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Differences in working memory between gifted or talented students and community samples: A meta-analysis

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Abstract

Background: Gifted and talented students have different functioning in some components of executive functions, such as working memory. This meta-analysis examines the differences between students with high abilities and with average intelligence in working memory. **Method:** A total of 17 articles with 33 different studies were analyzed. A random effects model was used, calculating the effect size with Hedges g. The moderating variables were analyzed using a meta-regression model for continuous variables and ANOVA for categorical variables. **Results:** Results show an average effect size of $\mathbf{g}_+$=0.80 (95% CI: 0.621, 0.976) and high heterogeneity (Q(32)=196.966; p<.001; I^2=83.754%). In the studies that measured verbal working memory, the effect size was $\mathbf{g}_+$=0.969 (95% CI: 0.697, 1.241) and heterogeneity I^2=83.416%. In those assessing visual working memory, $\mathbf{g}_+$=0.674 (95% CI: 0.443, 0.906) and the heterogeneity was 83.416%. The analysis of the moderating variables identified the way of measuring working memory as the only significant variable. **Conclusions:** There is a significant effect in favor of gifted and talented students in both verbal and visual working memory, with significant influence of the procedure used to measure working memory.

Keywords: Working memory, talent, gifted, meta-analysis.

Resumen

Diferencias en memoria de trabajo entre alumnado superdotado y talentoso y muestras comunitarias: un meta-análisis. **Antecedentes:** los estudiantes superdotados y con talento tienen un funcionamiento diferencial en algunas componentes de las funciones ejecutivas como la memoria de trabajo. Este meta-análisis estudia las diferencias entre estudiantes con alta capacidad intelectual y con inteligencia promedio en memoria de trabajo. **Método:** un total de 17 artículos con 33 estudios diferenciados fueron analizados. Se empleó un modelo de efectos aleatorios, calculando el tamaño del efecto con g de Hedges. Las variables moderadoras se analizaron empleando una meta-regresión para las continuas y ANOVA para las categóricas. **Resultados:** los resultados muestran un tamaño del efecto de $\mathbf{g}_+$=0.80 (95% CI: 0.621, 0.976) y una alta heterogeneidad (Q(32)=196.966; p<.001; I^2=83.754%). En los estudios que miden memoria de trabajo verbal, el tamaño del efecto fue de $\mathbf{g}_+$=0.969 (95% CI: 0.697, 1.241) y la heterogeneidad I2=83.416%. En los que evalúan memoria de trabajo visual, $\mathbf{g}_+$=0.674 (95% CI: 0.443, 0.906) y la heterogeneidad I^2=83.416%. El análisis de variables moderadoras identificó la forma de medir la memoria de trabajo como la única variable significativa. **Conclusiones:** existe un efecto significativo en favor de los estudiantes superdotados y con talento, tanto en memoria de trabajo verbal como visual, con influencia del procedimiento utilizado para medir memoria de trabajo.

Palabras clave: memoria de trabajo, superdotación, talento, meta-análisis.

The study of high intellectual abilities goes back to the beginning of psychology as a scientific discipline. One of the main problems that arises is that of its definition when considering the different theoretical models (Dai & Chen, 2014). The literature not only raises the question of which characteristics define this student body through the various theoretical models but also contributes to the existing confusion regarding the definition of the term itself. Sometimes, talent is used as a synonym for characteristics of gifted people and, in others, for different types of giftedness (Heller, 2004). Therefore, it is important to distinguish between the different terminologies of talent, high capacity, and giftedness in this respect (Matthews & Dai, 2014).

When detecting highly capable students, we must consider the theoretical model the measurement is based on, as it will guide the identification and subsequent intervention (Pfeiffer, 2012). Even though the first studies about high abilities by Terman (1925) who considered *gifted* those with an IQ equal or above 130, there has been an evolution of the concept including *talent*, *creativity*, *innovation* and *excellence* (Gagné, 2004; Hernández-Torrano & Gutiérrez-Sánchez, 2014; Touron & Touron, 2011). The identification may be carried out by measuring intelligence based on standardized tests, or including more variables, such as general and specific capabilities, personal variables, and the valuation of the environment (Harder, Vialle, & Ziegler, 2014).

The characteristics of high-ability students include the development of cognitive and motivational strategies, which makes their learning style different from that of normative students. This

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is defined by different learning rhythms, precocity and depth, abstract style, and a greater understanding that differentiates them from their other classmates (Van Tassel-Baska, 2013). The cognitive differential functioning of this group can be explained by greater plasticity and efficiency, which contributes to having extensive attentional processes facilitating the high level of cognitive skills, complexity, and—sometimes—precocity of manifestation (Geake, 2009). Working memory (WM), flexibility, and inhibition contribute to better complex cognitive functioning in these students, emphasizing the high performance in WM as an executive process for convergent and divergent intellectual functioning (Sastre-Riba & Viana-Sanz, 2016).

WM is a system that temporarily maintains and manipulates information (Tirapu-Ustárroz & Muñoz-Céspedes, 2005). The concept of WM has evolved from a simple memory store system to a multicomponent memory system, which shows an evolution to a more systematic and dynamic understanding of what WM is (Yuan, Steedle, Shavelson, Alonzo, & Oppezzo, 2006).

The most important conceptualization of WM was developed by Baddeley & Hitch (1974). They introduced the multicomponent model with a central executive system and two slave storage systems: the visuospatial sketchpad and the phonological loop. This model has been in continuous development and reflects the main theoretical framework in WM based on a multiprocess activity that relies on a variety of systems (Baddeley, 2003). However, other models, called *state-based*, also described WM mechanisms o from a cognitive neuroscience perspective (D'Esposito & Postle, 2015).

The relationship between intelligence and WM has been widely studied, although it is still a matter of debate. Recent studies have clarified underlying processes that explain this relationship (Rey-Mermet, Gade, Souza, von Bastian, & Oberauer, 2019; Waunguparaja, 2018) and the mechanisms of WM (Chekaf, Gauvrit, Guida, & Mathy, 2018). However, the discussion is focused around the amount of that relation and in what way both constructs are the same.

Nevertheless, this relationship seems to be more complex. A meta-analysis showed that WM and intelligence are related, but they are not the same (Ackerman, Beier, & Boyle, 2005). These authors found a moderate positive correlation across studies (ρ = 0.397), concluding that WM could be classified as a lower cognitive ability in hierarchical models of cognitive functioning. In a later study, Alloway and Alloway (2010) considered that WM is not a proxy for IQ, but it represents a cognitive ability dissociable with a greater importance to predict school performance in young children than IQ. On similar lines, Rey-Mermet, Souza, Gade and von Bastian (2019) related executive control with fluid intelligence and WM and showed that they are different factors but correlated. This relation is also showed by Redick et al. (2016) but not in an isomorphic way.

Other studies established a strong link between fluid intelligence and WM stating that WM and the *g* factor of intelligence are (almost) isomorphic constructs (Barbey, Colom, Paul, & Grafman, 2014; Colom, Abad, Rebollo, & Shih, 2005; Engle, 2002; Jastrzębskia, Ciechanowskab, & Chuderskib, 2018).

Given the existence of primary studies—in which children who are gifted and talented are compared with their normative peers—in this research, a meta-analysis will be carried out to determine the role that WM plays in the cognitive evolution of this student area.

The aim of this research is to evaluate WM in gifted children across different studies. Specifically, the main goals of this review are (a) to compare differences between gifted and talented children in WM, (b) to compare differences in verbal and visual WM between gifted and community children, (c) to analyze the age effect on WM in gifted children, and (d) to analyze the methodological issues affecting research on WM and gifted children. We hypothesized that talented students have a higher score in WM, which supports the idea of a high correlation between intelligence and WM.

Method

Participants

The 33 studies analyzed included a total of 609 talented students and 969 community samples. The mean and standard deviation of the age in gifted/talented are 11.08 (range 7.44 - 17.05) and 3.16, respectively, and community samples are 10.11 (range 6.83-17.5) and 3.31, respectively. The percentage of males in the experimental group was 66.60%, but in the community samples, it was 54.08%. In table 1 and 2, sample sizes of each study are showed, as well as the average age of the participants of each study.

Instruments

To do the meta-analysis, a coding book was prepared (available contacting the reference autor). The elaboration process of the coding book is detailed below.

Once the final articles were selected, a coding book was designed, in which the modulating variables of interest were recorded and divided into substantive and methodological variables (Botella & Sánchez-Meca, 2015).

The substantive variables are those related to and that allow the characterization of the topic studied in the meta-analysis. These were (a) the mean and SD of the age in gifted/ and community samples and (b) the procedure in which talent was diagnosed.

The methodological variables, which are related to the research design and the instruments, were (a) the total size of the study sample, (b) the total size of the experimental group, (c) the total size of the control group, (d) the type of the experimental group (gifted [IQ > 130] or talented [IQ < 130 or not specified]), (e) the instrument for measuring talent, and (f) how to measure WM.

Two of the authors participated in the analysis of the coding process's reliability with a random sample of 6 articles (Botella-Ausina & Sánchez-Meca, 2015). Cohen's Kappa index (Cohen, 1960) was calculated using SPSS v21, without reaching an excellence value of .75 according to the criteria of Fleiss (1981). The discrepancies were solved by consensus, doing again the codification. After obtaining an adequate value (.93), we proceeded to code all the articles to identify variables that influence the variability of the study results. Those that involved visual and verbal WM measures were coded as different studies.

Procedure

Search strategies

To search for relevant investigations, different procedures were used. The main one consisted of the electronic search of articles in the Academic Search Premier databases, Educational Resources Information Center (ERIC), MeDline, PsychArticle and PsychInfo using the terms "working memory" AND (gifted *) OR "talented student" OR "high ability students." The search was restricted to material published in English, Spanish, and French, and no temporal limitation in the publication of the articles was applied. The first search, conducted on November 23, 2016, yielded a total of 1,173 publications. The duplications were automatically deleted on January 1, 2017, leaving a total of 973 documents. A screening was carried out through by reading the titles and abstracts to select the articles that met the inclusion criteria, which were previously designed. In addition, other search strategies included (a) a review of titles and abstracts of articles suggested by the databases, (b) contact with the authors, (c) Google Scholar, and (d) the ability to track the bibliographic citations in the articles. The search procedure lasted 2 months, from November 2016 to January 5, 2017.

Selection and exclusion criteria

The following inclusion criteria were used on the articles sampled:

1. Studies measuring WM in populations diagnosed as "gifted," "talented," or "high ability student" were included.
2. Measures of WM should include the mean and variances in chosen studies.
3. Studies with full text available were included.
4. Studies with a community comparison group were included.
5. The WM measurement procedures must be identified in included studies.
6. Peer-reviewed publications chosen must be written in English, Spanish, or French.

The exclusion criteria follow:

1. Studies including children with double exceptionality or savant were excluded.
2. Studies with a control group with any neurological or psychiatric pathology were excluded.
3. Studies for which the article's full text was not available were excluded.
4. Studies without a community comparison group were excluded.

Data analysis

The means and standard deviations of WM measurements were recorded in each group and in each study. Subsequently, the calculation of the effect size for each of the studies was made from the standardized mean difference using Hedges' *g*. The effect size between the talented group and the control group of normative intelligence was found. For each value of *g*, the 95% confidence interval was calculated to determine its significance. Positive *g* values indicated a better performance in WM for the gifted group than for the control group. Following Cohen's (1988) guidelines, effect sizes around 0.2, 0.5, and 0.8 were interpreted as reflecting low, moderate, and large practical relevance.

The calculation of effect sizes and confidence intervals in the study set was done using a random-effects model. This model considers a within-study variability, depending on the sampling error, and between-studies variability that reflects the heterogeneity in methods and sample characteristics among studies. Once the total effect size was found, separate effect sizes were also calculated for verbal WM and visual WM. A forest plot was constructed, and heterogeneity among the effect sizes was assessed with the homogeneity Q statistic and the I^2 index. Publication bias was assessed by constructing funnel plots with the trim and fill method. Analysis of the moderating variables was accomplished by applying metaregression models for those that were continuous and ANOVAs for categorical ones. These analyses were carried out through Comprehensive Meta-Analysis v.3 (Borenstein, Hedges, Higgins, & Rothstein, 2014).

Results

Selection of studies and characteristics

A total of 17 articles met the inclusion criteria and were selected (Figure 1); they allowed us to obtain 33 independent studies or comparisons between an experimental and a control group. Tables 1 (Visual WM) and 2 (Verbal WM) show the characteristics of the studies analyzed:

- 23 studies are composed of samples of more than 30 gifted children, and 10 are made up of samples of up to 80 gifted children.
- 25 studies are made up of samples from the control group of more than 80 children and adolescents, and 8 studies are made up of samples of up to 80 children and adolescents.
- 14 of the studies mediated verbal work memory compared to 19 that mediated visual work memory through standardized tests in 15 studies and experimental tasks in 18 studies.
- In 26 studies, psychometric tests are used to determine the category of gifted children, and in 7 of the studies, this group presents a prior identification.
- To measure intelligence, 15 studies used Wechsler scales (Wechsler, 1991), 12 studies used Raven (Raven, Raven, & Court, 2003) and four other procedures, and two studies did not specify how to measure intelligence.

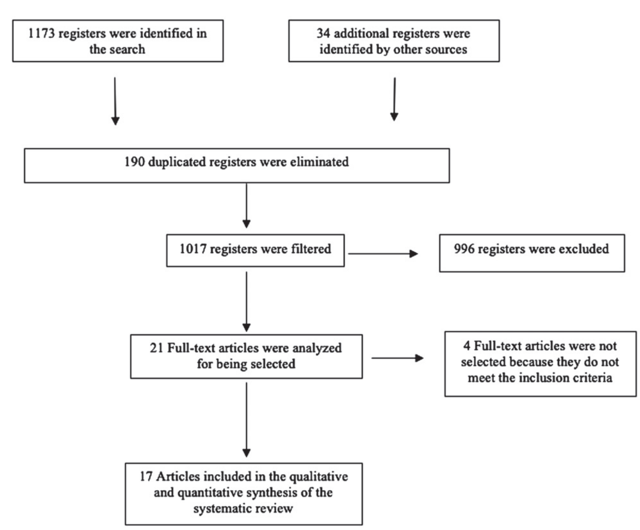

Figure 1. The flow chart of the reviewed articles

– With respect to the type of talent, 12 of the studies presented a sample with an IQ higher than 130 with or without mathematical talent. In the remaining 21 studies, talent diagnoses or undifferentiated talents were included, with unspecified IQ or mathematical talent or IQ below 130.

Average effect size and heterogeneity

The calculation of the effect sizes, using Hedges' *g*, was carried out by separately analyzing the data related to verbal and visual language, as well as the joint effect. Figure 3 shows the forest plot of the meta-analysis performed for all studies, differentiating

Table 1
Characteristics of the included studies by subgroup visual WM

						Talented				Community samples			
Authors	**N**	**Intelligence test**	**WM Task**	**Nomination**	**Talent type**	**n**	**Age Mean**	**WM mean**	**WM SD**	**n**	**Age Mean**	**WM mean**	**WM SD**
Alloway & Elsworth 2012	82	Wechsler	2	1	2	44	10.04	128.0	12.5	38	9.80	92.13	18.29
Desco et al 2011	27	Wechsler	2	2	1	13	13.40	75.8	12.4	14	13.80	64.1	17.4
Haring 2016	43	Other	2	1	2	27	10.70	0.73	0.70	41	10.00	0.73	0.11
Hoard 2005	217	Raven	2	1	2	26	8.790	5.375	2.109	191	8.89	3.98	1.41
Hoard 2005	211	Raven	2	1	2	44	6.130	57.7	30.4	167	6.80	28.6	28.8
Hoard et al 2008	211	Raven	2	1	2	44	6.160	112.0	14.0	167	6.16	97.0	14.0
Howard et al 2013	91	Unspecified	2	2	2	47	13.72	0.77	0.15	44	13.72	0.64	0.14
Johnson et al 2003	52	Wechsler	2	2	1	17	8.05	4.41	1.37	35	8.27	3.69	0.96
Johnson et al 2003	52	Wechsler	2	2	1	17	8.05	4,24	1.15	35	8.27	3.26	0.82
Johnson et al 2003	97	Wechsler	1	2	2	40	10.42	5.60	0.74	57	10.64	4.67	1.07
Johnson et al 2003	97	Wechsler	1	2	2	40	10.42	4.95	1.20	57	10.64	4.30	1.18
Khosravi et al 2016	148	Wechsler	1	1	2	73	13.00	4.753	0.98	75	13.00	3.65	0.797
Kornmann et al 2015	81	Other	1	1	2	42	9.87	9.02	2.29	39	9.60	7.87	2.77
Leikin et al 2013	157	Raven	2	1	1	70	17.50	11.2	2.40	87	16.70	10.2	2.50
Paz-Baruch et al 2016	96	Raven	1	1	1	40	17.00	6.00	0.78	56	17.00	6.07	1.09
Saccuzzo et al 1994	160	Raven	1	1	1	80	9.00	8.26	4.06	80	9.00	7.46	3.81
Saccuzzo et al 1994	160	Raven	1	1	1	80	9.00	11.09	4.62	80	9.00	9.22	5.37
Swanson 2005	127	Wechsler	1	1	2	50	7.44	2.14	4.51	77	7.30	1.54	3.65
Swanson 2005	127	Wechsler	1	1	2	50	7.44	4.00	5.74	77	7.30	3.19	3.33

Note: Nomination = Psychometric test =1; Prior identification =2. Talent = Gifted / Talented: IQ <130; IQ not specified Mathematical talent (IQ not specified) =1; Gifted (IQ> 130). In scores and percentiles, they are coded with scores higher than the 98th percentile. Ó Gifted + Mathematical talent = 2 WM Task: Experimental tasks=1; Standardized tests =2

Table 2
Characteristics of the included studies by subgroup verbal WM

						Talented				Community samples			
Authors	**N**	**Intelligence test**	**WM Task**	**Nomination**	**Talent type**	**n**	**Age Mean**	**WM mean**	**WM SD**	**n**	**Age Mean**	**WM mean**	**WM SD**
Alloway & Elsworth 2012	82	Wechsler	2	1	2	44	10.04	125.73	16.31	38	9.80	93.42	14.76
Calero et al 2007	47	Other	1	1	1	24	8.19	4.46	0.45	23	7.81	2.81	0.63
Hoard 2005	211	Raven	2	1	2	44	6.13	48.5	28.9	167	6.80	23.9	23.7
Hoard et al 2008	211	Raven	2	1	2	44	6.25	110.0	15.0	167	6.25	97.0	14.0
Howard et al 2013	91	Unspecified	2	2	2	47	9.81	0.59	0.12	44	9.81	0.47	0.12
Kornmann et al 2015	81	Other	1	1	2	42	9.87	8.97	0.61	39	9.60	8.52	0.63
Leikin et al 2013	157	Raven	2	1	1	70	16.50	12.1	1.90	87	16.70	10.2	2.50
Leikin et al 2014	49	Raven	2	1	1	26	16.70	11.0	2.10	23	16.70	10.8	3.10
Navarro et al 2006	110	Wechsler	2	1	1	70	10.30	5.70	1.20	40	9.37	3.90	1.40
Segalowitz et al 1992	48	Unspecified	2	2	1	18	12.20	6.80	1.53	30	12.60	4.70	1.53
Swanson 2005	127	Wechsler	1	1	2	50	7.44	1.66	0.65	77	7.30	1.33	0.69
Swanson 2005	127	Wechsler	1	1	2	50	7.44	5.56	4.24	77	7.30	3.20	3.44
Swanson 2005	127	Wechsler	1	1	2	50	7.44	3.94	2.84	77	7.30	2.80	2.68
Swanson 2005	127	Wechsler	1	1	2	50	7.44	6.64	5.40	77	7.30	4.32	4.34

Note: Nomination = Psychometric test =1; Prior identification =2. Talent = Gifted / Talented: IQ <130; IQ not specified Mathematical talent (IQ not specified) =1; Gifted (IQ> 130). In scores and percentiles, they are coded with scores higher than the 98th percentile. Ó Gifted + Mathematical talent = 2 WM Task: Experimental tasks=1; Standardized tests =2

Study	WM	Hedges's g	Ll	Ul	Relat.weight
Leikin et al 2014	Verbal	0,075	-0,477	0,627	6,50 %
Swanson 2005	Verbal	0,413	0,055	0,770	7,70 %
Swanson 2005	Verbal	0,482	0,123	0,840	7,69 %
Swanson 2005	Verbal	0,486	0,127	0,845	7,69 %
5Swanson 2005	Verbal	0,622	0,259	0,983	7,68 %
Kornmann et al 2015	Verbal	0,719	0,273	1,164	7,17 %
Leikin et al 2013	Verbal	0,839	0,512	1,165	7,88 %
Hoard et al 2008	Verbal	0,916	0,593	1,238	7,90 %
Hoard 2005	Verbal	0,986	0,641	1,330	7,78 %
Howard et al 2013	Verbal	0,992	0,559	1,423	7,25 %
Segalowitz et al 1992	Verbal	1,352	0,716	1,987	5,98 %
Navarro et al 2006	Verbal	1,401	0,973	1,828	7,28 %
Alloway, Elsworth 2012	Verbal	2,050	1,517	2,582	6,62 %
Calero et al 2007	Verbal	2,974	2,150	3,797	4,89 %
Random	**Verbal**	**0,961**	0,690	1,232	100 %
Paz-Baruch et al 2016	Visual	-0,071	-0,474	0,331	5,45%
Haring 2016	Visual	0,000	-0,480	0,480	5,10%
Swanson 2005	Visual	0,149	-0,206	0,503	5,66%
Swanson 2005	Visual	0,182	-0,173	0,536	5,66%
Saccuzzo et al 1994	Visual	0,201	-0,233	0,636	5,31%
Saccuzzo et al 1994	Visual	0,370	-0,068	0,808	5,29%
Leikin et al 2013	Visual	0,405	0,089	0,722	5,82%
Kornmann et al 2015	Visual	0,450	0,013	0,887	5,30%
Johnson et al 2003	Visual	0,543	0,134	0,951	2,43%
Johnson et al 2003	Visual	0,640	0,056	1,224	4,32%
Desco et al 2011	Visual	0,746	-0,013	1,505	3,85%
Howard et al 2013	Visual	0,887	0,460	1,315	5,34%
Hoard 2005	Visual	0,922	0,504	1,339	5,39%
Johnson et al 2003	Visual	0,973	0,549	1,396	5,36%
Hoard 2005	Visual	0,995	0,651	1,339	5,70%
Johnson et al 2003	Visual	1,029	0,425	1,633	4,53%
Hoard et al 2008	Visual	1,069	0,743	1,394	5,78%
Khosravi et al 2016	Visual	1,228	0,878	1,578	5,68%
Alloway, Elsworth 2012	Visual	2,300	1,744	2,856	4,75%
Random	**Visual**	**0,673**	0,441	0,906	100%
Random	**Overall**	0,809	0,527	1,090	

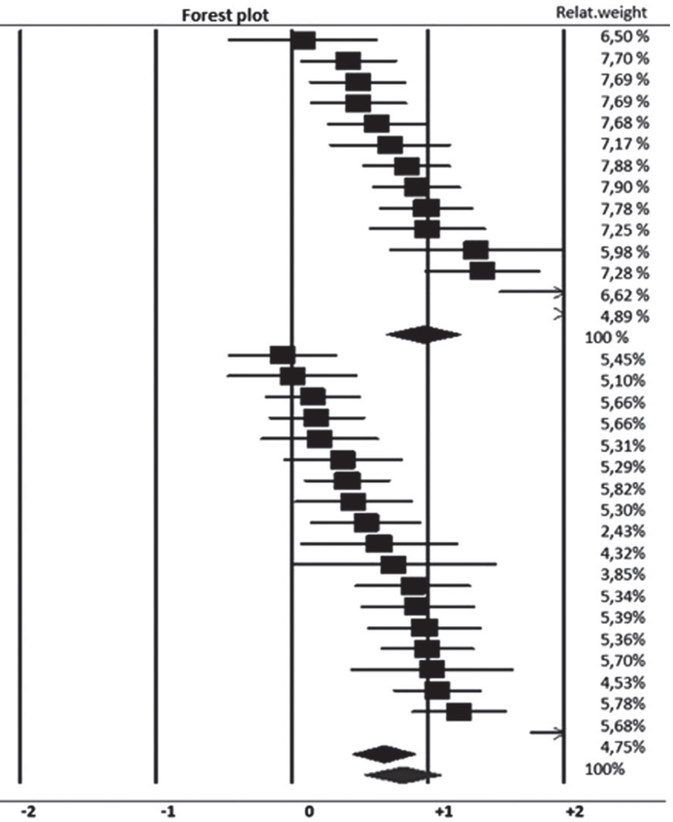

Figure 2. Forest plot showing the impact of subgroups within study

between visual and verbal work memory. In addition, a total effect is calculated without this differentiation.

The analysis of all the 33 studies (Figure 2) as a whole showed an average effect of $g_+ = 0.80$ (95% CI: 0.621, 0.976), of large and significant magnitude, and large heterogeneity ($Q(32) = 196.966$; $p < .001$; $I^2 = 83.754\%$). Analyzing the two subgroups separately, we found the following results. There were 14 studies measuring verbal WM, with an average effect of $g_+ = 0.969$ (95% CI: 0.697, 1.241) of large magnitude and large heterogeneity ($Q(13) = 78.388$; $p < .001$; $I^2 = 83.416\%$). A total of 19 studies included visual memory, with an average effect size of $g_+ = 0.674$ (95% CI: 0.443, 0.906) of moderate magnitude and large heterogeneity ($Q(18) = 108.078$; $p < .001$; $I^2 = 83.345\%$).

Publication bias

Figures 3 and 4 present funnel plots for visual and verbal WM meta-analyses, respectively. When the trim and fill method was applied to both funnel plots, no effect sizes were added to symmetrize the aspect of these funnel plots. Therefore, publication bias is not considered to be a threat in regard to the results of these meta-analyses.

Moderating variables

The variables that were analyzed as moderators were the total sample size, the sample size of the gifted group, the sample

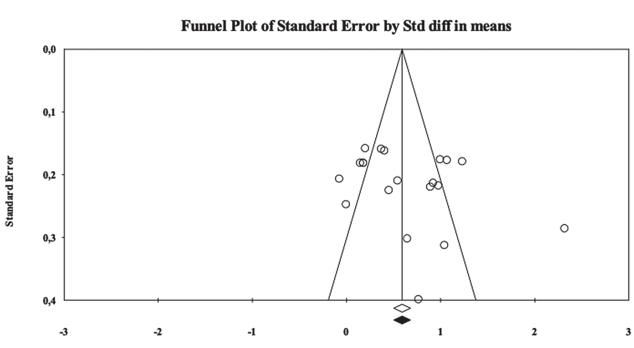

Figure 3. Trim and fill of visual working memory

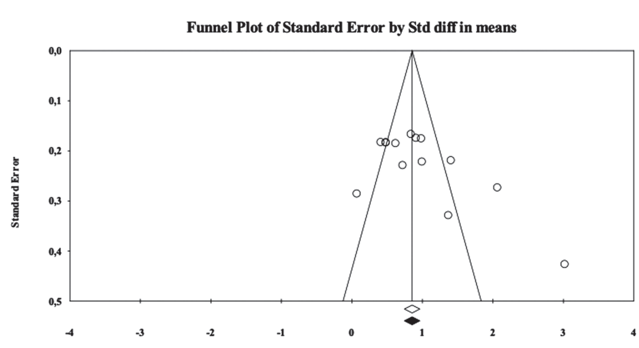

Figure 4. Trim and fill of verbal working memory

size of the control group, the nomination, the type of talent, the method of measuring intelligence, the method of measuring WM, and the age. Table 3 shows the results of the ANOVAs and meta-regressions applied for each moderator variable. The only variable that reached a statistically significant relationship with the effect sizes was the method of measuring the WM (p = .019), with a larger average effect size for studies that measured the WM with standardized tests (g_+ = 1.044) than for experimental tasks (g_+ = 0.661).

Discussion

In light of the results obtained, some important conclusions can be reached. First, there is a clear difference between the students with high abilities and the control group in visual WM and verbal WM, the size of the effect being greater in the case of verbal WM, which is considered large, but the visual is moderate (Cohen, 1988). This result support partially our hypothesis that states that there is a strong relation between WM and intelligence. However, a greater clarification in how is this relation established is needed (Chekaf et al., 2018; Jastrzębskia et al., 2018; Redick et al., 2016; Rey-Mermet et al., 2019; Wongupparaja et al., 2018).

The analysis carried out by moderating variables also yields relevant information. On the one hand, the only moderator that presents significant results is the procedure by which the WM concept is measured, which has a greater effect when using standardized tests against experimental tasks. This result highlights the idea that, throughout any measurement process, it is convenient to use a standard measure, as it allows greater comparability. The greater development at the psychometric level assumes criteria of goodness in the instruments that enable them to obtain more reliable data. This allows us to work through interchangeable measures while, when using laboratory measures, we must consider the lower applicability and the greater relationship with circumstantial aspects subject to the time and environment in which they are extracted. This result enhances the importance of psychometrics and highlights the need to use measurement instruments with good psychometric qualities.

Some important aspects should be highlighted within the absence of significant results: When the moderator is the type of talent diagnostic test, regardless of the test that has been measured, the type of talent is what sets differences, not the form of diagnosis made. On the other hand, there are no differences between the two groups depending on the participants' ages. The differences that are given are the equivalents by age, but this variable does not produce a differential effect depending on the groups.

In the face of the controversy raised about the type of talent and the great conceptual differentiations, the data obtained in this work do not show differences depending on the type of talent. The fundamental difference lies in the level of intellectual capacity. Although this result must be considered as one obtained when analyzing a sample of studies, it may reflect a problem present in the study of intelligence: The immense breadth of knowledge expands in different and multiple ways and may harm or postpone the search of common elements and may be mostly accepted in the scientific world. This makes reconsidering the extent to which so much variability in how the conception of talent allows real progress in the field of high intellectual capacities important.

In this way, this result is considered to be an aspect of great interest. How the different nomenclature or criterion for cataloging

Table 3
Moderating variables

	Categorical moderators	Studies	Hedges' g	Llimit 95%	Ulimit 95%	Z value	p-value	$Q_{(k-1)}$	P - value
N total	Average size: from 1 to 80 participants	9	0.917	0.549	1.285	4.883	0.001	$0.516_{(1)}$	0.473
	Large size: more than 80 participants	24	0.762	0.557	0.968	7.271	0.001		
N gifted	Average size: from one to 30 participants	10	0.918	0.572	1.263	5.204	0.001	$0.619_{(1)}$	0.431
	Large size: from 31 to 80 participants	23	0.755	0.546	0.965	7.069	0.001		
N control	Average size: from 1 to 80 participants	8	0.792	0.405	1.178	4.015	0.001	$0.002_{(1)}$	0.965
	Large size: more than 80 participants	25	0.801	0.598	1.005	7.727	0.005		
Nomination	Psychometric test	25	0.769	0.567	0.971	7.446	0.001	$0.371_{(1)}$	0.542
	Prior identification	8	0.903	0.524	1.281	4.673	0.001		
Talent	Gifted >130	12	0.763	0.458	1.069	4.901	0.001	$0.078_{(1)}$	0.5780
	Gifted<130	21	0.817	0.597	1.038	7.267	0.001		
Intelligence test	Raven	12	0.5642	0.347	0.936	4.266	0.001	$2.326_{(3)}$	0.543
	Weschler type	15	0.867	0.595	1.140	6.236	0.001		
	other tests	4	0.891	0.342	1.440	3.182	0.001		
	No intelligence tests or unspecified	2	1.170	0.396	1.943	2.965	0.003		
WM task	Experimental tasks	15	0.586	0.348	0.825	4.820	0.001	$5.470_{(1)}$	0.019
	Standardized tests	18	0.849	0.594	6.533	6.533	0.001		
Continuous moderators		**Coefficient**							
Sample size	**Intercept**	1.695		0.4897	1.6493	3.62	0.0001	$0.92_{(1)}$	0.337
	Average age gifted	-0.0270		-0.0820	0.0281	-0.96	0.1683		
	Intercept	1.0748		0.4882	1.6614	3.59	0.002	$0.94_{(1)}$	0.336
	Average age control	-0.0276		-0.0836	0.0284	-0.97	0.1667		

the condition of “high capacity” does not mean a difference in its superior performance in WM is observed as well. These data may be relevant to highlight how, in literature with different categories and labels for a population, a tendency of disaggregation can be implemented. The superior performance in WM without differences, depending on the label, raises the need to look for more common elements and gives way to an approach that seeks greater convergence.

As far as the limitations of this study are concerned, few primary studies have been used, which requires a greater number of them to strengthen and ensure these results. The small number of studies analyzed could explain the absence of significant effects of the moderating variables. Therefore, more primary studies should be done in this topic so the sample could be increased and test whether there are any effects due to these moderating variables.

The results obtained here corroborate the existence of differences at a cognitive level among the most capable students, which results in strengthening the need for a different educational approach based on this population’s defining abilities. The clarification of the differentiating characteristics of talented students is fundamental, especially when there is a clear maintenance of biased ideas and myths (Pérez-Tejera, Borges, & Rodríguez-Naveiras, 2017), both in the cognitive and socio-affective fields (Borges, Hernández-Jorge, & Rodríguez-Naveiras, 2011), so, fundamentally in order to receive the appropriate educational response, it is essential to know the real characteristics of these students.

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