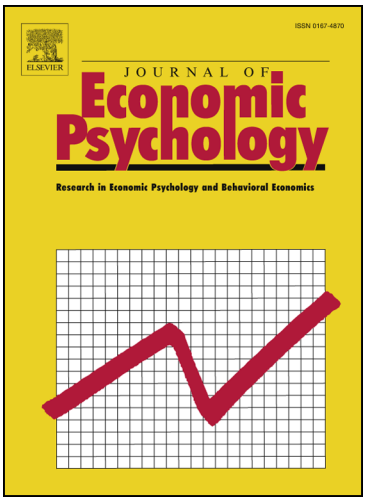

Unemployment and General Cognitive Ability: A Review and Meta-Analysis

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Unemployment and General Cognitive Ability: a Review and Meta-Analysis.

Abstract. Evidence suggests an association between unemployment and general cognitive ability. Factors such as changes in environmental stimulation and the effects of stress may act as mediators in this relationship. We conduct a qualitative review and meta-analysis to determine whether an association between unemployment and general cognitive ability exists. Eighteen studies were included in the qualitative review, and six in the meta-analysis. Results of the review indicated a significant association between unemployment and lower cognitive ability. The meta-analysis supports this association, displaying a medium effect size which increased when age was included as a covariate. Both analyses point towards the existence of a relationship between unemployment and low cognition, moderated by age and promoted by the loss of stimulation obtained through employment, as well as by the stress experienced during unemployment. Based on these results, a series of suggestions are made to improve future studies in this emerging area.

Keywords: unemployment, general cognitive ability, systematic review, meta-analysis

Unemployment has a significant impact on individuals, economy, and society, and comes at a high personal and economic cost (Eardley, 2002). Therefore, to develop interventions that mitigate its effects, it is essential to study the factors involved in the relationship between unemployment and psychological, social, and health dimensions (Friehe & Marcus, 2021; Hoang & Knabe, 2021; Moore et al., 2017; Tøge, 2016; Watson et al., 2020). One of these factors may be cognitive ability. However, to understand how the lack of employment may affect cognitive ability, and vice versa, it is first necessary to understand what cognitive benefits employment brings. According to Vance et al. (2016), work has a positive effect on cognitive abilities through brain plasticity, particularly through the increase of the cognitive reserve. Neural plasticity is the brain's ability to change its structure, and to function through experience and environmental stimulation, and it is reflected in behavioral differences between stages of life and/or individual experiences (Kolb & Whishaw, 1998). Findings may have established five characteristics of work that maintain and improve cognition through brain plasticity (Vance et al., 2016): social participation (Evans et al., 2019; Jedrziewski et al., 2014), routine (Erickson et al., 2019), goal setting and its meaning (Hakanen & Schaufeli, 2012), income (Mucci et al., 2016; Sturgeon et al., 2016), and learning new skills (Chein & Schneider, 2005; Zatorre et al., 2012). Furthermore, there is a large body of literature on the cognitive benefits of jobs that involve learning and developing new skills. For instance, Marquie et al. (2010) found that, in 32-62-year-old workers, higher levels of cognitive demands at work were associated with better cognitive performance. However, a more interesting finding of this study was that these demands were related to a favorable change in cognition, as noted in a 10-year follow-up. Similarly, Schooler (1984) through his study of environmental complexity

posited that intellectually demanding environments enhance cognitive status due to the activation of brain plasticity. As challenging work tasks require and reward workers' cognitive effort (Then et al., 2014), this theory can be applied to the stimulation provided by employment. Therefore, when the environment changes and demands decrease, a reduction in cognitive functioning could also be expected when adapting to the new environment. In this case, changes are explained by the malleable attentional resources theory (Young & Stanton, 2002), according to which low demands cause a decrease in cognitive performance when resources adapt to the needs of the situation. In this model, the relationship between demands and performance would display an inverted U-shape. Thus, cognitive performance would not only deteriorate in low-demand situations (e.g., unemployment), but also in highly demanding environments (e.g., highly stressful jobs).

Furthermore, unemployment is considered a psychosocial stressor (Sumner & Gallagher, 2017) and some theoretical models of stress have sought to argue why unemployment might lead to alterations in health and cognition. The stress process model (Sandín, 1994) posits that stress is an interactive process whereby environmental demands, which are perceived as threatening, trigger a physiological reaction that activates the hypothalamic-pituitary-adrenal axis (HPA), with the consequent release of cortisol and the activation of the autonomic nervous system. These physiological responses have been associated with structural and functional changes in the brain (Martín-Pérez et al., 2019). Specifically, these responses inhibit the genesis of new neurons and reduce the size of the hippocampus and prefrontal cortex. Thus, stress has been linked to the deterioration of cognitive abilities (Butler et al., 2017; de Quervain et al., 2009; Lupien et al., 2009).

Complementarily, Blanchard and Summers' (1986) theory of hysteresis suggests that longer periods of unemployment initiate a process of deterioration of workers' skills, with cognitive abilities possibly included among these skills. This process is accompanied by a drain in productivity and motivation, and ultimately might affect workers in the opposite direction, reducing their employability in the future. Therefore, the deterioration of cognitive performance due to unemployment might be a mediating factor of unemployment at a later stage in life. In favor of this argument, evidence from findings in industrial and organizational psychology supports the general cognitive ability index (g factor) as being the best predictor of job performance (Bertua et al., 2005; Schmidt & Hunter, 1998), and mediates unemployed people's likelihood of being hired (Outtz, 2002).

The above-mentioned theories suggest that not only may cognitive abilities be a factor of employability, but they may also change because of employment status. Given the socio-economic and psychological relevance of unemployment, it is necessary to find data that provide a deeper understanding of the association between human cognition and unemployment. To our knowledge, this is the first systematic review and meta-analysis analyzing this topic and the correlation between unemployment and cognitive performance.

Therefore, the aims of this study were: (i) to systematically review the evidence on the association between unemployment and cognition; (ii) to determine what is the average strength of the association between unemployment and cognition; and (iii) to explore whether there are moderator variables in the association between unemployment and cognition.

1. Method

A literature review of the topic was conducted with the following eligibility criteria: (a) longitudinal, cross-sectional, or case-control studies; (b) at least one unemployment variable; (c) at least one cognitive functioning measurement; (d) statistical results showing an association between unemployment and cognitive performance measures; (e) no language or date restriction. The criteria for exclusion were studies that used samples of people with physical or mental illness, or studies that were exclusively composed of retired people. Following the screening, 18 studies were included in the review. All of them were methodologically assessed and a selection was made for inclusion in the meta-analysis. More details about the procedure of the literature search are available in the Online Appendix (S1).

1.1. Meta-analysis procedures

Only those studies that had a measure of general comparable cognitive ability were included; that is, general intelligence multicomponent measures (i.e., the Børge Priens Prøve – Teasdale, 2009-, a test that provides an overall score from 78 items assessing letter matrices, verbal analogies, numbers and geometric figures series), and global measures based on fluid intelligence (i.e., standard progressive matrix). Both kinds of measures are widely considered as general cognitive ability tests due to their high correlation (Raven & Raven, 2003). Two studies were excluded from the meta-analysis because they applied tools that were specific to screening cognitive impairment in older people (Freitas et al., 2012; Moraes et al., 2010). An additional requirement was that the data of these measurements were available for both unemployed (non-working or studying individuals, and those who are seeking employment) and employed groups (individuals in a paid job). If this additional

requirement was not met, studies were included if an odds ratio measure indicating the probability of being employed or not, based on cognitive performance, was available. As a result, six of the eighteen studies were included in the meta-analysis (Creed, 1999; Creed & Wiener, 1999; Lynn et al., 1984; Meyers & Houssemand, 2010; Mani et al., 2013; Hegelund et al., 2018).

1.2.1 Data extraction and management.

To perform the meta-analysis, we extracted means and standard deviations from the unemployed and employed groups to compute effect sizes and standard errors. In cases where means and standard deviations were not available, data were requested from the authors. In one case (Meyers & Houssemand, 2010), odds ratios were transformed to effect sizes according to Cohen (1988), using the Psychometrica calculator (Lenhard & Lenhard, 2016). Means and standard deviations for women and men from Lynn et al.'s study (1984) were merged according to Cochrane's recommendations (Higgins et al., 2019). One study could not be included, as the necessary data to calculate its effect size were not available (Caspi et al., 1998).

1.2.2. Statistical analyses.

The meta-analysis was conducted using a random-effects model based on Hunter and Schmidt's method (1990). Q, I^2 and τ statistics were used to test heterogeneity. The magnitude of the average effect size was judged using a recently proposed guideline (Gignac & Szodorai, 2016) where effect sizes of 0.15, 0.25 and 0.35 are considered small, typical, and large, respectively. Furthermore, a separate meta-regression was also conducted to test if the age of the sample when the cognitive measures were collected explained some variance. The study of other moderator variables was not possible due to a lack of available data. Publication bias analyses

were conducted using a rank correlation test to study asymmetry (Begg & Mazumdar, 1994; Egger et al., 1997). Forest plots and funnel plots with standard errors were also generated. Analyses were performed using the JASP software (2020).

2. Results

2.1. Characteristics of the studies

The 18 included studies in the review were published between 1917 and 2020 (Details in Online Appendix – S2). Regarding the age of the samples at the time of cognitive assessment, six studies included broad age ranges (from younger to older adults, i.e., 25-91 years old), four studies included middle- and older-aged adults (50-60+ years old), two used a sample from young to middle-aged adults (20-55 years old), and three of them were comprised of young people (15-20 years old). Additionally, one study used cognitive scores which were measured when the sample was only 7-9 years old (Caspi et al., 1998), and two did not report the age of the sample (Layton, 1985; Mani et al., 2013).

In terms of cognitive measures, tests for specific cognitive components were used in seven studies. However, they differed in the set of cognitive skills assessed, such as attention, speed processing, cognitive control, memory, or fluency. Two types of general ability measures were applied in nine studies. Five studies used a general measure based on fluid intelligence performance through a logic matrix task. The remaining four used a general multicomponent intelligence test, such as WISC-R (Weschler, 1974), MoCA (Nasreddine et al., 2005), BBP (Teasdale, 2009), and MMSE (Bottino et al., 1999). Finally, one study (Fryer & Warr, 1984) used a questionnaire of subjective cognitive ability instead of performance measures, another applied an IQ

measure (Caspi et al., 1998), and one used the crystallized factor measured with a vocabulary test (Layton, 1985).

The studies also varied by design (Cross-sectional, *n*=9; Cohort, *n*=9). Among the cross-sectional studies, two classified types of unemployed people according to their level of intelligence. Two studies used a pre-post design to determine if cognitive difficulties changed in the transition to or from unemployment. Four studies used a cross-sectional design to observe the differences in cognitive performance between unemployed and employed individuals. Among the cohort studies, three analyzed general cognitive ability in different employment trajectories after a short follow-up period (4-6 months). Three studies intended to predict employment status by the level of fluid intelligence after a one-year follow-up. One study carried out a follow-up of 4-6 years. Two studies aimed to predict young-adult unemployment through intelligence measured at an earlier stage after a 12-year follow-up. Finally, the aim of one cohort study was to determine if unemployment spells (>6 months) during the working stages of life were associated with cognitive performance at later stages of life.

2.2. *Qualitative results*

Regarding the relationship between unemployment and cognition, significant associations were found in 14 out of 18 studies. Nine studies supported cognition being worse in unemployed people in comparison with employed. Mani et al. (2013) found that a group of harvesters displayed worse cognitive performance during their unemployment period (before harvest), despite controlling for exercise, anxiety, stress, and physical activity. Haworth et al. (1990) found that unemployed people had lower general cognitive scores than employed people. Moreover, Moraes et al. (2010) reported that those who were 75 years old or more and were employed performed

better than their matched unemployed sample in the MiniMental State Examination. Longer unemployment length was associated with worse self-reported cognitive performance (Fryer & Warr, 1984), and unemployed individuals showed poorer cognition than employed individuals (Košćec-Bjelajac et al., 2019). A similar result was obtained by Lynn et al. (1984), who found that unemployed people had lower fluid intelligence than employed individuals. Pintner and Toops found that just 12.8% (1917) and 35% (1918) of their unemployed sample had a normal or higher mental age. Finally, Creed and Wiener (1999) showed lower scores in the Standard Progressive Matrix for unemployed people when compared with normative data.

One study found evidence for the long-term influence of unemployment during the course of life on later cognition (Leist et al., 2013). That is, the longer unemployment lasted for middle-aged individuals, the higher their risk of cognitive impairment in later stages of life. After stratifying their analyses by occupational class, they also found that, among the unemployed individuals, those in higher occupational categories showed a higher risk of cognitive impairment.

The four remaining significant results support cognition being associated with a later unemployment duration or occupational status. Meyers and Houssemand's (2010) research showed that fluid intelligence predicted unemployment following a 12-month follow-up period. In addition, fluid intelligence was the better psychological predictor of unemployment at 12 months for participants that did not find a job in the six first months of the study. Heineck (2011) showed that processing speed predicted unemployment propensity and the maintenance of a job, but it did not predict the manner in which an individual could exit unemployment. Caspi et al. (1998) and Hegelund et al. (2018) found that cognitive ability in younger ages (IQ being 7-9 years

old and fluid intelligence being 18 years old, respectively) was a strong predictor of unemployment 12 years later, particularly for people with lower levels of ability.

Only one finding supported a positive and significant association between unemployed people and better cognitive scores. It was reported by Creed and Wiener (1999) using the SILS-Abstract, despite them finding the opposite result with the Standard Progressive Matrix. It should be noted that the comparison group for the SILS-Abstract was a non-unemployed clinical sample from a previous study conducted 10 years earlier by Felvus (1989).

There were four findings regarding non-significant associations between cognition and unemployment. When age and education were controlled, Freitas et al. (2012) did not find differences in terms of cognition between unemployed people, retired people, and homemakers versus an employed group. Creed (1999) showed no correlation between fluid intelligence at ages 15-20 and length of unemployment four months later and during that period. Similarly, Sundstrup et al. (2020) found that the level of cognitive ability at ages 49-63 was not associated with unemployment 4-6 months later, after controlling for sociodemographic aspects, work characteristics, and health. Finally, Lynn et al. (1984) reported that even though fluid intelligence was lower in unemployed people, it did not predict unemployment one year later.

2.3. Results from the methodological quality assessment of the studies

Regarding the methodological quality score in the Newcastle-Ottawa scale (NOS; Wells et al., n. d.) and the adapted Newcastle-Ottawa scale (aNOS; Hermont et al., 2014), six of the eighteen studies were of good methodological quality (Caspi et al., 1998; Freitas et al., 2012; Košćec-Bjelajac et al., 2019; Leist et al., 2013; Moraes et al., 2012; Sundstrup et al., 2020). Nine of the studies were of fair methodological quality,

and three were of poor methodological quality. The checklist, detailed procedure, and scores for each study can be consulted in the Online Appendix (S3).

2.4. Meta-analysis results

A total of six studies were included in the meta-analysis (Creed, 1999; Creed & Wiener, 1999; Lynn et al., 1984; Meyers & Houssemand, 2010; Mani et al., 2013; Hegelund et al., 2018). The results showed a medium and significant effect size (*ES* = -0.27, *SE* = .088, 95%CI = [-0.44; -0.09], *p*=.002) (Figure 1). The Kendall's τ method indicated the absence of publication bias (τ = 0.067, *p*=1.00). However, Egger's rank correlation test was marginally significant (*p*=.048), indicating the possible presence of publication bias. The results showed a large heterogeneity, with *Q*(5) = 87.97, *p*<.001, I^2 = 85.0%, τ = 0.178. Therefore, a meta-regression was performed to examine the potential moderator effect of the age of the sample at the time of the cognitive assessment. The results displayed significant association (*ES* = -1.666, *SE* = .315, 95%CI = [-2.28; -1.04], *p*<.001; Age β = -0.058, *SE* = 0.012, 95%CI = [0.03; 0.08], *p*<.001), the heterogeneity indexes decreased to a medium degree (*Q*(5) = 45.579, *p*<.001, I^2 = 68.7%, τ = 0.131), and the Egger's test suggested the absence of publication bias (*p*=.379) (Figure 2).

Figure 1
Forest plot of the meta-analysis of studies assessing fluid intelligence.

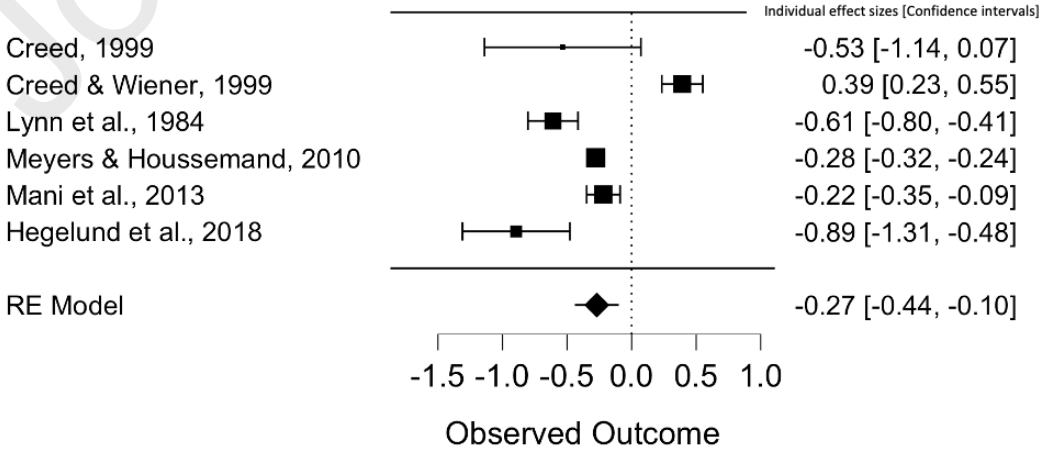
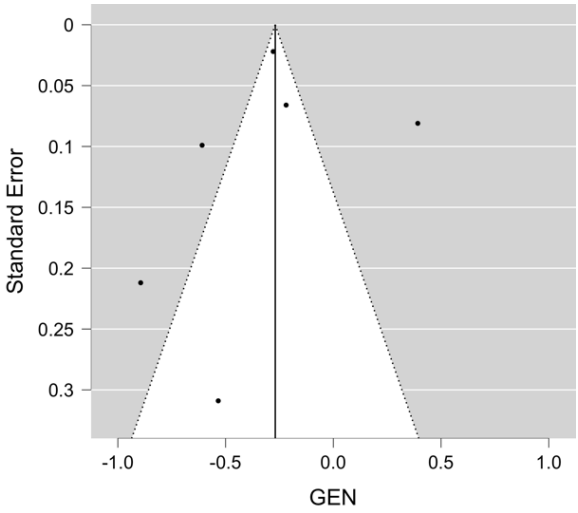


Figure 2

Funnel plot of the meta-analysis.



3. Discussion

The first objective of the study was to determine whether an association between unemployment and cognition exists. Findings from the qualitative review and the meta-analysis indicate that there is evidence to support an association between unemployment and lower general cognitive performance.

The following set of studies, which show that unemployed people have lower cognition, can help us understand the complexity of this relationship. One of the mechanisms that could explain this association, and which has been found in previous research (Rohwedder & Willis, 2010; Schooler, 1984; Young & Stanton, 2002), is the effect of losing the stimulation that was provided by work during unemployment. In this regard, the environmental complexity theory (Schooler et al., 1999) posits that cognitive function is more likely to decline when some environmental factors change and when intellectual effort is no longer required. There are findings that support this theory in the opposite direction, as high intellectual demands at work have been proven to increase people's cognitive functioning (Schooler et al., 1999; Then et al.,

2014). In addition, low intellectual demands have been shown to be associated with a higher risk of decline in processing speed, memory, and general cognitive performance (Bosma et al., 2003). Unfortunately, most of the studies analyzed in this work did not report specific data to discuss potential explanatory mechanisms. The only one that clearly presents support for this theory found that the risk of cognitive impairment in older individuals was higher for higher-skilled workers (Leist et al., 2013), who were employed in jobs with higher intellectual demands.

A second mechanism that may be proposed is based on the evidence that unemployment is a stressor and, as such, affects people's health and cognition (Kapuvári, 2011; Sumner & Gallagher, 2017). Stress has been linked to worse attention performance (Liston et al., 2009), learning (Niessen, 2006), and information recall (de Quervain et al., 2009). Thus, referring to the processual model of stress (Sandín, 1994), stress could be a mediator between unemployment and impaired cognitive performance. However, only one of the studies reviewed analyzed stress as a possible moderating factor (Mani et al., 2013), and showed worse cognitive performance for the period of unemployment. According to Mani et al. (2013), cognitive functioning was affected by the financial worry brought on by unemployment. A recent study (Bruijn & Antonides, 2020) has found that income and making ends meet are the main determinants of financial worries. In this sense, it would be interesting to study the relationship between stress and income during unemployment, and the association with cognitive ability at this time, in greater depth.

On the other hand, some studies show that lower cognitive ability is associated with a higher probability of being unemployed. We propose that the theory of hysteresis (Blanchard & Summers, 1986) could explain this effect. According to this

theory, there is a fundamental asymmetry between unemployed people and those who continue working (e.g., in wages or skills), which places the former in a disadvantaged situation. While employed individuals maintain or improve their standard of living and skills, unemployed individuals must adapt and face greater difficulties in returning to the labor market. This affects their risk-taking attitude, which may prevent them from entrepreneurship (Hetschko & Preuss, 2020). The qualitative analysis highly suggests an association between low general cognitive ability and unemployment, although it is not possible to apply this theory to those with higher general cognitive ability levels. Results from Hegelund et al. (2018) clearly represent this effect, as they found that low intelligence at age 18 predicted unemployment at the age of 30, but the prediction was weak for medium IQ levels and null for higher intelligence scores. This seems reasonable, considering that general cognitive ability is one of the main predictors of job performance (Bertua et al., 2005). Thus, a low level of cognitive ability may be insufficient to meet the requirements for obtaining or maintaining certain jobs. However, some characteristics of these studies might prevent generalization of these results, such as the duration of the follow-ups and the age of the samples. Some of the studies included follow-up periods of four months (Creed, 1999) or one year (Lynn et al., 1984) for samples aged 16-20 and 15-16, respectively, which are not representative of unemployment or the course of professional trajectories. Manacorda et al. (2017) found that for individuals in Asia, Latin America, Africa, and Europe, the mean duration of job seeking for their first job is 23 months, and 41.3 months for a stable job. Moreover, it is known that teenagers and young adults face more difficulties when seeking employment because of their lack of work experience (Raaum & Røed, 2006; Reneflot & Evensen, 2014). However, the

availability of routes to exit from unemployment are greater for young adults, as they can seek education or training programs (Reneflot & Evensen, 2014), which increase their likelihood of finding a job at a faster rate (Ahn et al., 2004; Manacorda et al., 2017). In light of this, longer periods of follow-up and consideration of enrollment in education among the sample should be controlled when studying young samples, in order to make more generalized conclusions. Additionally, some studies where general ability was measured at earlier ages accounted for other social and health variables, suggesting the influence of a process of cumulative disadvantages (Caspi et al., 1998, Lynn et al., 1984).

Regarding age outcomes, introducing this variable in the meta-analysis increased the size of the average effect of the association, and made the displayed slope positive. Thus, it could be suggested that the strength of the association between unemployment and cognitive ability is greater the higher the average age of the sample. Among the studies that have analyzed this association, only that carried out by Fryer and Warr (1984) stratified the results by age groups, while the rest of the studies included it as a covariate. These authors found a greater presence of cognitive difficulties in middle-aged unemployed people. This finding could be due to a non-linear relationship in terms of age. Similarly, Strittmatter et al. (2020) found that during the course of life, cognitive ability shows an inverted U-pattern, reaching a peak around age 40. This pattern is maintained even after controlling for the level of task complexity. Therefore, a non-linear pattern might be suggested in the relationship between age and cognitive ability during unemployment. Accordingly, in studies on the influence of unemployment on emotional facets, depressive symptoms show an inverted U-pattern, reaching its maximum effect around the age of 35 (Pavlova &

Silbereisen, 2012). Given the possibility that emotional mechanisms with non-linear patterns also act on the association of unemployment and cognitive ability, more research is needed to study age differences, as well as the mechanisms which might determine it.

Nonetheless, this review and meta-analysis presents several limitations that must be considered for future studies. First, the meta-analysis was limited to a small number of studies, among which methodological heterogeneity was high. However, this was also the result of taking the necessary measures to reduce heterogeneity, and it was also conditioned to the available data and characteristics of the studies. Thus, the difficulty in comparing results may be solved by experts reaching a consensus on how to investigate the issue. In relation to this issue, and according to our findings, we recommend including a greater list of modulatory variables in order to provide a comprehensive vision of the topic. All sociodemographic, educational, and personality factors should be controlled as confounding or modulator variables. Moreover, due to the special plasticity of cognitive functions, socio-professional variables might be included in the analysis. Thus, related fields of research include the level of job complexity or mental workload as key factors. The concept of occupational complexity has stood out for its relevance in research on different stages of working life. It refers to the extent to which work provides cognitively challenging tasks and rewards that improve workers' abilities, and it has been found that higher levels of complexity are associated with better general cognitive ability during work (Gajewski et al., 2010; Kraup et al., 2018), and even after retirement (Andel et al., 2017; Vélez-Coto et al., 2021). In addition, cognitive ability influences the likelihood of obtaining a more complex job (Schooler et al., 1999). However, none of the studies included have

considered the effect of the complexity of previous or future work. Thus, including characteristics of the complexity of work could help to conceptualize the relationship, and find more moderating mechanisms of it. It also would be valuable to specify the unemployment rates and characteristics of the labor market in the countries where studies are carried out. There is evidence regarding the influence of unemployment rates on the relationship between health effects and unemployment (Thern et al., 2017). Periods of high unemployment rates may buffer negative consequences and can be attributed to external factors. In addition, it may be interesting to include indicators of stress at work, training during unemployment, underemployment, or voluntary work. Lastly, the methodological quality of studies should be improved to obtain stronger generalizations. As such, it would be of interest to apply the counterfactual outcome framework (Angrist & Pischke, 2008; Morgan & Winship, 2014) to obtain a measure of the average effect of both unemployment as a cause and a consequence of variations of cognition.

Conclusions

Evidence supports the existence of an association between unemployment and general cognitive ability, supported by a meta-analysis that showed a medium size effect, in which age is a moderating factor. However, more research on the topic and its mediator mechanisms (e. g. length of unemployment, age, level of education, complexity of work, and stress) is needed. As such, future findings may help improve interventions and the quality of life of unemployed people, reemployment strategies, and welfare systems.

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- This is the first review and meta-analysis studying unemployment and general cognitive ability.
- The review showed an association between unemployment and lower general cognitive ability.
- The meta-analysis supported the association between unemployment and cognition.
- Age moderated the association and increased the average effect size.
- A series of suggestions are made to improve future studies in this topic.