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COGNITIVE STIMULATION IS ESSENTIAL TO MAINTAIN AND/OR IMPROVE THE COGNITIVE FUNCTION OF THE ELDERLY

Telma Filipa Mendes Ramos - Master in Psychology; Instituto Superior Miguel Torga

Lisete dos Santos Mendes Mónico - Assistant Professor in the Faculty of Psychology and Education Sciences of the University of Coimbra

Pedro Miguel Parreira - Adjunct Professor of the Nursing School of Coimbra

César Fonseca - Adjunct Professor University of Évora

Maria dos Anjos Coelho Rodrigues Dixe - Coordinator Professor of the Polytechnic Institute of Leiria

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ABSTRACT

Introduction: Cognitive stimulation is essential to maintain and / or improve the cognitive function of the elderly.

Objectives: This study aimed to evaluate the impact of the application of a Cognitive Stimulation Program on the maintenance or improvement of the cognitive function of the elderly at the levels of orientation, memory, calculation and language. It was also intended to evaluate complementary measures of the impact of the intervention program, namely on the quality of life, depressive symptoms, in the eight cognitive domains, executive function, visuospatial capacity, memory, attention, concentration and working memory, language and orientation.

Method: The program was performed in 14 sessions for seven weeks, with pre-and post--test measurements. The final sample consisted of seven elderly men, four men and three women aged between 68-89 years (80.29 ± 8.83 years), who responded to the following measures: Montreal Cognitive Assessment (MoCA), Quality of life (IAQdV-8), Geriatric Depression Scale (GDS-15) and Cognitive Decline Test (6-CIT).

Results: The post-test cognitive decline in relation to the pre-test decreased significantly (6_CIT), with an improvement in the cognitive function of the elderly. The improvement of some indicators of cognitive function is positively correlated with the self-perception of quality of life with negatively depressive symptomatology.

Conclusions: The administration of Cognitive Stimulation Programs contributes to an improvement of the cognitive function in the elderly and an increase in the quality of life.

Key-words: Cognitive function; memory; quality of life and depression.

INTRODUCTION

Aging is a stage of the life cycle that is characterized by the emergence of several issues, namely isolation, loneliness, loss, depression, identity and interpersonal relationship issues, feelings of inferiority, mental confusion, and dementia, among others[1]. Due to the increase in life expectancy, the efforts to understand the aging process aim to improve older adults' quality of life and subjective well-being[2]. Quality of life in old age is often associated with environmental conditions, behavioral skills, and psychological well-being[3]. However, cognitive ability is essential to achieve quality of life in old age. Cognitive training leads to many benefits, not only at the cognitive level but also in other domains such as psychological well-being, which results from the individuals' perception of their satisfaction with life and affections[3]. According to Morais[4], aging is a unique process for

every person, thus making it necessary to consider the older person's functional capacity to perform activities of daily living and contribute to the quality of life in old age. Therefore, the improvement of quality of life contributes to older adults' healthy aging[3] and preserved cognitive function[4], which may decline with age.

Cognitive processing includes the information processing speed, the working memory, and the sensory skills[5]. The decline in information processing speed and response is the most predictable cognitive change. It is characterized by a cognitive decline and affects the attention, memory, performance of activities of daily living, and decision-making[5]. Functional impairment influences the older person's ability to perform activities of daily living, thus compromising their autonomy[6]. Functional impairment is characterized by the inability to perform activities of daily living without the help of others.

Functional impairment hinders the individual's ability to engage in physical activity[6], which is a risk factor. The fact that older people are unable to move correctly (due to weak muscle strength, balance or gait) leads to an increased risk of falls, which have a significant impact on the family and the healthcare system because the older person becomes disabled. The older person starts depending on other people and requiring more care, thus increasing the burden on the family and the institutions[5,6]. According to the Pordata database[7], less than 5% of older people aged over 65 years are institutionalized in Portugal.

The impact of age-related physical, psychological, and social changes depends on the older person's life context[7]. Most institutions do not implement programs aimed at enhancing cognitive function, which leads to the functional and cognitive impairment of older people[9].

There are multiple cognitive stimulation programs described in the literature. A cognitive stimulation program (memory) was implemented in a sample of 46 healthy older people, who showed significant improvement, as assessed by the Mini Mental State Examination (MMSE)[9]. The program consisted of several activities based on lectures, games, problem-solving, and reasoning exercises. Souza, Borges, Vitória, and Chippetta[10] carried out a training and memory program with institutionalized older people aged 65 to 98 years, who were evaluated using the MMSE, word recall and recognition, and verbal fluency. The results showed that women and younger older people had a better performance and that individuals with a higher education level had greater language skills.

Garcia and González[11] distributed 98 older people into two groups and applied a memory stimulation program to the experimental group. The subjects in the experimental group showed an improvement in their cognitive function, while the subjects in the control group showed a decline in their cognitive function.

Castro[11] analyzed the impact of a 16-session Cognitive Training Program on 15 institutionalized older people, who were divided into an experimental and a control group. The Alzheimer's Disease Assessment Scale-cognitive subscale and the Geriatric Depression Scale were applied in the pre- and post-testing. Older people improved their cognitive function, which demonstrated that the Cognitive Training Program is important for institutionalized older people by contributing to their cognitive development and improving their quality of life.

Apóstolo and Cardoso[13] adapted the Cognitive Stimulation Program *Making a Difference: An Evidence-based Group Programme to Offer Cognitive Stimulation Therapy (CST) to People with Dementia* to the Portuguese context and used it as a cognitive stimulation intervention. The program included several activities aimed at stimulating thinking, reasoning, attention, verbal fluency, and the psychological well-being of older people, who showed an improvement in their cognitive function[13]. Silva, Oliveira, Malagutti, Danzini, and Yassuda[14] conducted a study with 21 older people who were asked to memorized shopping lists and do basic mathematical calculations. The subjects were assessed using the Consortium to Establish a Registry for Alzheimer's Disease (CERAD) battery, the Mini Mental State Examination (MMSE), and the cognitive screening test (the clock-drawing test). The results showed an improvement in word recall and verbal fluency.

Objectives, design, and research hypotheses

This study aimed to assess the impact of a Cognitive Stimulation Program on the maintenance or improvement of institutionalized older adults' cognitive function (orientation, memory, calculation, and language). In addition, it aimed to assess the impact of the program using complementary assessment tools such as the participants' quality of life, depressive symptoms, and eight cognitive domains (executive function, visuospatial ability, memory, attention, concentration, working memory, language, and orientation).

The following research hypotheses were established: H1 - There is a statistically significant improvement in older adults' cognitive function between the pretest (before the Cognitive Stimulation Program intervention) and the posttest (after the Cognitive Stimulation Program intervention) moments; H2 - There is an association between cognitive function and quality of life, depressive symptoms, and cognitive domains after the Cognitive Stimulation Program intervention.

METHOD

Sample

The sample was composed of nine older people residing in a nursing home with a capacity for 75 older people. The following inclusion criteria were applied: a) having no severe cognitive impairment (information confirmed in the medical records) and b) being available to participate in the Cognitive Stimulation Program. It should be noted that, at the time of the study, three residents had scored >10 (12, 18, and 19) in the Six Item Cognitive Impairment Test (6-CIT); however, they were not excluded because they showed adequate special-time orientation, motivation, and interest to participate in the study.

Two weeks after beginning the study, two of the nine patients left the study due to illness. The final sample was composed of seven older people (four men and three women) aged 68 to 89 years (80.29±8.83 years). Most participants were married (n= 3) or widowed (n= 3). Their education level was heterogeneous (two participants were illiterate, two had completed the first cycle of Basic Education, one the second cycle of Basic Education, and two had a Higher Education degree). The majority of older people had been living in the institution for more than one year (n = 5), and all had regular (mostly weekly) visits, either from family members (five participants) or friends (two participants). Four older people had a chronic illness.

Implementation of the Cognitive Stimulation Program

The activities and duration of the sessions were based on the Cognitive Stimulation Program *Making a Difference: An Evidence-based Group Programme to Offer Cognitive Stimulation Therapy (CST) to People with Dementia*[13], as well as on the work of Bailly and Alaphilippe[15,16].

The Cognitive Stimulation Program was implemented during one month and two weeks, with two one-hour sessions per week. The program integrated multiple activities aimed at stimulating older adults' thinking, reasoning, attention, language, and psychological well-being. The activities aimed at maintaining their brain activity, practicing their language and thinking skills, helping them to lead a more active life, improving their social relationships with others at the same situation, developing their mental activity and autonomy, encouraging them to have a more proactive role and boosting their confidence (by making them feel that they are still ulseful members of society), and promoting their integration into the surrounding environment.

Measurement tools

Several tools, including a sociodemographic questionnaire, were used to characterize the sample and assess the variables under study.

The 6-CIT consists of six items that serve as a simple screening test for mild dementia. The scores range from 0 to 28, with the following cutoff points: 0 - 10 (normal function or mild cognitive impairment) and 11 - 28 (moderate to severe cognitive impairment). The cutoff values proposed for the Portuguese population were as follows: ≥ 16 for 0 to 2 years of education, ≥ 11 for 3 to 6 years of education, and ≥ 9 for 7 or more years of education(15). This tool was administered before (pretest) and after the intervention (posttest).

The Montreal Cognitive Assessment (MoCA) test assesses eight cognitive domains: executive function, visuospatial ability, memory, attention, concentration, working memory, language, and orientation[16]. The total maximum score is 30 points.

The Quality of Life Assessment Tool (*Instrumento de Avaliação da Qualidade de Vida, IAQdV-8*) is composed of eight items that assess quality of life, health, energy, activities of daily living, self-esteem, personal relationships, financial resources, and satisfaction with the living conditions. Items are scored using a 5-point Likert-type scale, ranging from 1= Not at all to 5= Completely[17].

The Geriatric Depression Scale (GDS-15) is used to screen for depressive symptoms in older patients using 15 items with a yes or no answer. The total score is 5 or more points, and respondents who score 11 or more are diagnosed with severe depression[18].

Procedures and statistical analysis

In July 2016, the authorization to implement the program and collect the data was formally requested to the nursing home, addressed to the person responsible for the older people. After permission was granted, older people who met the inclusion criteria were invited to participate in the study.

All ethical assumptions and confidentiality were ensured during the research process. All participants gave their permission to implement the program and apply the questionnaires, after being informed of the voluntary nature of their participation and the possibility of withdrawal at any time. They were also assured of the anonymity and confidentiality of the data collected before and after the implementation of the program.

Data were statistically processed using the Statistical Package for the Social Sciences (SPSS), version 22.0. Data were analyzed using inferential statistics through non-parametric tests due to the sample size and the non-distribution of the variables.

RESULTS

To analyze if there were statistically significant differences between the results obtained in the pre- and post-test moments, the nonparametric Wilcoxon signed rank test was performed using the data obtained in the 6-CIT. Table 1 shows the pre- and post-test results, the minimum (Min), maximum (Max), and mean scores (M), as well as the standard deviation (SD) for the total scale and each individual item.

Table 1 - Minimum, Maximum, and Mean scores, Standard Deviation of the Six Item Cognitive Impairment Test (6-CIT): Wilcoxon test between pre- and post-test

	Score Range	Pre-test				Post-test				Wilcoxon Test	
		Min	Max	M	SD	Min	Max	M	SD	Z	Sig.
What year is it?	Correct (0) Incorrect (4)	0	4	.57	1.51	0	4	.57	1.51	.00	1.00
What month is it?	Correct (0) Incorrect (3)	0	3	.43	1.13	0	0	.00	.00	-1.00	.317
About what time is it?	Correct (0) Incorrect (3)	0	0	.00	.00	0	0	.00	.00	.00	1.00
Count backwards from 20-1	Correct (0) 1 error (2) + 1 error (4)	0	2	.57	.98	0	0	.00	.00	-1.41	.157
Say the months of the year in reverse	Correct (0) 1 error (2) + 1 error (4)	0	4	1.43	1.90	0	2	1.14	1.07	-0.58	.564
Repeat address phrase	Correct (0) 1 error (2) 1 error (4) 3 error (6) 4 error (8) All wrong (10)	2	10	7.43	3.41	0	10	5.43	3.60	-2.07	.038**
6-CIT (total scale)	Total score	2	19	10.43	6.48	0	14	7.14	5.27	-1.90	.058*

* $p < .05$ ** $p < .05$

With regard to the total scale, the scores obtained in the post-test were lower than in the pre-test, which suggests a decrease in cognitive impairment. It should be noted that cognitive function improved in five participants, worsened in one participant, and remained unchanged in one participant. The exclusion of the older person whose cognitive impairment worsened (from 10 to 12 points) led to a z= -2.03 (p= .042) on the total scale, which is a statistically significant result with a 95% confidence interval.

Despite the small sample size, the program had an impact on the reduction of cognitive impairment, thus corroborating H1. This improvement was particularly evident in the *Repeat address phrase* item (item 3 of the 6-CIT).

Afterwards, the results obtained in the pre- and post-test were compared according to the participants' gender. For this purpose, new variables were created using the differential results (after subtracting the post-test result to the pre-test result in each item of the 6-CIT). The non-parametric Mann-Whitney U test was then performed using the participants' gender (male vs. female) as the independent variable and the differential results (pre- and post-test) as dependent variables. As shown in Table 2, no gender differences were found, both in the total scale and in each individual item, which suggests that both men and women had a similar evolution between the pre- and post-test moments.

Table 2 - Gender differences in the differential results (pre-test and post-test) obtained in the Six Item Cognitive Impairment Test (6-CIT): Mann-Whitney U test according to gender

	Men (n=4)		Women (n=3)		Mann-Whitney Test	
	Mean rank	Rank sum	Mean rank	Rank sum	U	Sig.
6-CIT (total scale)	5.00	20.00	2.67	8.00	2.00	0.23
What year is it?	4.00	16.00	4.00	12.00	6.00	1.00
What month is it?	4.50	18.00	3.33	10.00	4.00	0.63
About what time is it?	4.00	16.00	4.00	12.00	6.00	1.00
Count backwards from 20-1	4.13	16.50	3.83	11.50	5.50	0.86
Say the months of the year in reverse	5.13	20.50	2.50	7.50	1.50	0.11
Repeat address phrase	4.63	18.50	3.17	9.50	3.50	0.40

As complementary assessment tools on the effectiveness of the Cognitive Stimulation Program, the Montreal Cognitive Assessment (MoCA) test, the Quality of Life Assessment Tool (IAQdV-8), and the Geriatric Depression Scale (GDS-15) were used at post-test to analyze the association between the intervention and the improvements shown in the Cognitive Impairment Test between the pre- and post-test moments.

Table 3 shows the absolute scores (the absolute number of points obtained by each respondent in each item/question) and the relative scores (the absolute number of points obtained by each respondent in each item/question, divided by the maximum number of points that can be obtained in each item/question). The highest scores were obtained in the Alphabet item, followed by the Orientation item. Identical scores were obtained in the Attention, Language, and Abstraction items. The lowest score was found in the Verbal fluency item.

Table 3 - Descriptive statistics of the absolute and relative scores obtained in the Montreal Cognitive Assessment (MoCA) test

	Total Score	Absolute scores				Relative scores			
		Min	Max	M	SD	Min	Max	M	SD
MoCa – total scale	30	15.00	21.00	18.00	2.65	.30	.70	.60	.09
Items:									
Visuospatial/executive function	5	1.00	3.00	2.00	.82	.20	.60	.40	.16
Naming	3	2.00	2.00	2.00	.00	.67	.67	.67	.00
Attention	2	1.00	2.00	1.71	.49	.50	1.00	.86	.24
Alphabet	1	1.00	1.00	1.00	.00	1.00	1.00	1.00	.00
Calculation	3	.00	3.00	1.86	1.21	.00	1.00	.62	.40
Verbal fluency	1	.00	1.00	.14	.38	.00	.50	.07	.19
Language	2	.00	2.00	.86	.90	.00	2.00	.86	.90
Abstraction	2	1.00	2.00	1.71	.49	.50	1.00	.86	.24
Delayed recall	5	.00	2.00	1.29	.95	.00	.40	.26	.19
Orientation	6	4.00	6.00	5.43	.79	.67	1.00	.90	.13

Table 4 shows the results obtained in the Quality of Life Assessment Tool. On a 5-point scale, the mean total score slightly exceeds the intermediate value of the scale. Items with the highest scores focused on the respondents' level of satisfaction with their personal relationships, followed by their level of satisfaction with themselves, their living conditions, their everyday life, their ability to perform activities of daily living, having enough money to meet their needs, their health, and, finally, having enough energy for everyday life.

Table 4 - Descriptive statistics of the Quality of Life Assessment Tool (IAQdV-8)

	Min	Max	M	SD
IAQdV-8 (mean of the total scale)	2.75	4.50	3.45	.66
1- How would you rate your quality of life?	3.00	4.00	3.43	.53
2- How satisfied are you with your health?	2.00	5.00	3.00	1.29
3- Do you have enough energy for everyday life?	1.00	5.00	2.57	1.40
4- How satisfied are you with your ability to perform your daily living activities?	2.00	5.00	3.43	.98
5- How satisfied are you with yourself?	2.00	5.00	4.00	1.29
6- How satisfied are you with your personal relationships?	3.00	5.00	4.14	.90
7- Do you have enough money to meet your needs?	1.00	5.00	3.29	1.38
8- How satisfied are you with the conditions of your living space?	3.00	5.00	3.71	.76

The results of the Geriatric Depression Scale (GDS-15) were rated as 1 for answers indicating depression and 0 for answers indicating no depression. The sum of "yes" answers, after reverse scoring the items marked with (i) (Table 5), shows that the answers to items 9, 2, 4, and 12 were the most indicative of depression. All participants answered affirmatively to questions 5(i) and 11(i), which, after reverse scoring, resulted in 0 points on the depression scale. The mean relative score (0 to 1 points) allowed verifying if the scores are closer to the response option 0 or 1. Regarding the total scale, the score is below the intermediate score (.50 or 50%), which indicates a lower depression score (.40 in the sample of older people, which corresponds to 40% of the answers indicating depression).

Table 5 - Descriptive statistics of the Geriatric Depression Scale (GDS-15)

	Min	Max	Sum of response options 1		M (0-1 points)	SD (0-1 points)
			n	%		
Geriatric Depression Scale (GDS-15 – sum – total)	2.00	12.00	42	40.0	.40	.25
1(i) - Are you basically satisfied with your life?	.00	1.00	2	28.6	.29	.49
2 - Have you dropped many of your activities or interests?	.00	1.00	5	71.4	.71	.49
3 - Do you feel that your life is empty?	.00	1.00	4	57.1	.57	.53
4 - Do you often get bored?	.00	1.00	5	71.4	.71	.49
5(i) - Are you in good spirits most of the time?	.00	.00	0	0.0	.00	.00
6 - Are you afraid that something bad is going to happen to you?	.00	1.00	4	57.1	.57	.53
7(i) - Do you feel happy most of the time?	.00	1.00	2	28.6	.29	.49
8 - Do you feel helpless?	.00	1.00	1	14.3	.14	.38
9 - Do you prefer to stay at home, rather than going out and doing new things?	.00	1.00	6	85.7	.86	.38
10 - Do you feel you have more problems with memory than most?	.00	1.00	2	28.6	.29	.49
11(i) - Do you think it is wonderful to be alive now?	.00	.00	0	0.0	.00	.00
12 - Do you feel pretty worthless the way you are now?	.00	1.00	4	57.1	.57	.53
13(i) - Do you feel full of energy?	.00	1.00	3	42.9	.43	.53
14 - Do you feel that your situation is hopeless?	.00	1.00	2	28.6	.29	.49
15 - Do you think that most people are better off than you are?	.00	1.00	2	28.6	.29	.49

(i) Items with reversed scoring.

Finally, the association between the improvements reported in the 6-CIT after the intervention program and the results obtained in the MoCA, IAQdV-8, and GDS-15 were analyzed. The correlation coefficients were calculated based on the differential results (post-/pre-test), that is, the improvements reported after the implementation of the intervention program. Significant associations were found, which provide empirical support to the effectiveness of the program. Table 6 shows the results of the Spearman's rank correlation coefficient (rho) test.

Table 6 - Correlation between the level of cognitive impairment (6-CIT), cognitive function (MoCA), quality of life (IAQdV-8), and depressive symptoms (GDS-15)

	MoCA		IAQdV-8		GDS-15	
	rho	*p*	*rho*	*p*	*rho*	*p*
6-CIT (total scale)	.713	.072	.527	.224	-.541	.210
What year is it?[a]	-	-	-	-	-	-
What month is it?	.525	.227	.103	.826	-.408	.363
About what time is it?[a]	-	-	-	-	-	-
Count backwards from 20-1	.325	.477	-.08	.865	-.474	.282
Say the months of the year in reverse	*.870**	*.011*	.603	.125	*-.797*	*.032**
Repeat address phrase	.340	.456	.667	.101	.000	1.00

[a] Associations were not calculated due to the lack of variability between pre- and post-test assessments (pre-/post-test = 0); * $p < .05$.

Statistically significant correlations ($p < .05$) are shown in italics. Strong positive correlations were found between the 6-CIT and the MoCA test (*rho*= .713), which indicates that higher scores in the 6-CIT are positively associated with higher scores in the cognitive domains of executive function, visuospatial ability, memory, attention, concentration, working memory, language, and orientation (R^2= .5084, corresponding to 50.84% of shared variance). In turn, a strong positive correlation was also found between improved cognitive function and the scores obtained in the IAQdV-8, which indicates that higher gains

obtained in the program are associated with a more positive perceived quality of life (*rho*= 527, R^2= .2777, corresponding to 27.77% of shared variance). Finally, a strong negative correlation was found between improvements in the 6-CIT and the GDS-15 scores, showing that improvements obtained in the program correspond to less depressive symptoms (*rho*= -.541, R^2= .2927, corresponding to 29.27% of shared variance).

The strongest positive correlation was found between the 6-CIT item *Say the months of the year in reverse* and the MoCA test (*rho*= .870, R^2= .7569, corresponding to 75.69% of shared variance). Regarding IAQdV-8 scores, the strongest positive correlation was found in the item *Repeat address phrase* (*rho*= .667, R^2= .4449, corresponding to 44.49% of shared variance). Finally, in relation to the negative correlations with the GDS-15, the strongest correlation was found in the item *Say the months of the year in reverse* (*rho*= -.797, R^2= .6352, corresponding to 63.52% of shared variance). These correlations corroborate H2, thus putting into evidence the impact of the intervention program on reducing cognitive impairment, promoting quality of life, and reducing depression.

DISCUSSION

This study aimed to implement a Cognitive Stimulation Program and assess its impact on the maintenance or improvement of older adults' cognitive function (orientation, memory, calculation, and language). In addition, it aimed to analyze its correlation with complementary tools used to assess the impact of the intervention program.

The results showed that the total scores (6-CIT) were lower in the post-test when compared to the pre-test, which indicates a decrease in cognitive impairment (i.e., an improvement in the cognitive function) in five of the seven older adults in this sample. Other authors[12, 13] obtained similar data, using different programs and cognitive assessment tools.

In this study, both men and women improved their cognitive functioning, without statistically significant gender differences, which may be explained by the small sample size. In the study conducted by Souza, Borges, Vitória, Magalhães, and Chippeta[10], women scored higher in the performance of activities; however, this difference may have been due to the fact that the sampled women were younger than the men.

Based on the differential results obtained in the 6-CIT, the item *Say the months of the year in reverse* showed a positive correlation with improvements in the older adults' cognitive function (MoCA test) and a negative correlation with the presence of depressive symptoms (GDS-15). Other studies have also found a correlation between improved cognition

and better quality of life, as well as less depressive symptoms in older people after the implementation of the program used in this study[13,19].

In this study, no significant correlations were found between quality of life (IAQdV-8) and improved cognitive function, which is not in line with the results obtained by other authors[12,19,20,21].

CONCLUSIONS

This study showed that the Cognitive Stimulation Program significantly improved older adults' cognitive function, despite having a short duration (7 weeks) and a small sample. The program has contributed to the maintenance of cognitive health and proved to be effective in delaying dementia and improving older adults' ability to perform activities of daily living, autonomy, and independence. It also showed positive correlations with older adults' self-perceived quality of life and negative correlations with depressive symptoms.

Study limitations and future research possibilities

The main limitations of this study were the small sample size and the lack of a control group with pre- and post-test assessment.

With regard to future research possibilities, the program should include strategies aimed at encouraging older adults not to feel inferior because of their age. It would also be important to analyze the effectiveness of programs that include activities with family members. It is also necessary to implement strategies that raise older adults' interest in participating in cognitive stimulation programs, as well as to conduct experimental studies during longer periods of time and with more sessions.

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Correspondence: lisete.monico@fpce.uc.pt