and environmental factors that are associated to ageing process, anti-ageing drugs, rehabilitation and the use of digitally-mediated learning interventions to foster active ageing [2, 3]. In fact, the ageing process has aroused the curiosity of Humankind over the years with the attempts made by a number of philosophers to define happiness (e.g. Aristotle), the proposed theories of wellbeing (e.g. Hedonism – Plato in Protagoras) or the concerns with longevity, domestic medicine in the 18th and 19th century [4]. In recent years, a sedentary lifestyle [5], the loss

of muscle mass [6] and the frequency of psychiatric disorders in older adults [7] have led to the need of investigating the use of digitally-mediated interventions to prevent, rehabilitate and contribute to active ageing in the dimensions of health (i.e. physical activity, nutrition, cognition and social activity), sense of security and participation in society [8].

Alongside this concern with active ageing, there has been an interest associated to adult learning for health [9] and the use of Information and Communication Technologies (ICT) in older adult learning and behavior change [10]. Furthermore, it is believed that adult learning has its roots in the 70 s with the author Malcom Knowles [11] (p.2), who defines the field of Andragogy [greek root – andr (man), agogos (learning) and logy (study)] as: "Core principles of adult learning that in turn enables those designing and conducting adult learning to build more effective learning processes for adults." These principles are [11]: the learner's need to know; self-concept of the learner; prior experiences of the learner; readiness to learn; orientation to learning; and motivation.

Relative to the process of learning in later adulthood, the terms of geragogy, gerontagogy [12, 13] or educational gerontology [12, 14] are used in order to characterize the interdependence of such different knowledge bases as: gerontology (geront-old man + logy- study of) and pedagogy (paidios – child + ago – lead + logy – study of) [13] that can occur in formal, non-formal or informal contexts [15]. Whereas formal learning is characterized by hierarchy (i.e. Universities of Third Age, Institutes for learning in retirement or Elderhostels), non-formal and informal learning refers to learning through social groups or networks (e.g. voluntary organizations, churches, sports and clubs) or/and its embeddedness in daily life (e.g. television, games, radio or family background).

It is worth noting that the older adults' access to learning is a right that is recognized in the Second World Assembly on Ageing [16] and initiatives as the Universities of Third Age seem to have a crucial role in the individual's wellbeing and quality of life through communal activities, self-actualization and its interrelationships with the society [17]. In this sense, adopting digital platforms in these contexts may have the potential to extend these formal learning spaces to the daily base, create collaborative and safe learning environments that take into account the learners' pace and confidentiality and may forge intergenerational relationships [17]. The aim of this study is, therefore, to identify the main requirements for designing digitally-mediated learning environments for active ageing.

2 Method

A Participatory Action Research (PAR) was used in order to involve the end-users in the assessment of the requirements for designing digitally-mediated learning environments for active ageing. In specific, this study used the Delphi method with experts to validate the instruments used for data collection, participant surveying and field notes to understand the requirements that would be necessary for designing such a program.

The field work and a set of group discussions to evaluate the learning programs were carried out at the Portuguese Universities of Third Age Gafanha da Nazaré. From March 2015 to December 2016 (2 hr session per week), the researcher lectured about ICT and Active ageing in order to gain the participants' confidence, commitment and trust and assess both the learning context and motivations to learn.

2.1   Participants

Thirty-three out of thirty-seven participants were involved in this survey, regarding the fact that four did not meet the selection criteria (1 did not fit within the age bracket and 3 did not complete all sessions). The criteria used for selecting the participants in this study were: (a) being aged 50 and over; (b) know how to read and write; (c) voluntary participation; and (d) interest in learning. The sample was gender-balanced (51.5% female and 48.5% male), the average age was 67 years old (SD = 7.06; minimum = 55; maximum = 82) and the majority of the participants had between 10 and 14 years of schooling. Forty adult learners at four Universities of Third Age then tested two digitally-mediated learning programs (a game-based learning – GBLP and a computer-assisted learning program – CALP) for active ageing in order to define the requirements for designing digitally-mediated learning environments for active ageing. Twenty participants (50% female and 50% male, M = 73 years old, SD = 5.93) tested firstly the GBLP and then the CALP whereas other 20 (60% female and 40% male, M = 69 years old, SD = 7.16) tested firstly the CALP and then the GBLP, aiming at not creating some bias relative to the order in which the learning programs were presented.

The study has been approved by the Ethics Committee of the University of Aveiro (Resolution n.3/2015) that safeguards, among other things: the informed consent of the participants aged 50 and over; voluntary participation; involvement of the research team in the process; and that the risks do not outweigh the risks associated with the participants' daily lives.

2.2   Measures and Procedures

Before assessing the participants' perceived learning motivation and styles, the surveys and content provided relative to the domains of active ageing [8]- i.e. health, security and participation in society were reviewed in terms of the quality of the materials and the procedures to be undertaken in the fieldwork by a group of experts in the fields of Gerontology, Psychology, Education and Social Work. These planned sessions embodied the following themes:

1. Presentation of the Research Project;
2. Physical Activity;
3. Nutrition;
4. Cognitive Activity;
5. Sense of Security; and
6. Participation in Society.

These sessions would enable to have access to the participants' context in order to design a digitally-mediated learning program for active ageing. In terms of the planned sessions, the criteria used were the following:

- The goals presented were/were not specific, measurable, achievable and time-based;
- The content covered/did not cover essential topics related with the concept of Active Ageing;
- The module was/was not sufficient and clear;
- There was/was not a risk of multiple interpretations or ambiguity in the use of terms;
- The sequence in which the content presented was/was not the most appropriate;
- There were/were not terms that needed explanation;
- The subject was/was not in-depth, in view of the objectives presented;
- The language used was/was not clear and accessible;
- The content was/was not updated;
- The literature presented was/was not relevant to support the arguments presented.

Relative to the survey, the criteria were the following:

- The scope and the purpose of the research were/were not explained;
- The instructions were/were not sufficiently and clearly described;
- There was/was not risk of multiple interpretations or ambiguity in the use of terms;
- The sequence of the questions;
- Suitability of the questions to each section;
- Number of repeated or inappropriate questions;
- Terms that needed explanation;
- Adequacy of the scale used;
- Suitability of the questions formulated for the analysis; and
- Validity of the content in scientific terms.

The objective of the survey was to assess the participants' context relative to the learning process in order to find the best strategy to transmit the information about active ageing in both digitally-mediated platforms.

After validating these instruments for data collection, the learning sessions at a University of Third Age were carried out *in loco*, aiming at understanding the current participants' learning context. In the specific case of learning motivations, preferences and styles, a questionnaire was self-administered that covered the following topics: The motivation to adhere to a learning program ('What motivates you to adhere to a learning program?'), in which the participants were given a list of possible reasons why they might adhere to the program ('Pleasure and fun', 'Relax', 'Pass time', 'Meet new people and make friendships', 'Increment participation in activities', 'Update skills at work', 'Foster life-long learning', 'Encourage intergenerational learning', 'Personal fulfilment', and 'Prevent or lessen the severity of certain diseases – e.g. Alzheimer, dementia'), including the 'Other';

The participants' learning style was assessed based on a set of sentences that were categorized into the theories: Behaviorism (BH), Cognitivism (CG) and Constructivism

(CT). The statements relative to Behaviorism (BH) were: 1. 'My surroundings affect my learning process (e.g. place, people…)'; 2. 'New apprenticeships influence my behaviors', 3. 'I like that the goals of the training activities, which I participate, are presented.', 4. 'I learn a lot through observation of others' behaviors, attitudes and herein consequences'.

In Cognitivism (CG), the following items were used: 'I like when schemas are presented relative to the learning content', 'I learn better if words and images are displayed rather than only images', 'Learning is a discovery process', 'Emotions have a strong influence on my learning process', 'My success in training activities depends on my effort', 'My success in training activities depends on the difficulty level of the task', 'My success in training depends on the luck factor', 'I often select only the information that interests me', 'I like to start with simple challenges and then move to the difficult ones' and 'I like examples to be presented about what I am learning.'

Finally, the following statements were formulated based on the Constructivism theory (CT): 'I like to participate in group activities', 'I like to build my own knowledge', 'I enjoy sharing information with people who have common interests', 'I enjoy learning challenges', 'I enjoy learning challenges that meet my learning capacities'. Associated to constructivism (CT), the social component is also important and, therefore, the following statements were added: 'I like to use Information and Communication Technologies (ICT) to learn and share information' and 'I enjoy sharing knowledge with the same interests as me.' The list of reasons that could lead the participants to adhere to a learning program were based on the Political declaration and Madrid International Plan of Action on Ageing [18], the Hamburg Declaration on Adult Learning [19] and the Andragogical principles proposed by Knowles, Holton and Swanson [11], in which the following recommendations were related with the proposed statements:

(a) Create collaborative and safe environments – 'Meet new people and make new friends' and 'Increment participation in activities';
(b) Adapt adult learning to changing world of work – 'Update skills at work', 'Foster life-long learning';
(c) Meet the learners' self-concept and take into account the learners' pace and confidentiality – 'Improve self- esteem', 'Pleasure and fun', 'Relax', 'Pass time', 'Personal fulfilment'
(d) Foster self-direct learning and take into account the ageing factors – 'Prevent or lessen the severity of certain diseases'; and
(e) Motivate adult learners to produce their own learning artefacts and share them with younger generations – 'Encourage intergenerational learning'.

Relative to the learning styles, these were based on different theories:

• Behaviorism: Relative to this theory, the willing that learners' behaviors can be shaped by different stimulus and positive or negative reinforcements was illustrated in the statement 'My surroundings affect my learning process – e.g. place, people…'; the interrelationship between learning and behaviors was covered in 'New

apprenticeships influence my behaviors' whereas the design of goal-oriented learning program (GOMS – Goals, Operators, Methods, Selection, Rules model) was relative to 'I like that the goals of the training activities, which I participate, are presented' and the process of observational learning was covered in 'I learn a lot through observation of others' behaviors, attitudes and herein consequences.'

- Cognitivism: The learner is seen as an information processor and learning is based on mental constructions of daily life events and symbols, being words and pictures also important in comparison with words – 'I like when schemas are presented relative to the learning content', 'I learn better if words and images are displayed rather than only images' and 'Learning is a discovery process.' The influence of emotions in the learning process are illustrated in the following sentences: 'Emotions have a strong influence on my learning process', 'My success in training activities depends on my effort', 'My success in training activities depends on the difficulty level of the task' and 'My success in training depends on the luck factor.' The Cognitive Theory of Multimedia Learning, in which the learning process is dependent on the process of filtering, selecting, organizing and manipulating information is covered in the following statements: 'I often select only the information that interests me' and 'I like to start with simple challenges and then move to the difficult ones.' The situated cognition principle that refers to the interconnection between the learning content and the individuals' daily life is then alluded to the statement 'I like examples to be presented about what I am learning.'
- Constructivism: In constructivism, learners are seen as active constructors of their own knowledge and the learning process is challenge or problem driven. This process of self-discovery were then reflected in the following statements: 'I like to participate in group activities', 'I like to build my own knowledge', 'I enjoy sharing information with people who have common interests', 'I enjoy learning challenges that meet my learning capacities.'

Finally, social interactions and Communities of practices are both related with the process of constructing knowledge and connectivism and as such, the following statements were added: 'I like to use Information and Communication Technologies (ICT) to learn and share information' and 'I enjoy sharing knowledge with people with the same interests as me.' For each statement, the participants had to rate them, using the scale from 1 (1 = totally disagree) to 5 (5 = totally agree). Two digitally-mediated learning programs that covered the dimensions of Active ageing – Health (Physical activity, Cognitive activity, Nutrition), Security and Participation in Society were then developed and the participants' perceived strengths, weaknesses and suggestions for improvement in both the learning platforms were registered using field notes.

The learning process is then centered on missions that can be both accomplished both in-game and in the physical space. Depending on the player's activity, he/she can be rewarded by each mission through the use of experience points (ranking), being able to discuss the learning content with other players through an off-game discussing area. These different functionalities meet the principles that were proposed by Gee [9]: empowering learners (through identity, offering a personal discovery through missions and enabling learners to interact with a digital environment; problem-solving by

enabling scaffolding in missions and monitoring them through rewards, presenting information 'just in time' and associating the gameplay activity to skills and experience points; and deep understanding by intertwining the information provided to the learners' context and activity as well as a certain point of time and place. Figure 1 shows an example of a mission related with Nutrition, in which the adult learners have to guess in which card the food with a certain vitamin is hidden.
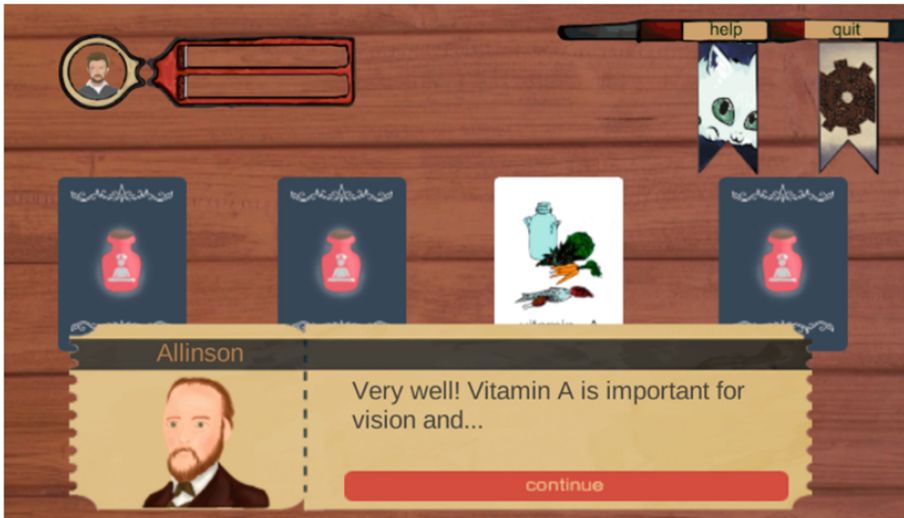

Fig. 1. Minigame related with the learning content about Nutrition - Game-based Learning Programme (GBLP)

In relation to the Computer-assisted Learning Program (CALP), the learning process in the is divided into the following areas: Learning, Rewards/Analytics, Learning Plan and Social. In specific, the CALP stores information relative to the learner (name. date, email, password, photo and description) and (s)he can create multiple events and posts that are dependent on the learning course. A task-based system is then associated to trophies and on-demand doubts that are posed the adult learners. This system operates the following recommendations: (a) an audio-visual strategy that gets the learner familiar with the source of information – learning profile, mentoring and on-demand doubts; (b) foster self-knowledge with the learning profile and the possibility of creating events (learning plan); (c) reward task-management through the interrelationship between the individual activities and the area of badges and trophies; and (d) build a community of practice through the area of sharing, in which learners can share their views on the learning content and share doubts relative to a certain minute of the video. Figure 2 shows an example of a video of the online course.

Fig. 2. Video of the online course

The learning content is delivered through an audiovisual strategy, in which the participants can send their doubts to the instructor depending on the time they are at the moment by clicking 'I have a doubt'. Both learning programs are available on the following links: Game-based learning - jump.web.ua.pt and Computer-assisted learning – seriousgiggle.web.ua.pt (Access date: January 16th, 2019).

An observation protocol was then used for each session, being structured as follows: reference number, place, date and time, activity and goals, portraits/description of the main actions with the participants' statements and references to audio-visual materials/photos/documents.

3   Results

When surveying the participants about their main motivations to adhere to a digitally mediated learning program, these were: foster life-long learning (N = 28, 84.8%); and improve self-esteem, self-confidence, cognitive capacity and personal fulfilment (N = 21, 93.9%). Furthermore, only four out of the thirty-three adult learners, who were interviewed (12.1%), have enrolled a course delivered at distance and the main reasons that they have pointed out were: flexibility in schedules; and personalization of the learning programs to the learner's context. In relation to the perception towards the different learning styles, Table 1 shows its popularity towards the participants. As can be shown in Table 1, the adult learners are likely to prefer learning environments that would enable them to be active constructors of their own knowledge challenge or problem driven. Learning environments addressed to the adults aged 50 and over should, therefore, enable self-discovery (M = 4.43, SD = 0.68), display words and images rather than only images (M = 4.43; SD = 0.63) and present schemas relative to the learning content (M = 4.26, SD = 0.82). In fact, constructivism tends to be the learning style that mostly suits the participants (the mean was 4 points or over to 6 out 8 sentences).

When observing the participants and discussing about the main strengths and weaknesses of both learning platforms relative to the different functionalities, the

following recommendations were added: 1. Enable the participants to share information with those who have common interests and present multimodal texts and schemas that illustrate the learning content: 2. Prioritize problem-solving (strategy), memory and attention, logic and reaction time as cognitive skills that the participants wanted to practice with the learning program; 3. The digitally-mediated learning program should also take into account face-to-face learning events –e.g. round tables, solving problems related with the learning content and get challenges that are intertwined with daily lives, and contribute with own content to the course; 4. Monitor the participants' progress in the platform and reward their activity in the platform in order bring some incentives to their learning efforts and enable self-knowledge; and 5. Organise the learning content in terms of goals and missions, being flexible in schedules, enabling scaffolding and providing information about the 'source of information.'

Table 1. Participants' perception towards their learning style (L.Style)

L.Style	Sentences	Mean	SD
BH	1. My surroundings affect my learning process (e.g. place, people…)	3.77	1.14
	2. New apprenticeships influence my behaviours	3.07	1.19
	3. I like that the goals of training activities, which I participate, are presented	4.21	0.77
	4. I learn a lot through observation of others' behaviours, attitudes and herein consequences	4.10	0.72
CG	5. I like when schemas are presented relative to the learning content	4.26	0.82
	6. I learn better if words and images are displayed rather than only images	4.43	0.63
	7. Learning is a discovery process	4.43	0.68
	8. Emotions have a strong influence on my learning process	3.87	1.01
	9. My success in training activities depends on my effort	4.10	0.99
	10. My success in training activities depends on the difficulty level of the task	3.68	1.08
	11. My success in training activities depends on the luck factor	2.23	1.22
	12. I often select only the information that interests me	3.59	1.27
	13. I like to start with simple challenges and then move on to the more difficult ones	3.97	0.91
	14. I like examples to be presented about what I am learning	4.19	0.93
CT	15. I like to participate in group activities	4.06	0.99
	16. I like to build my own knowledge	3.88	0.98
	16. I enjoy sharing information with people who have common interests	4.31	0.93
	17. I enjoy learning challenges	4.00	0.95
	18. I like to solve problems based on previous experiences	4.19	0.89
	19. I like to use Information and Communication Technologies (ICT) to learn and share information	3.81	1.01
	20. I enjoy sharing knowledge with people with the same interests as me	4.25	0.92
	21. I enjoy learning challenges that meet my learning capacities	4.03	0.95

4 Discussion

This study set out to identify the main requirements for designing digitally-mediated learning environments for active ageing, in which the ultimate goal is the individual's well-being and quality of life. Based on the use of the Delphi method with experts to validate the instruments used for data collection, 33 participant surveying and field notes, the following requirements are suggested: (a) combine information delivered in digital devices with face-to-face learning events; (b) intertwine daily-life phenomena with the learning content; and (c) offer the possibility to share the learning content with friends and contribute with own content. Furthermore, the adult learners are likely to prefer learning environments that would enable them to be active constructors of their own knowledge challenge or problem driven and as such, these programmes should enable self-discovery and present schemas relative to the learning content. In fact, adopting digital platforms in these contexts may have the potential to extend these formal learning spaces to the daily base, create collaborative and safe learning environments that take into account the learners' pace and confidentiality and may forge intergenerational relationships. Future work is being carried out in order to explore the adaption of these requirements to the context of an online community.

References

1. Hindle, J.V.: Ageing, neurodegeneration and Parkinson's disease. Age Ageing **39**(2), 156–161 (2010). https://doi.org/10.1093/ageing/afp223
2. Bouma, H., Fozard, J.L., Taipale, V.: Gerontotechnology in perspective. Gerontotechnology **6**(4), 190–216 (2007)
3. Costa, L.: Game-based learning for Active Ageing. Doctoral thesis, University of Aveiro, Aveiro, Portugal (2017)
4. Cheyne, G.: An Essay of Health and Long Life. Arno Press, New York (1724)
5. Burton, L.C., et al.: The effect among older persons of a general preventive visit on three health behaviors: smoking, excessive alcohol drinking, and sedentary lifestyle. Prev. Med. **24**(5), 492–497 (1995). https://doi.org/10.1006/pmed.1995.1078
6. Grönstedt, H., et al.: A study protocol of Older Person's Exercise and Nutrition Study (OPEN) - a sit-to-stand activity combined with oral protein supplement – effects on physical function and independence: a cluster randomized clinical trial. BMC Geriatr. **18**(138), 1–10 (2018). https://doi.org/10.1186/s12877-018-0824-1
7. Seitz, D., Purandare, N., Conn, D.: Prevalence of psychiatric disorders among older adults in long-term care homes: a systematic review. Int. Psychogeriatr. **22**(7), 1025–1039 (2010). https://doi.org/10.1017/S1041610210000608
8. WHO - World Health Organization.: Active ageing: A policy framework, pp. 5–55. World Health Organization, Geneva (2002)

9. Feinstein, L., Hammond, C.: The contribution of adult learning to health and social capital. Oxf. Rev. Educ. **30**(2), 199–221 (2004)
10. Glanz, K., Rimer, B., Viswanath, K.: Health Behavior and Health: Theory, Research and Practice. Wiley, San Francisco (2008)
11. Knowles, M.S., Holton, E.F., Swanson, R.A.: The Adult Learner. Routledge, New York (2012)
12. Findsen, B., Formosa, M.: Rationales for older adult learning, In: Lifefong Learning in Later Life, pp. 89–101. SensePublishers (2011). https://doi.org/10.1007/978-94-6091-651-9_8
13. Lemieux, A., Martinez, M.: Gerontagogy beyond word: a reality. Educ. Gerontol. **26**(5), 475–498 (2000)
14. Peterson, D.A.: Educational gerontology: the state of the art. Educ. Gerontol. **1**(1), 61–68 (1976)
15. Jarvis, P.: Sociological perspective on lifelong education and lifelong learning, Department of Adult Education, University of Georgia, Athens (1985)
16. UN - United Nations: Universal Declaration of Human Rights (1948). http://www.un.org/en/universal-declaration-human-rights/. Accessed 12 June 2019
17. Czaja, S.J., Sharit, J.: Designing Training and Instructional Programs for Older Adults. CRC, Boca Raton (2012)
18. UN-United Nations: Political Declaration and Madrid International Plan of Action on Ageing, Madrid (2002)
19. UNESCO, Adult Education – The Hamburg declaration the agenda for the future, UNESCO (1997)