

Neuropsychological and affective assessment of teachers over 50 years old before and after an ICT-focused training program: Improved job satisfaction and links with affective factors

ABSTRACT

The aging of the population raises several social and health related issues and is particularly high in Europe, where policies promoting Active Aging are being pursued. In Education, the aging of the teaching workforce poses significant challenges to the profession. The REKINDLE+50 project developed a training program on Information and Communications Technology (ICT) use for teachers with the parallel intent of promoting the abilities and motivation of teachers over 50 years old. Here we report on the pre- and post-test assessment of neuropsychological abilities (“cool” and “hot” executive functions), self-reported affective functioning and job satisfaction. We found that the training program was associated with increased satisfaction with the nature of the teachers’ work and with material working conditions. There were no significant changes in neuropsychological nor affective measures before and after the program. We also found that job satisfaction was positively associated with “hot” executive functions and negatively linked to affective symptoms (sub-clinical anxiety and depression). These findings, although tentative, suggest that the training program had a positive impact on teacher job satisfaction, and may have potential implications for the promotion of active aging in teachers. Overall, the aging of teachers remains a challenge for the future. The policies for promoting Active Aging provide a strategic outlook on how to tackle this issue, but a more detailed understanding of age-related cognitive and affective changes is likely required to devise effective measures.

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1. INTRODUCTION

“I am too old for this!” is a phrase heard in many professional contexts, sometimes used humorously but many times reflecting a serious effect of

aging on professional capacity and motivation. In Education, as teachers grow older, the age gap between them and their students widens, and this may impair the pedagogical and relational environment. The rapid development of new technological tools in education (e.g., Lencastre et al., 2020) further contributes to the difficulties of aging teachers that may struggle to keep up with a plethora of online tools across a variety of ICT platforms. This factor, heightened by the typical age-related decrease in physical abilities, may, in some cases, lead older teachers to think that, indeed, they may be too old to continue as active professionals.

In face of this, the REKINDLE+50 project developed a training program on ICT use for teachers with the parallel intent of promoting the digital abilities and teaching motivation of teachers over 50 years old (for a detailed overview of the project, see Mouraz et al., 2021). In the present study, we report on the pre- and post-test assessment of neuropsychological abilities, and self-reported affective functioning and job satisfaction. We were interested in examining the effects of the training program on the aforementioned variables, but also on how neuropsychological and affective capacities related to job satisfaction in older teachers.

We begin by reviewing the challenges that aging poses to health and social issues at large, and then focus specifically on the challenges raised for the teaching profession. Then, we focus on research on the cognitive and neuropsychological abilities of aging teachers, and how assessing these abilities may help us better understand how to promote active aging in educational professionals.

1.1. AGING: PROBLEMS AND STRATEGIES

Aging is recognized by the World Health Organization (WHO) as an important topic as the proportion of people over 60 is rising in almost every country in the world (WHO, 2015). This issue is especially relevant in Europe, as it is the region with the highest median age in the world (European Commission's Directorate-General for Economic and Financial Affairs, 2018). This shift in the demographic make-up of societies is accompanied by several social and health related issues: as populations become older, the traditional role of older adults in society is changing. Aging workers are expected to work until later in life before being eligible for state pensions as the age of retirement increases, but this increase in working years is often accompanied by an increase in health problems (Jagger et al., 2020).

The challenges that aging brings about have been met by a strategic outlook that is embedded in the concept of Active Aging, which is defined as:

[T]he process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age. (...). The word 'active' refers to continuing participation in social, economic, cultural, spiritual and civic affairs, not just the ability to be physically active or to participate in the labor force. (WHO, 2002, p. 12)

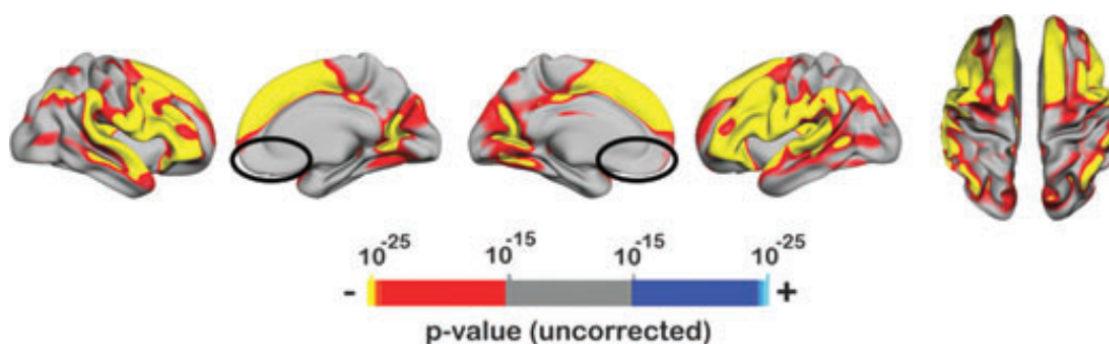
Indeed, achieving Active and Healthy Aging requires enabling older adults to maintain their autonomy at personal, professional, and social levels,

which undoubtedly requires an interdisciplinary approach to the problem (Liotta et al., 2018). As aging has been typically associated with a decline in physical and cognitive abilities, knowledge of the neural, physiological, behavioral, affective, and cognitive changes that accompany aging is essential for the effective promotion of Active Aging and these have been areas of active research in recent years (National Institute on Aging, 2011).

As a result of this research effort, several neuropsychological aspects of aging are now well established. Normal aging is associated with a decline in cognitive function (Caselli et al., 2014; Paulo et al., 2011; Toescu, 2005) which is accompanied by changes in the brain at both macroscopic (e.g., reductions of cortical thickness and subcortical volumes, of white matter integrity, and of overall brain volume; Fjell et al., 2013; Salat, 2011) and microscopic levels (e.g., reduction of dendritic arbor complexity and of dendritic spines, decrease in synaptic density; Dickstein et al., 2007; Hof & Morrison, 2004). However, not all regions of the brain show similar age-related changes (Fjell et al., 2013). Indeed, as illustrated in Figure 1, cortical thinning seems to be largest in dorsal and lateral regions of the frontal and temporal lobes (brain areas often associated with cognitive processes), whereas the ventromedial prefrontal cortex and the anterior cingulate cortex (areas broadly related to affective processes) seem to be largely preserved (Mather, 2012). The distinction between “cognitive” and “affective” processes is, of course, arbitrary to some extent and normal neuropsychological processes will typically involve both cognitive and affective components. This distinction is often used in the literature to distinguish between processes that involve deliberation and controlled reasoning, typically in abstract contexts or problems (cognitive), and processes that involve motivational impulses and emotional arousal, usually in situations that involve subjective valuation (affective; Zelazo & Carlson, 2012).

Figure 1

Illustration of the Correlation Between Age and Cortical Thickness Across the Brain. Some Brain Regions Show Reduction of Cortical Thickness With Aging (Significant Correlations Shown in Yellow and Red) but Other Areas do not Show This Age-Related Decline (Grey Areas). Reused from Mather (2012) with Permission.



The fact that age-related changes in the brain seem to affect specific regions while leaving others unaltered is consistent with a wealth of data showing that the ability to process emotional materials in older adults is preserved, even if differing from that of younger adults in important aspects. In

fact, despite the well-documented age-related cognitive decline, older adults generally show higher levels of emotional well-being than younger adults (Mather, 2012). This “emotional paradox” (Mather, 2012) has been described as a positivity effect: older adults allocate more attention to positive emotional materials and memorize them better than younger adults, while showing diminished processing of negative stimuli (Nashiro et al., 2012).

Another finding that contradicts the traditional view of aging as necessarily involving cognitive decline comes from studies that contrast the effect of aging on different cognitive abilities (Gonçalves et al., 2018; Hartshorne & Germine, 2015). Overall, the findings suggest that while many abilities do decline with age as previously reported, others actually improve as age increases, in a way that parallels the classic distinction between fluid and crystallized intelligence (Cattell, 1963). Fluid intelligence is more associated with the ability to reason quickly and flexibly, whereas crystallized intelligence relates to the cumulative acquisition of knowledge and skills throughout the lifespan. In aging, it seems that “fluid” cognitive abilities (e.g., working memory tasks) show an age-related decline, but “crystallized” cognitive abilities (e.g., vocabulary) continue to improve until late in life, on average until over 65 years of age (Hartshorne & Germine, 2015).

In summary, although the aging of the population has been recognized as a serious problem that societies will have to tackle in coming years, the actual effects of aging on cognitive and emotional performance do not reflect a simple and continuous decline. Instead, there are cognitive and affective domains that tend to improve with aging, and these are important findings as they may inform better strategies for the promotion of Active and Healthy Aging. In the following section we will link the issues presented above with the field of Education.

1.2. AGING TEACHERS

Considering the field of Education, the aging of the teaching workforce is a known problem (Ingersoll, 2009). In Portugal, about half of the teachers have ages around or above 55 years, and this range in where the highest levels of burnout have been found (Conselho Nacional de Educação [CNE], 2019; Varela et al., 2018). Advancing age for a teacher has been associated with some gains in teaching, as older/veteran teachers may capitalize on the experience they have gained throughout the years, but these advantages are often offset by decreases in motivation and job satisfaction (Admiraal et al., 2019; Alves et al., 2020; Alves & Lopes, 2016). Indeed, several factors associated with aging may contribute to negative outcomes: the increased generational gap between teachers and students, lack of familiarity with ICTs (which are increasingly becoming not only tools for teaching, but requirements for bureaucratic work), mandatory increases in retirement age (which altered professional expectations), and the lack of social recognition of the teaching profession (Dotta et al., 2019; Mouraz et al., 2021).

In contrast with the general literature on aging, much less is known specifically about the cognitive, affective, and neural age-related changes in the teaching profession (Aschwanden et al., 2019; for a similar argument

regarding research on teachers' cognitive abilities, see Bardach & Klassen, 2020). A sensible hypothesis would be that the intellectual demands of the teaching profession would enhance cognitive abilities and perhaps delay age-related cognitive decline and some initial evidence seemed to support this view. In one study, university professors showed less cognitive decline than expected for the general population (Shimamura et al., 1995), but later studies did not find this effect (Vanderaspoilden & Morais, 2001) or found more nuanced benefits (e.g., benefits associated mainly with better processing speed; Aschwanden et al., 2019). In sum, it may be that the intellectual demands of teaching may serve as a protective factor for cognitive aging, but the evidence remains inconclusive.

There is also limited research on the affective consequences of aging in teachers and the evidence is mixed: there are reports that increased years of teaching experience result in better affective well-being of teachers (Kini & Podolsky, 2016), but also findings that show the opposite effect (Fernández-Berrocal et al., 2017). In Portugal, the mental health data seems to support the latter findings (Varela et al., 2018), running counter to some of the trends in the literature on affective aging in the general population that show a general maintenance of emotional abilities and well-being in older life (although in Portugal the issue is concomitant with political and institutional changes that may negatively affect teacher motivation; for a discussion see Alves et al., 2020).

Finally, the least studied area of teachers' aging concerns the neural/neuropsychological age-related effects. The rationale for this approach follows what has been described above for the examination of teachers' cognitive abilities: as teaching is an intellectually demanding profession, it may serve as a protective factor from cognitive and neural age-related decline. In one study (the only one of its kind to our knowledge), researchers used neuropsychological assessment and functional magnetic resonance imaging (fMRI) to compare the performance and brain activity of young and middle-aged teachers (Klaassen et al., 2016). The authors found no significant differences in neuropsychological performance between the groups in verbal memory and working memory tasks, but found better performance for the middle-aged group in verbal performance tasks (letter fluency and reading). However, despite no differences in performance, neuroimaging results showed that middle-aged teachers had higher levels of brain activation in the prefrontal cortex, which may be interpreted as a form of neural compensation: with age-related cognitive decline, larger portions of the brain are activated to perform a task, which reveals a less effective neural system (Klaassen et al., 2016). In summary, as mentioned, although there are signs of neural decline, aging teachers perform as well as younger teachers. Hypothetically, this may be an effect of the high intellectual demands of the teaching profession (involving reorganization of neural networks) that, in the face of neurobiological aging, induces novel neural strategies to achieve the required results.

The finding described above raises the possibility of dissociating cognitive abilities *per se*, many of which indeed decline with aging, from the capacity to employ them strategically, which allows maintaining an adequate level of performance even in the face of age-related cognitive decline. A domain that related to this is that of executive functions, which are defined as

“domain-general control processes that monitor and regulate other cognitive processes to guide the attainment of future goals” (Head et al., 2008, p. 492). These include the broad components of inhibitory control (to be able to inhibit one’s behavior or thoughts), working memory (to mentally store and manipulate information), and cognitive flexibility (the ability to adaptively change between tasks or cognitive operations) (Diamond, 2013).

In summary, there is mixed evidence regarding the emotional well-being of older teachers. It is also unclear whether the demands of teaching function as a protective factor in the face of neurobiological aging. In this sense, more research on the neuropsychology of aging teachers is needed. Specifically, it is of import to assess executive functions as these may be better predictors of successful outcomes than cognitive abilities per se. The present study, which we describe below, attempts to contribute to this research effort.

1.3. THE REKINDLE+50 PROJECT AND THE PRESENT STUDY

The REKINDLE+50 project (<https://www.fpce.up.pt/rekindle50>) was designed to address the issue of aging in the teaching profession, aiming to mitigate some of the negative aspects related to aging. By offering training programs to teachers designed to increase their mastery of new technologies, we expected to provide teachers, and especially aging teachers, with tools for curricular innovation that could capitalize on their vast experience while integrating it with novel digital tools (Morgado et al., 2021; Mouraz et al., 2021). The selection of ICT as a target for the training program comes from evidence that older teachers often struggle to keep up with technological advances, which adds to the difficulties that accompany aging, and would benefit from skills that allow them to overcome this gap (for a detailed take on this issue, see Monteiro & Carqueja, 2021).

In this training program, teachers were introduced to technology-based teaching methods (e.g., use of digital devices in the classroom, flipped classroom, digital storytelling, including video development and editing) and several specific educational digital platforms (e.g., Padlet, Powtoon, EdPuzzle). The training program involved active engagement by the participating teachers that were encouraged to develop small projects making use of these platforms and to outline possible use-cases to bring to their own classrooms. The program consisted of nine sessions totaling 25 hours, plus 25 hours of autonomous work.

As the focus of the present study is on more general characteristics of aging teachers, we refer the reader to the published works that document the training program in more detail – see Mouraz et al. (2021) –, which include contributions by the participating teachers that describe the concrete examples of the teaching projects they developed in the training program (e.g., “Producing a Digital Storytelling on healthy eating” – Firmino, 2021; “An experiment with EdPuzzle in Physics and Chemistry” –Costa, 2021).

In line with the literature reviewed above on aging and aging teachers, the REKINDLE+50 project offers an interesting opportunity to further our understanding of the neuropsychological and affective characteristics of aging teachers. To that end, we conducted neuropsychological evaluations of

the teachers that participated in the training program before and after the program was implemented. We assessed “cool” and “hot” executive functions (Zelazo & Carlson, 2012), that concern cognitive and emotional/affective functioning respectively, symptoms for anxiety and depression, as proxies for affective well-being, and teacher job satisfaction, as a way to examine the association between the psychological variables and professional dimensions. The full details of the assessment instruments and procedure are described in the Method section below. Although the distinction between “hot” and “cool” executive functions is not consensual in the literature, we followed the conceptualization of Zelazo and Carlson (2012). These authors describe all executive functions as top-down regulatory processes but suggest that there may be different executive processes for tasks involving only “cool” cognitive control (e.g., the Wisconsin Card Sorting Test, the Trail Making Test) and “hot” tasks that additionally carry motivational or emotional significance (e.g., the Iowa Gambling Task) based on neuropsychological lesion studies that show dissociation between the two. Specifically, “cool” executive functions seem to depend more on dorsolateral regions of the prefrontal cortex whereas “hot” executive functions are more linked to the orbitofrontal cortex. Interestingly, this dissociation mimics some of the observed findings regarding the differential effects of aging on different brain regions (described in section 1.1). In any case, it is worth noting that distinctions such as “hot”/“cool” executive function are simplifications of neuropsychological functioning that, for the time being, may serve as proxies for more complex sets of neuropsychological processes that are yet to be fully understood.

This assessment allowed us to conduct an exploratory study with the following goals. First, we wanted to examine whether the neuropsychological findings and/or job satisfaction changed as a function of the training program. It is unlikely that there would be neuropsychological changes following a brief training program, but we expected some increase in job satisfaction, and the contents of the training programs directly impinge on job skills. Secondly, we were also interested in whether neuropsychological findings would be related to job satisfaction. Given the lack of consistent previous research on this topic, we were unable to advance strong hypotheses, but we expected to find an association between job satisfaction and symptom measures, given that both constructs involve affective components.

2. METHOD

2.1. PARTICIPANTS

Forty-one teachers that took part in the REKINDLE+50 training programs at two geographical sites (Maia and Mangualde school districts in Portugal) participated in the pre-test assessment. However, the final sample only included the 24 participants that also completed the post-test assessment (17 female, $M_{age} = 55.17$, $SD_{age} = 2.88$, range 51 to 62 years of age). None of the participants reported a neurological or psychiatric condition at the time of assessment.

2.2. MATERIALS

Trail Making Test (TMT). The TMT assesses visuo-motor attention and executive function by asking participants to connect ordered dots as quickly as possible and measuring the time (in seconds) it takes for them to complete the task. Part A provides a score for visuo-motor attention (participants must connect numbered dots) while Part B assesses both visuo-motor attention performance and executive function, namely the ability to switch between stimuli sets (participants must alternate in connecting numbers and letters, e.g., 1-A, 2-B, etc.). The difference between Parts A and B provides a measure of executive function without the components of visual scanning and motor speed. The Portuguese normative data for the TMT supports its reliability and validity (Cavaco et al., 2013).

INECO Frontal Screening (IFS). The IFS is a brief screening tool to assess executive function, with well-established psychometric properties. It includes eight subtests that tap into three broad components of executive function: (1) response inhibition and set shifting (subtests Motor Programming, Conflicting Instructions, Go–No Go, Verbal Inhibitory Control), (2) abstraction (Proverb Interpretation), and (3) working memory (subtests Backwards Digit Span, Verbal Working Memory, Spatial Working Memory) (Torralva et al., 2009). We used the validated Portuguese adaptation of the IFS and the respective norms for the Portuguese population (Moreira et al., 2014).

Computerized version of the Iowa Gambling Test (IGT). The IGT was introduced by Bechara et al. (1994) to simulate, “in real time, personal real-life decision-making relative to the way it factors uncertainty of premises and outcomes, as well as reward and punishment” (p. 8). Participants must choose between four different decks of cards that may yield gains or losses, without knowing initially that two of the decks are disadvantageous (they yield high gains but higher losses) and the other two are advantageous (yielding lower gains, but even lower losses). The score in the task is computed as the following subtraction: number of cards chosen from the advantageous decks minus number of cards drawn from the disadvantageous decks. This task is considered to measure “hot” executive functions as participants must inhibit their tendency to draw cards from the decks with higher gains (disadvantageous) to reach a better outcome at the end of the task (Pasion et al., 2017). We used the Portuguese version of the IGT incorporated in the PEBL tool (Mueller, 2012; Mueller & Piper, 2014).

Hospital Anxiety and Depression Scales (HADS). The HADS is a screening test for anxiety and depression with proven utility in the assessment of changes in emotional state. It includes two subscales, namely Anxiety and Depression. Each scale has seven items, and each item is answered by the participant in a 4-point response scale (0-3), yielding results between 0 and 21 for each subscale. The Portuguese version of the HADS showed indicators of reliability (Cronbach's alpha of .76 for anxiety and .81 for depression) and validity (factorial structure; convergent validity) that are similar to those in international studies (Pais-Ribeiro et al., 2007).

Teacher Job Satisfaction Questionnaire (TJSQ). The TJSQ assesses the teachers' perception and evaluation of several work-related factors (Lester, 1987). We used the Portuguese version adapted and validated by Seco (2000), which showed high reliability (Cronbach's alpha of .91 for the full scale and > .84 for individual factors). It consists of 70 Likert-scale items (1 = completely disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = completely agree) that make up five subscales/factors. Factor 1, "Nature of the work itself" (21 items), concerns satisfaction with teaching tasks, including creativity and autonomy in the profession. Factor 2, "Personal rewards" (19 items), relates to salary, social recognition, and career progression. Factor 3, "Material working conditions" (8 items), addresses school facilities and equipment. Factor 4, "Relationship with colleagues" (14 items), and Factor 5, "Relationship with management structures" (8 items), regard interactions with colleagues and with management, respectively (Borges & Daniel, 2009; Seco, 2000).

2.3. PROCEDURE

Participants read and signed an informed consent form that explained the details of the study, which conformed to the professional ethical standards for research in Psychology. After that, they were assessed by a registered psychologist who administered the Trail Making Test (TMT), INECO Frontal Screening (IFS), and Iowa Gambling Task (IGT). This concluded the testing session and soon after they received a link to respond to an online survey including the Hospital Anxiety and Depression Scales and the Teacher Job Satisfaction Questionnaire (survey hosted at the University of Porto's LimeSurvey server: <https://inqueritos.up.pt>). This procedure was conducted at the beginning of the training program and then repeated after the training program was over. We will refer to these two time-points as pre-test and post-test assessment hereafter.

2.4. ANALYSIS

Standardized results (z-scores) were computed for each participant and time-point (pre- and post-test) based on norms for the Portuguese population for the TMT and IFS. The HADS provided scores (sums) for anxious and depressive symptoms and the TJSQ allowed computing scores (percent of maximum possible subscale score, as different subscales have a different number of items) for the five factors that make up this instrument.

In line with our research questions, we first tested for differences between the pre-test and the post-test for the measures collected by using paired samples t-tests. Then we examined the correlations between neuropsychological measures, symptom scales, and dimensions of job satisfaction using Pearson's correlation coefficients. Given the exploratory nature of this study, we report a statistical significance threshold of $\alpha = .05$ without correction for multiple comparisons (Dirnagl, 2020).

3. RESULTS

The descriptive statistics and statistical comparisons of the pre- and post-test assessments are presented in Table 1.

Table 1
Descriptive (Means and Standard Deviations) and Paired Samples T-Test Statistics for the Comparison of Neuropsychological, Affective, and Job Satisfaction Measures Between Pre-Test and Post-Test

	$M_{pre} (SD)$	$M_{post} (SD)$	$t_{post-pre}$	df	p	d
TMT A (z)	-0.67 (1.64)	0.48 (0.84)	4.26	23	<.001	0.87
TMT B (z)	0.11 (0.79)	0.42 (0.85)	2.00	23	.057	0.41
TMT difference (z)	0.58 (1.26)	0.23 (0.85)	-0.99	20	.336	-0.22
IFS (z)	0.31 (0.73)	0.36 (0.65)	0.30	23	.769	0.06
IGT total	-3.64 (10.36)	-0.92 (27.58)	-0.29	21	.774	-0.06
HADS Anxiety	6.86 (2.77)	7.09 (3.30)	0.63	21	.535	0.13
HADS Depression	5.68 (3.12)	5.30 (3.30)	-1.13	21	.271	-0.24
TJSQ F1 (%)	79.78 (9.19)	83.31 (8.95)	2.26	21	.035	0.48
TJSQ F2 (%)	49.81 (7.41)	52.49 (10.52)	1.92	21	.069	0.41
TJSQ F3 (%)	66.62 (17.49)	73.42 (13.82)	2.47	21	.022	0.53
TJSQ F4 (%)	74.81 (8.66)	76.15 (9.56)	0.72	21	.478	0.15
TJSQ F5 (%)	63.64 (17.77)	66.83 (20.47)	1.06	21	.302	0.23

Note. TMT: Trail Making Test; IFS: INECO Frontal Screening; IGT: Iowa Gambling Task; HADS: Hospital Anxiety and Depression Scales; TJSQ: Teacher Job Satisfaction Questionnaire; F1: Nature of the work itself; F2: Personal rewards; F3: Material working conditions; F4: Relationship with colleagues; F5: Relationship with management structures. Statistically significant results in bold.

Regarding the correlations between neuropsychological measures, symptom scales, and dimensions of job satisfaction, in the pre-test, the IGT showed a statistically significant positive correlation with TJSQ Factor 1 - "Nature of the work itself", ($r(18) = .489, p = .029$), Factor 2 - "Personal rewards" ($r(18) = -.471, p = .036$), and Factor 3 - "Material working conditions"

($r(18) = -.499, p = .025$). We also found a negative association between the pre-test score on the HADS Anxiety scale and the TJSQ Factor 4 - "Relationship with colleagues", $r(20) = -.443, p = .039$.

In the post-test, the HADS Depression scale was negatively correlated with the TJSQ Factor 1 - "Nature of the work itself" ($r(21) = -.442, p = .035$), Factor 3 - "Material working conditions" ($r(21) = -.433, p = .045$), and Factor 5 - "Relationship with management structures" ($r(21) = -.498, p = .016$).

4. DISCUSSION

Given the current interest on understanding the psychological and social effects of aging, we conducted neuropsychological and affective evaluations of teachers over 50 years of age that participated in an ICT-focused training program before and after the program was implemented. These assessments covered executive functioning (both "cool" and "hot"), affective symptoms (anxiety and depression), and teacher job satisfaction.

The standardized results obtained by the participants in both pre- and pos-test assessments showed that neuropsychological abilities and affective symptoms were within the normal range, when compared to the general Portuguese population (matched for age, sex, and education). We believe this is to be expected of active teachers, but as the literature in this field is scarce, we hope that more studies will provide these kinds of data as to establish a proper evidence base.

When comparing neuropsychological results before and after the training program, only the results for the Trail Making Test (TMT) - Part A showed a significant improvement. However, this is likely due to practice effects (which are known to occur for this instrument; Strauss et al., 2006): as participants already had completed this simple test before, they were able to perform faster in the second assessment. Indeed, our expectation was that neuropsychological results would not significantly change due to the training program as these instruments assess somewhat stable individual characteristics whereas a training program is, by definition, an activity that aims improve and change specific skills and knowledge of the individual. Nonetheless, we thought it would be important to characterize teachers at this level, as research in this field is limited. Perhaps a long-term program would amount to changes in some domains of neuropsychological functioning. We also did not find differences in affective symptoms before and after the program.

Comparing the results for job satisfaction, we found increased satisfaction in two dimensions of teacher job satisfaction, namely for Factor 1 - "Nature of the work itself", and Factor 3 - "Material working conditions". This finding seems to be aligned with the nature of the training program that targeted ICT skills and resources. Having undergone the training, teachers objectively gained ICT expertise that impinges on the nature of their pedagogical work and were able to use a set of novel digital tools that effectively change the material conditions for performing their work (Mouraz et al., 2021). Interestingly, we found no improvement in job satisfaction for dimensions that were not directly targeted by the training program (namely, Factor 2 - "Personal rewards", and Factor 5 - "Relationship with management

structures”). Concerning Factor 4 - “Relationship with colleagues”, there was an emphasis on collaborative work during the training program, which could lead us to expect changes at this level. But these collaborations were restricted to the training setting and did not necessarily involve engaging with other teachers in the school, which may explain this result.

Overall, these findings, although tentative due to the limited sample size (see discussion on limitations below), suggest that the training program had a positive impact on teacher job satisfaction. This has potential implications for the promotion of active aging in teachers. If the results of this exploratory study are replicated, perhaps they can provide an operational way to improve job satisfaction of aging teachers. This practical consequence will be of growing importance in upcoming years, as the active population and teachers continue to age (European Commission’s Directorate-General for Economic and Financial Affairs, 2018).

Turning to the associations between neuropsychological/symptom assessments and job satisfaction, these analyses were meant to examine what aspects of psychological functioning contributed to job satisfaction and how. We analyzed the association between neuropsychological/affective measures and job satisfaction separately for the pre-test and post-test periods.

Regarding job satisfaction in the pre-test assessment, we found that scores on the IGT, which measures “hot” executive functions, were positively correlated with three dimensions of teacher job satisfaction: “Nature of the work itself”, “Personal rewards”, and “Material working conditions”. “Hot” executive functions concern the ability to regulate cognitions and behaviors in affectively and motivationally charged situations (Zelazo & Carlson, 2012). In this sense, the positive correlations found suggest that better levels of affective regulation/hot executive functioning are linked to higher satisfaction in performing the teaching profession, the appreciation of the tangible and social rewards associated with the job, and a better handling of the material working conditions. It may be that better abilities to regulate emotions and exert self-control allows teachers to make the most out of the job and derive higher satisfaction from their activity. Also, it is well established that teacher satisfaction is linked with positive teacher-student relationships and student achievement (Meister & Ahrens, 2011; Veldman et al., 2016). Perhaps affective regulation, as measured by neuropsychological and affective measures, plays a role in the quality of teacher-student relationships and influences teacher satisfaction as a moderator (a hypothesis that may be tested in future studies).

We also found that higher (non-clinical) levels of anxiety symptoms were linked to less job satisfaction regarding “Relationship with colleagues”. Anxiety can be broadly defined as a negative affective state due to the anticipation of a threat, and anxiety symptoms involve damaging effects of these processes (McNally, 2009). Indeed, higher levels of anxiety are associated with impaired social functioning (Saris et al., 2017), and our findings suggest that this link may also affect professional relationships in educational settings.

In the post-test assessment, we found that higher levels of (non-clinical) depression were associated with lower job satisfaction in terms of the “Nature of the work itself”, “Material working conditions”, and “Relationship with management structures”. Depression is characterized by the experience

of negative mood and emotional states, lack of physical and mental energy, lack of engagement in activities, and sometimes changes in motivated behaviors (e.g., appetite, sleep) (Power, 2009).

Overall, these results (including both pre-test and post-test) show a link between “hot” executive functions and affective symptoms and job satisfaction. We cannot infer causality based on the data we have, but the association is nonetheless relevant. This finding highlights the importance of emotional factors, when considered from a neuropsychological point of view, in teacher job satisfaction, which we hope may become a focus of research. Specifically, it would be important to rely on psychological and neuropsychological assessment to further investigate these associations. We also found that cognitive executive function measures were neither improved by training nor associated with teacher job satisfaction. On one hand, we did not expect improvements at this level and findings seem to go with this prediction. On another hand, the baseline levels of executive function were in the normal range, suggesting no difficulties in this domain. Perhaps in samples that demonstrate difficulties in executive function this may impact on job performance and satisfaction, but this remains an open question for future research.

Finally, it is important to note the limitations of the present study, which should be considered exploratory, given that it relied on a small sample size and a specific selection of measures (Jaeger & Halliday, 1998). As such, the findings with the present sample warrant further replication in future studies to be confirmed. Also, a wider selection of assessment measures may provide more information. Here we were limited in the number of instruments as to make the assessment sessions feasible. Despite these limitations, we believe that the findings reported in this study raise relevant hypotheses for future research.

Overall, the aging of teachers remains a challenge for the future. The policies for promoting Active Aging provide a strategic outlook on how to tackle this issue, but a more detailed understanding of age-related cognitive and affective changes is required to devise effective measures. In this study, we found initial evidence that job satisfaction in older teachers can be improved by innovative training programs and that job satisfaction is mainly related to affective well-being, namely “hot” executive functions and levels of anxious and depressive symptoms (although we cannot specify if emotional well-being is a cause or a consequence of job satisfaction). If these results are replicated and extended, they may provide an evidence base for devising concrete applications to promote Active Aging in teachers.

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Avaliação neuropsicológica e afetiva de professores com mais de 50 anos antes e depois de uma formação focada nas TIC: Aumento da satisfação profissional e relação com fatores afetivos

RESUMO

O envelhecimento da população levanta várias questões sociais e relacionadas com a saúde, sendo que este fenómeno é particularmente acentuado na Europa, onde políticas de promoção do Envelhecimento Ativo estão a ser desenvolvidas. Na Educação, o envelhecimento dos professores coloca desafios significativos à profissão. O projeto REKINDLE+50 desenvolveu um programa de formação sobre o uso de Tecnologias de Informação e Comunicação (TIC) para professores com o intuito paralelo de promover as capacidades e motivação de professores com mais de 50 anos. Aqui reportamos sobre a avaliação, pré e pós-formação, de capacidades neuropsicológicas (funções executivas “cool” e “hot”), autorrelatos afetivos e satisfação profissional. Verificámos que a formação estava associada a um aumento da satisfação com a natureza do próprio trabalho de professor e com as condições materiais de trabalho. Não houve alterações significativas nas medidas neuropsicológicas nem afetivas antes e depois da formação. Também verificámos que a satisfação profissional estava positivamente associada com funções executivas “hot” e negativamente associada a sintomas afetivos (ansiedade e depressão subclínicas). Estes resultados, embora provisórios, sugerem que a formação teve um impacto positivo na satisfação profissional dos professores e que pode ter implicações para a promoção do envelhecimento ativo destes profissionais. No geral, o envelhecimento dos professores permanece um desafio para o futuro. As políticas de promoção do Envelhecimento Ativo oferecem uma visão estratégica sobre como lidar com esta questão, mas uma compreensão mais detalhada das alterações cognitivas e afetivas relacionadas com a idade é provavelmente necessária para a criação de medidas efetivas.

Keywords: Envelhecimento ativo; Professores; Funções executivas; Neuropsicologia; Satisfação profissional

Evaluación neuropsicológica y afectiva de docentes mayores de 50 años antes y después de la formación centrada en las TIC: Incremento de la satisfacción laboral y relación con factores afectivos

RESUMEN

El envejecimiento de la población plantea varios problemas sociales y relacionados con la salud, y este fenómeno es particularmente pronunciado en Europa, donde se están desarrollando políticas para promover el Envejecimiento Activo. En Educación, el envejecimiento de los docentes plantea importantes desafíos a la profesión. El proyecto REKINDLE+50 desarrolló un programa de formación sobre el uso de las Tecnologías de la Información y la Comunicación (TIC) para profesores con el objetivo paralelo de promover las habilidades y la motivación de los profesores mayores de 50 años. Aquí informamos sobre la evaluación, previa y posterior a la formación, de las habilidades neuropsicológicas (funciones ejecutivas “cool” y “hot”), autoinformes afectivos y satisfacción laboral. Encontramos que la formación se asoció con una mayor satisfacción con la naturaleza del propio trabajo del profesor y con las condiciones materiales de trabajo. No hubo cambios significativos en las medidas neuropsicológicas o afectivas antes y después del entrenamiento. También encontramos que la satisfacción laboral se asoció positivamente con las funciones ejecutivas “hot” y negativamente con los síntomas afectivos (ansiedad y depresión subclínicas). Estos resultados, aunque provisionales, sugieren que la formación tuvo un impacto positivo en la satisfacción laboral del profesorado y que puede tener implicaciones para la promoción del envejecimiento activo de estos profesionales. En general, el envejecimiento de los docentes sigue siendo un desafío para el futuro. Las políticas para promover el envejecimiento activo ofrecen una visión estratégica sobre cómo abordar este problema, pero es probable que se necesite una comprensión más detallada de los cambios cognitivos y afectivos relacionados con la edad para crear medidas efectivas.

Palavras-chave: Envejecimiento activo; Profesores; Funciones ejecutivas; Neuropsicología; Satisfacción laboral