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*Article*

# Should we Help our Children with Homework? A Meta-Analysis Using PISA Data

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## Abstract

**Background:** The role of homework in students' academic performance is a widely debated topic about which there is no definitive answer. The objective of this study was to analyse the importance of parental help with homework in academic achievement, testing its cultural invariance (by country), academic invariance (by subject), and the stability of its effects over time. **Method:** A meta-analysis was performed using the results of PISA evaluations from 2009, 2012, 2015, and 2018 from countries which applied the family PISA questionnaire. We analysed 180 effects and confirmed the fit of the model and the heterogeneity of the effects, performing an analysis of moderators and multimodal inference. **Results:** Students who had more help with homework had lower academic achievement, with an overall effect (d) = 0.23, 95% CI [0.21, 0.25]. The effects were greater in Europe than in Asia. We did not find differences by subject type, and the results were stable over time. **Conclusions:** Family help with homework does not ensure students' academic success, and it is more important how that help is given than how much. This conclusion is valid for different types of subjects and is stable over time, with some variation between cultures.

***Keywords:*** Homework; home-based involvement; family help with homework; meta-analysis, PISA.

## Resumen

***¿Debemos Ayudar a Nuestros Hijos con los Deberes? un Meta-Análisis con Datos PISA.*** **Antecedentes:** el papel de los deberes escolares en el rendimiento académico es un tema ampliamente debatido, no existiendo una respuesta definitiva. El presente trabajo analiza el efecto de la ayuda parental con los deberes sobre los resultados educativos, comprobando la invarianza cultural (por países) y académica (por asignaturas), así como la estabilidad temporal de los efectos. **Método:** se realizó un meta-análisis con los resultados PISA de los años 2009, 2012, 2015 y 2018, incluyendo los países que aplicaron el cuestionario PISA para las familias. Se analizaron 180 efectos, comprobando el ajuste del modelo y la heterogeneidad de los efectos, y realizando análisis de moderadores y análisis de inferencia con modelos múltiples. **Resultados:** los estudiantes que reciben más ayuda con los deberes obtienen resultados más bajos: d = 0.23, IC 95% [0.21, 0.25]. Los efectos son mayores en Europa que en Asia. No se encontraron diferencias en función de la asignatura, y los resultados son estables a lo largo del tiempo. **Conclusiones:** la ayuda familiar con los deberes no garantiza el éxito académico, siendo más importante cómo se hace que el cuánto. Esta conclusión es válida en todas las asignaturas y se muestra estable en el tiempo, observándose variaciones interculturales.

***Palabras clave:*** tareas escolares en el hogar; implicación familiar; ayuda con los deberes escolares; meta-análisis; PISA.

The effects of family involvement on educational results has been widely studied, and there is no lack of excellent reviews (Boonk et al., 2018; Desforges & Abouchaar, 2003; Hoover-Dempsey et al., 2001; Pomerantz et al., 2007; Rosenzweig, 2001; Scheerens, 2016; Scheerens et al., 2013; Suárez et al., 2012). Some of the quantitative meta-analyses are general (Barger et al., 2019; Castro et al., 2015; Fan & Chen, 2001; Tan et al., 2020), while others have focused on specific aspects such as home tutoring (Erion, 2006; Jeynes, 2012), reading acquisition (Sénéchal & Young, 2008), and involvement with homework (Patall et al., 2008). Other meta-analyses have selected only studies with specific socio-demographic or ethnic groups (Jeynes, 2003, 2005, 2007, 2016, 2017), specific educational stages (Ma et al., 2016), or culturally similar countries (Kim, 2020). There are also reviews that have addressed only studies which include fathers in the picture (Kim & Hill, 2015). Some meta-analyses have only included studies that fit a specific research design, such as randomized controlled trials (Nye et al., 2006), or correlational analysis on naturally-occurring involvement (Barger et al., 2019). Others have included different research designs but offered the effects separately according to the type of design (Hill & Tyson, 2009; Patall et al., 2008) or have used the design characteristics as a moderating variable (Jeynes, 2017). Lastly, there are also reviews of reviews, whether qualitative summaries of meta-analysis (Wilder, 2014), or umbrella reviews (Higgins & Katsipataki, 2015).

The general conclusion from this wealth of information is that family involvement and engagement in children's education has a beneficial effect on all of the educational agents: students,

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families, teachers, and schools. However, these reviews also indicate the existence of more controversial results, particularly about the relationship between academic achievement and parental involvement in homework (Higgins & Katsipataki, 2015). In this case, researchers talk of *mixed findings* (Hoover-Dempsey et al., 2001), *inconsistences* (Higgins & Katsipataki, 2015), and *undermining effects* (Barger et al., 2019). One of the causes of these inconsistent results may lie in the nature of the quantitative meta-analyses themselves, as the construct involvement in homework is very generic and includes a variety of paternal behaviours which may have contrasting effects on academic achievement (Rosenzweig, 2001). For example, Fan and Chen (2001) located *assistance with homework* within the *parent-child communication* dimension, together with interest in and conversations about school topics. Tan et al. (2020), in their construct of *parental supervision of children*, included all parental activities related to homework (knowing what homework is set, helping and checking it is done), together with other behaviours such as controlling use of time (setting rules), helping prepare for exams (monitoring), and knowing their children's classmates and friends outside the home. The meta-analysis by Hill and Tyson (2009) is one of those which goes into more detail, separating family help with homework from the other home-based involvement activities, and perhaps because of this it suggests a more negative effect (r = -.11). In summary, the generic nature of the involvement in homework construct may make it difficult to reach valid, detailed conclusions. In this regard, Boonk et al. (2018) called on researchers to abandon the use of broad descriptions and analyse specific aspects of the construct in order to achieve analytical clarity. Following this recommendation, our meta-analysis will examine a very specific behaviour, the frequency with which parents help with homework.

Another of the open questions is whether the effects of family involvement, and help with homework in particular, are universal or depend on cultural and socio-demographic contexts, given that most of the research to date is from the USA (Kim, 2020). In their monumental meta-analysis, Barger et al. (2019) compared five ethnic groups, four from the US (African, Asian, Caucasian, and Latino) and one combining studies with samples from other countries. The meta-analysis by Kim (2020) was the first that selected studies in which samples were solely from East Asian countries, and there are no similar studies from Europe or Latin America. Thus, the available cultural comparisons come from North American studies that either selected studies focusing on ethnic groups (Jeynes, 2016, 2017), or used the variable race/ethnicity as a moderator (Barger et al., 2019; Hill & Tyson, 2009). Kim's (2020) meta-analysis found a smaller effect size ($r$ = .12) than that estimated from Asian-American ($r$ = .19) or English-speaking samples (Fan & Chen, 2001, $r$ = .25; Hill & Tyson, 2009, $r$ = .18), and smaller than the effect sizes found by Jeynes with African-American (Jeynes, 2016, $r$ = .26) or Latino samples (Jeynes, 2017, $r$ = .22). Barger et al. (2019) indicated that variation due to ethnicity was small, and in the specific case of involvement with homework, the only significant comparison that they reported were from studies with Caucasian samples which demonstrated larger negative effects than Latino samples. In any case, there is a clear need for studies that provide true transcultural evidence and offer rigorous, systematic comparisons between regions and countries with distinct cultural and educational traditions, something which various summary studies have called for (Boonk et al., 2018; Higgins & Katsipataki, 2015; Kim, 2020).

Another aspect that researchers are less than unanimous about is whether the effects of family help with homework are constant or whether they vary depending on the subject matter. Fan and Chen (2001) clearly reported the former ($r$ = .18, in reading and mathematics). Results to date have mostly indicated an absence of significant differences between the effects in linguistic-reading areas and mathematics, although the effects in the former are slightly greater than in the latter (Castro et al., 2015; Jeynes, 2016, 2017; Kim, 2020; Nye et al., 2006). Erion (2006) found a slightly larger effect in mathematics ($d$ = 0.59) than in reading comprehension ($d$ = 0.57). Nonetheless, the conclusion is not definitive, as there are studies with results that are compatible with the hypothesis of differential effects (Patall et al., 2008). Along these lines, Tan et al. (2020) found parental involvement to be significantly associated with performance in languages for students whose families were more highly educated, an effect that was not replicated in mathematics. This finding is consistent with studies reporting that the effect of socio-demographic factors is clearer in socio-linguistic areas than in scientific-mathematical areas (Woitschach et al., 2017). In the area of the sciences the evidence is even more sparse (Nye et al., 2006; Tan et al., 2020). Castro et al. (2015) reported that the effect was no different to 0, suggesting a certain independence between family involvement and results in science, whereas Fan and Chen (2001) reported a positive association between the two variables ($r$ = .15), very similar to that estimated by the same authors for reading and mathematics. In any case, as Wilder (2014) stated, these results are not strictly comparable, given the multiple definitions of parental involvement and the various measures of academic achievement, such as grades, subjective evaluations, ad hoc tests, public exams, standardized test scores, etc. (Higgins & Katsipataki, 2015). We will attempt to overcome these limitations in this study, using a results measure that is comparable for all of the samples: the scores in reading, mathematics, and science in the *Programme for International Student Assessment* (PISA).

Within this context, the overall objective of our study is to analyse the importance of family help with homework on academic achievement. The study aims to provide new empirical evidence showing whether homework has positive effects on academic achievement (Fan & Chen, 2011; Jeynes, 2003; Patall et al., 2008), has no significant effect (Castro et al., 2015; Jeynes, 2005, 2007; Kim, 2020; Kim & Hill, 2015; Tan et al., 2020), or in contrast, demonstrates negative effects (Barger et al., 2019; Hill & Tyson, 2009).

Together with this general objective, we have three specific objectives. The first is to evaluate whether the relationship between family help with homework and academic performance is invariant, or is influenced by the geographical-cultural groups examined: Asian, European, and Latin American. Our second specific objective is to determine whether the effect of family help with homework and academic performance is invariant or is influenced by the type of subject examined: reading, mathematics, and science. Finally, our third objective is to determine whether the relationships between family help with homework and academic performance are stable over time, using the PISA studies from 2009 to 2018.

## Method

### *Participants*

The study population for this meta-analysis are the results of the PISA evaluations in 2009, 2012, 2015, and 2018 from those

countries that applied the family questionnaire. This questionnaire was optional for each participating country, and Table 1 lists the 25 countries that chose to apply it. The table also gives information about: a) the effective sample with sufficient, valid information to make it comparable (*N*), in other words, students with results in the three subjects whose parents completed the family questionnaire, b) the sum of the weights of samples with sufficient, valid information (*S-WT*), and c) the percentage representativeness of the effective sample in terms of the population of 15-year-olds in each country (*%R15*).

The pattern of participation is rather varied. Some countries only applied the family questionnaire once, whereas others did it systematically. Over the four editions there have been the equivalent of 60 country participations, and because PISA offers results for three subjects, that means being able to estimate 180 independent effects. On average, in each year there are around 90,000 students with valid information representing between 2 and 5 million 15-year-olds in the participating countries.

*Instruments*

*Help with homework*. This was evaluated using the family questionnaires, which included a question about how often the parents helped their children do their homework. The question has five response options: 1 = Never or hardly ever; 2 = Once or twice a year; 3 = Once or twice a month; 4 = Once or twice a week; 5 = Every day or almost every day. We generated a binary variable from the responses (*HW-Help*) which took responses one and two as negative, and the remaining three as positive, as previous analysis had shown that this binary solution was parsimonious and produced the most conservative estimates, which is advisable given the current state of knowledge in this area of study (Fernández-Alonso & Muñiz, 2021). The exact wording of the questionnaire varied slightly in each edition of PISA. In 2009, the question was generic (help with homework), whereas in subsequent evaluation cycles the question focused on the main subject being evaluated in that edition: help with mathematics homework in 2012; help

*Table 1*
Effective sample, sum of sample weights, and percentage representativeness by country and PISA edition

| | PISA 2009 | | | PISA 2012 | | | PISA 2015 | | | PISA 2018 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **N** | **S-WT** | **% R15** | **N** | **S-WT** | **% R15** | **N** | **S-WT** | **% R15** | **N** | **S-WT** | **% R15** |
| Belgium | (.) | (.) | (.) | 4093 | 55630 | 47.2 | 4659 | 51260 | 48.3 | 3866 | 51638 | 43.8 |
| Brazil | (.) | (.) | (.) | (.) | (.) | | (.) | (.) | (.) | 8676 | 1641032 | 80.6 |
| Chile | 5104 | 221485 | 89.6 | 6301 | 209560 | 91.4 | 6458 | 185049 | 91.6 | 6846 | 191386 | 89.5 |
| Croatia | 4473 | 38617 | 89.7 | 4692 | 42703 | 93.8 | 5362 | 37731 | 92.3 | 5659 | 30408 | 85.7 |
| Denmark | 3483 | 40139 | 66.0 | (.) | (.) | | (.) | (.) | (.) | (.) | (.) | (.) |
| Dominican Republic | (.) | (.) | (.) | (.) | (.) | (.) | 4528 | 126518 | 95.5 | 5363 | 132452 | 94.4 |
| France | (.) | (.) | (.) | (.) | (.) | (.) | 5298 | 630736 | 86.7 | (.) | (.) | (.) |
| Georgia | (.) | (.) | (.) | (.) | (.) | (.) | 5077 | 36680 | 95.5 | 5289 | 36523 | 94.9 |
| Germany | 3129 | 484797 | 63.2 | 2801 | 422610 | 55.8 | 3338 | 377380 | 51.3 | 2528 | 334502 | 45.5 |
| Hong Kong | 4712 | 73549 | 97.4 | 4517 | 68399 | 96.8 | 5212 | 55906 | 97.3 | 5457 | 46098 | 90.2 |
| Hungary | 4408 | 100887 | 95.5 | 4544 | 86007 | 94.3 | (.) | (.) | (.) | (.) | (.) | (.) |
| Ireland | (.) | (.) | (.) | (.) | (.) | (.) | 5062 | 51737 | 88.2 | 4897 | 52326 | 87.7 |
| Italy | 27209 | 446718 | 88.2 | 27329 | 464361 | 89.1 | 8953 | 394927 | 77.3 | 9913 | 441824 | 84.8 |
| Korea | 4870 | 614550 | 97.5 | 4952 | 594170 | 98.4 | 5500 | 560884 | 98.5 | 6536 | 449168 | 98.6 |
| Lithuania | 4400 | 39366 | 97.1 | (.) | (.) | (.) | (.) | (.) | (.) | (.) | (.) | (.) |
| Luxembourg | (.) | (.) | (.) | (.) | (.) | (.) | 3234 | 3374 | 61.0 | 2703 | 2825 | 51.6 |
| Macao | 5809 | 5834 | 97.6 | 5151 | 5179 | 96.5 | 4377 | 4406 | 97.8 | 3667 | 3690 | 97.1 |
| Malta | (.) | (.) | (.) | (.) | (.) | (.) | 3097 | 3631 | 85.2 | 2645 | 3072 | 78.3 |
| Mexico | (.) | (.) | (.) | 30681 | 1200659 | 90.5 | 6974 | 1283312 | 92.2 | 6944 | 1408512 | 95.1 |
| New Zealand | 3433 | 40665 | 73.8 | (.) | (.) | (.) | (.) | (.) | (.) | (.) | (.) | (.) |
| Panama | 3284 | 24828 | 81.4 | (.) | (.) | (.) | (.) | (.) | (.) | 4773 | 30001 | 77.8 |
| Portugal | 4825 | 73565 | 76.0 | 4647 | 77433 | 80.6 | 6770 | 90067 | 92.4 | 5279 | 87715 | 88.9 |
| Qatar | 6012 | 6439 | 65.7 | (.) | (.) | (.) | (.) | (.) | (.) | (.) | (.) | (.) |
| Spain | (.) | (.) | (.) | (.) | (.) | (.) | 4655 | 274659 | 69.1 | (.) | (.) | (.) |
| United Kingdom | (.) | (.) | (.) | (.) | (.) | (.) | 1408 | 22883 | 9.9 | (.) | (.) | (.) |
| Total | 85151 | 2211439 | – | 99708 | 3226711 | – | 89962 | 4191140 | – | 91041 | 4943173 | – |
| N Countries / Effects | | 14 / 42 | | | 11 / 33 | | | 18 / 54 | | | 17 / 51 | |

**N:** Number of students in the effective PISA sample with sufficient, valid information.
**S-WT**: Sum of the sample weights of students with sufficient, valid information. Ideally it represents the size of the population of 15-yer-olds in each country. The S-WT values are slightly lower than those reported by PISA because we eliminated cases without responses, invalid responses, missing items, and so on from this study.
**% R15**: Representativeness percentage of S-TW in terms of the population of 15-year-olds in the country. Values above 80% indicate high quality of the S-WT value, in other words, the sample manages to adequately reproduce the population of 15-year-olds in the country. The results of countries with very low representativeness rates should be interpreted with much caution, as they may be biased.
**(.)**: The country did not apply the family questionnaire in the corresponding edition of PISA

with science homework in 2015; and help with reading and writing homework in 2018. These variations in how the questions were worded will allow us to determine whether the effects of family help differ according to whether the question is generic or aimed at a specific subject (Trautwein & Lüdtke, 2007).

*Reading, mathematics, and science*. These were evaluated via the corresponding PISA tests, whose assessment and analytical frameworks can be found at https://www.oecd.org/pisa/data/. The scores are expressed via a series of plausible values and the international scale has a mean of 500 points with a standard deviation of 100 (Organisation for Economic Co-operation and Development [OECD], 2009).

Finally, three *moderating variables* were considered**:**

- *World region*. Each country was assigned to its cultural-geographical region: Europe, Latin America and the Caribbean, and Southeast Asia. New Zealand and Qatar did not fit into any of these groups and were covered by the category Other region, although culturally, socially, and educationally, they make up a rather diverse category. We created three binary variables to partially code this label, with Europe as the reference region (EU = 0,0,0) and the others with the following codes: LatinCarib = 1,0,0; SE-Asia = 0,1,0 and Other = 0,0,1.
- *Subject*. We created two binary variables via partial coding. Mathematics was the reference category (MAT = 0,0) and the other variables identified effects in reading (READ = 1,0) and science (SCI = 0,1).
- *PISA-Year*. This variable identified the corresponding PISA edition (2009, 2012, 2015, and 2018). 2009 was set at 0 points, and the variable increased by 3 points for each subsequent edition.

*Procedure*

To obtain the data in the different countries, the procedure as established in the PISA evaluation guidelines was followed, which is described in detail in the research documentation available at: https://www.oecd.org/pisa/data/

*Data Analysis*

Given that the study population was clearly restricted, the codification process was limited to identifying the variables of interest to the study objectives: PISA edition, country, region, subject assessed, effective sample, sum of sample weights, and calculation of sufficient statistics to perform the meta-analysis. The analysis was organized in three phases, identification and collection of cases with sufficient, valid information, calculation of statistics needed for the meta-analysis, and the meta-analytical comparison itself. The PISA databases can be found at http://www.oecd.org/pisa/data/. For the 2015 and 2018 editions, the student scores in the three subjects and the parents' responses are in a single SPSS or SAS database and can be downloaded directly. For the other two editions the databases are in .txt formats and need syntax files (also available at the link above) for the conversion to SPSS or SAS filetypes. In addition, in the studies prior to 2015 the scores and the family responses are in separate files, so it is necessary to create—with the country, school, and student codes—a single student identifier that allows the databases to be merged before any analysis. For all of this, we used SPSS v22 (IBM Corp Released, 2013).

To calculate the statistics needed for the meta-analysis, we used IDB-Analyzer 4.0.31 (International Association for the Evaluation of Educational Achievement [IEA], 2018), which is specially designed for the analysis of data from international large-scale assessments as it allows us to work with plausible values and perform replicate analysis using the student sampling weights. The statistics we calculated (and their corresponding standard errors) for the two HW-Help groups were: number of cases and sum of weightings by country, and mean and standard deviation of the plausible values in the three subjects.

The meta-analysis itself was performed using *R* (R Core Team, 2016). The effect size was expressed as *Cohen's d*, which is the difference in mean results in PISA between children whose parents helped and did not help with homework divided by the pooled standard deviations. Positive values indicate benefits in favor of students who do their homework autonomously or without parental help. *Cohen's d* was calculated specifying a random-effects model, testing its fit and variability of the effects using the estimators: Cochran's $Q$, $I^2$, $\tau^2$ and prediction interval (Higgins et al., 2003; IntHout et al., 2016), Although PISA is a cross-sectional study, the use of Cohen's $d$ is justified because the PISA scale scores are standardized to have a standard deviation of 100 points, which means that $d$ is a relatively close estimator of the real difference between group means. Once we had discounted the null hypothesis of homogeneity of effects we identified the outliers and influential cases via the study of distance values DFFITS and Cook's D (Viechtbauer & Cheung, 2010) and performed the analysis of moderators by region, subject, and PISA year. Finally, in the meta-regression analysis, we performed multimodal inference using the *R* package *dmetar*, which allows the evaluation and comparison of regression models that are produced with all of the possible combinations of predictors considered initially (Harrer et al., 2019). As the full regression model had 6 predictors (year of publication, two partial codings for the subject variable, and three partial codings for the regions), in the multimodal inference we compared 64 models ($2^6$), evaluating their fit using the following estimators of parsimony: Akaike's information criterion (AIC), Akaike weight (A-$w_i$) and Evidence Ratio (Burnham & Anderson, 2004; Cade, 2015; Ferrando, 2021; Symonds & Moussalli, 2010).

## Results

The overall effect ($d = 0.23$) indicates that children whose parents help with homework tend to have slightly lower achievement. Although the effect size can be characterized as small (Cohen, 1988), that statement needs two additional details. Firstly, the precision of the estimator is very high ($d_{se} = 0.01$) and therefore the confidence interval is very narrow and clearly different to 0 (95% CI [0.21, 0.25]). Secondly, 35 points on the PISA scale is a difference "equivalent to half of a skill level or a school year" (OECD, 2010, p. 55). This means that an effect larger than 0.20 points indicates that the advantage of students who do their homework without help over those who need frequent help is the equivalent of approximately two school terms. In other words, not only is the effect statistically significant, it also seems important.

The analysis of homogeneity ($Q(179) = 3966.51$, $p < .001$; $I^2 = 95.5$ %, CI 95% [95.1%, 95.9%]) indicates that family help with homework did not have the same impact in the different samples

(Table A1 in the appendix gives the distribution of estimated effects). This is not unexpected, given that the power of the test in a meta-analysis increases when, as in this case, it deals with many effects and large samples. Similar consideration applies to the value of $I^2$, which being greater than 75% indicates substantial heterogeneity (Higgins et al., 2003). Nevertheless, it should be borne in mind that PISA collects large samples which means that despite using clustered samples, the sampling errors are small, and when the sample error tends towards zero, $I^2$ tends towards 100%. This may suggest much more heterogeneity in the data than the effect sizes per se indicate. In any case, the variance of the true effect sizes and the confidence intervals ($\tau^2 = 0.020$, CI 95% [0.016, 0.025]) seem to confirm that there is some between-study heterogeneity in the data. Finally, the prediction interval ranges from -0.05 to 0.51, indicating that in future studies it may be possible to find observations where the effect is practically null, although the upper interval suggests that it would also be possible to find cases where the general effect is twice that estimated in this study.

Table 2 gives the results for the moderators and indicates that there are statistically significant differences according to geographical region. In European countries the difference, expressed in units of standardized mean difference (SMD) is three times greater than in Asian countries, and approximately 30% greater than that found in Latin American and Caribbean countries. For subjects, there is hardly any variation, with all of the subjects giving similar values to the overall effect. In general, the analysis by PISA edition demonstrated stable values. However, the effect in PISA 2015 was slightly smaller, and in fact the confidence intervals in 2012 and 2015 did not overlap, so the comparison in this moderator indicates a statistically significant difference.

*Table 2*
Moderator analysis

| | | Homogeneity analyses | | Comparisons by moderator |
|---|---|---|---|---|
| **Moderators (k)** | **SMD and 95% CI** (†) | **Q** (††) | **I²** | **$Q_b$ (df)** |
| **Region** | | | | 147.47 (3) *** |
| Europe (102) | 0.30 [0.27, 0.33] | 1709.35 | 94.1% | |
| Latin America & the Caribbean (36) | 0.19 [0.16, 0.22] | 299.89 | 88.3% | |
| Southeast Asia (36) | 0.09 [0.07, 0.11] | 188.84 | 81.5% | |
| Other (6) | 0.15 [0.13, 0.17] | 1.30 | 0.0% | |
| **Subject** | | | | 0.32 (2) |
| Mathematics (60) | 0.24 [0.20, 0.28] | 1490.13 | 96.0% | |
| Reading (60) | 0.23 [0.19, 0.27] | 1261.14 | 95.3% | |
| Science (60) | 0.22 [0.19; 0.26] | 1208.81 | 95.1% | |
| **PISA Year** | | | | 11.28 (3) * |
| 2009 (42) | 0.25 [0.21, 0.29] | 722.87 | 94.3% | |
| 2012 (33) | 0.29 [0.23, 0.35] | 1164.49 | 97.3% | |
| 2015 (54) | 0.18 [0.14, 0.22] | 1205.72 | 95.6% | |
| 2018 (51) | 0.23 [0.20, 0.27] | 771.50 | 93.5% | |

*k*: number of effects; SMD: difference in terms of units of standard deviation; CI: confidence interval; *df*: degrees of freedom
(†) All of the SMD were statistically significant ($p < .001$)
(††) All of the *Q* values were statistically significant ($p < .001$), except Region = Others (not significant)
*** $p < .001$; * $p < .05$

One notable part of the variability of the data can be found between the geographical regions and countries. In this case, because of the nature of the PISA data, the analysis of outliers and influential cases is particularly interesting, as that allows us to identify countries whose effects differ from the mean, and are therefore causing much of the heterogeneity. Figure 1 shows the values of the indicators of distance (DFFITS and Cook's D) and indicates the countries where the effect of parental homework help on academic achievement is more marked.

The first thing that stands out is Germany (DEU), Croatia (HRV), and Hungary (HUN) exhibiting the most negative DFFITS values in all of the PISA editions and subjects, indicating that they systematically presented above-average effect sizes, and consequently, larger Cook distances. Other countries in Europe also stand out from the pattern of European results: Malta (MLT) and the United Kingdom (GBR), whose DFFITS values indicate very small effect sizes. In the case of the UK, in the only edition in which they participated the level of representativeness of the sample was very low (less than 10%, see Table 1) because the family questionnaire was only applied in Scotland. Therefore caution must be used with the data as it may reflect bias in sample selection. The anomaly in Malta is the large variation of the effect depending on the PISA edition. In 2015 the effect was practically null (high DFFITS values), whereas in 2018 the size was similar to the international mean, and so the final three points in the DFFITS series are close to 0.

Korea stands out within the Southeast Asian countries, systematically giving high DFFITS values, which indicates a relatively small effect in all editions and subjects. Finally, in Latin America and the Caribbean, the country which stands out is Mexico, where the effect size fluctuates from year to year: in 2012 and 2018 it was around the international mean, while in 2015 it was clearly lower and a long way from the mean as the peak in the Cook's distance series shows.

Figure 2 groups the countries by region, and within the regions, orders them by descending effect size (the numerical values are available in the appendix, Table A2). The European countries largely exhibit effects that are larger than the mean. For Germany, Hungary, and Croatia, we estimate that students who get frequent or constant help with homework are around five school terms (about a year and a half) behind. In Latin America and the Caribbean the situation is varied. In Panama, the size of the effect is above the mean, although without statistical significance, whereas in the Dominican Republic, the effect is similar to the Asian countries, which exhibit effects that are significantly below the international mean.

Tables 3 and 4 show the results of the meta-regression analysis. Table 3 compares the five regression models that best represented the data, ordered by parsimony, as indicated by AIC. Model M#61, which had the lowest AIC, was four times more likely to be a better fit to the data than the second best model (M#29). In addition, the A-$w_i$ estimator indicates that approximately 70% of the M#61 simulations would be the solution that best covers the distribution of the estimated effects. Multimodal inference confirmed that any model that aims to predict the differences of the effect of family help must include the geographical predictors, as they appeared in all of the models. PISA-Year seems to be another interesting predictor, it appeared in three of the five best models, including M#61.

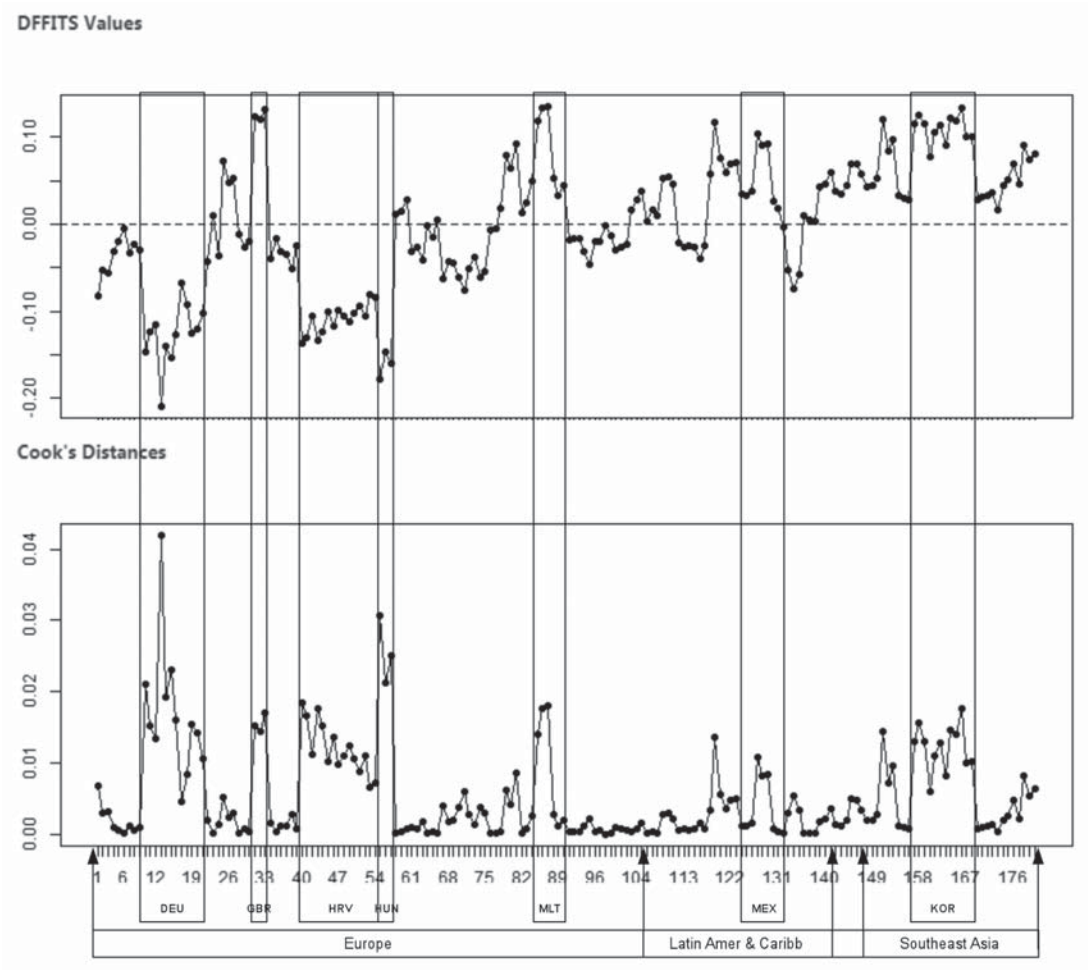


**Figure 1.** Results of the DFFITS analysis and Cook's distances for the effect analysed

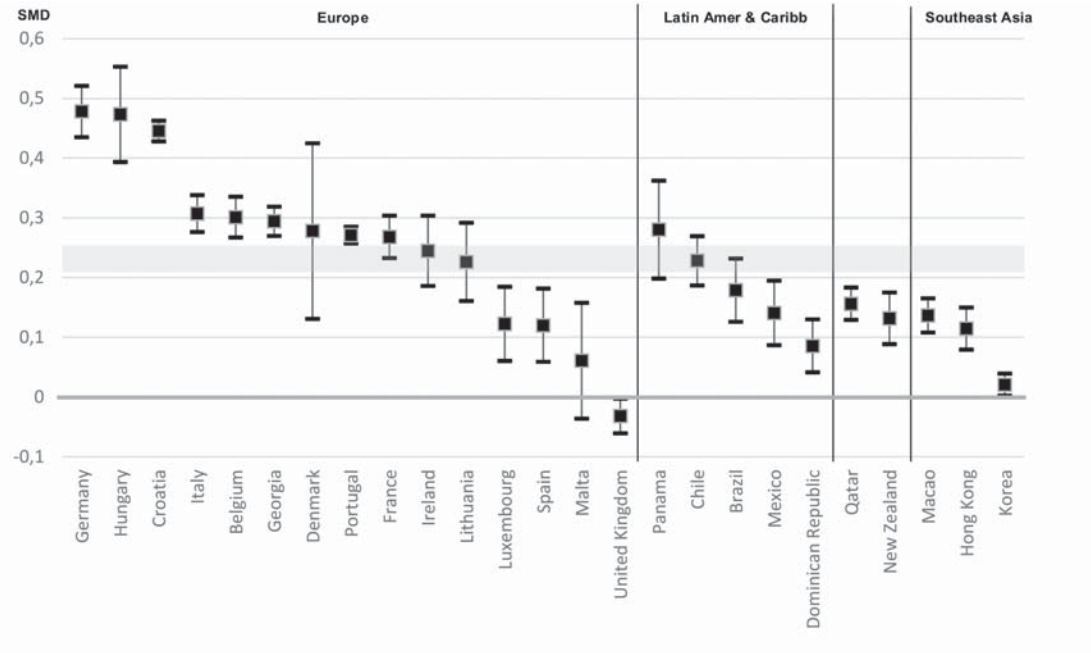


**Figure 2.** Effect size and 95% Confidence Intervals by country

*Table 3*
Multi-model inference: coefficients of the five best regression models and comparisons of their fit values

| | Identification of regression models | | | | |
|---|---|---|---|---|---|
| | **M#61** | **M#29** | **M#63** | **M#62** | **M#31** |
| Reg: Southeast Asia | -0.215 | -0.211 | -0.215 | -0.215 | -0.211 |
| Reg: Latin America & the Caribbean | -0.109 | -0.115 | -0.109 | -0.109 | -0.115 |
| Reg: other | -0.194 | -0.157 | -0.194 | -0.194 | -0.157 |
| PISA Year (2009 = 0) | -0.007 | *n.i.* | -0.007 | -0.007 | *n.i.* |
| Subject: Science | *n.i.* | *n.i.* | -0.010 | *n.i.* | -0.010 |
| Subject: Read | *n.i.* | *n.i.* | *n.i.* | -0.003 | *n.i.* |
| Number of parameters in the model *(k)* | 6 | 5 | 7 | 7 | 6 |
| Akaike's information criterion (AIC) | -248.0 | -244.8 | -243.6 | -243.3 | -240.5 |
| $\Delta i$ | 0 | 3.2 | 4.4 | 4.7 | 7.5 |
| Evidence ratio *(ER)* | 1 | 5.0 | 9.0 | 10.5 | 42.5 |
| Akaike weight (A-$w_i$) | 0.697 | 0.141 | 0.078 | 0.068 | 0.016 |

$\Delta i$: Increase in AIC compared to the best model (M #61); *n.i.*: Predictor not included in the model

In Table 4, the full model predicts that students who receive frequent, systematic help with their homework get worse results. However, it indicates that the size of the effect varies from region to region. Europe exhibits the greatest differences; the effect size is 0.33, which in terms of the PISA scale would be equivalent to being one school year behind. The countries of Southeast Asia are at the opposite end of the spectrum, controlling for the effect of subjects and PISA-year, the difference between autonomous students and students who need or get frequent help is estimated to be around 0.11 units of standard deviation, or approximately one school term. In Latin America and the Caribbean the size of the effect (0.22) would be equivalent to approximately two school terms in the PISA scale. The size of the effect shrank very slightly (0.05) between the 2009 and 2018 editions of PISA, and was not statistically significant. However, PISA-Year cannot be completely ruled. out, as that was found on the limit of significance ($Z = 1.6$, $p \approx .10$) and the predictor importance indicator suggests that in more than 80% of the replications this variable would be an important predictor for explaining variations in the distribution of the data. Finally, the effect is practically identical in the three subjects evaluated, and the capacity of the subject variables to predict changes in effects seems to be marginal.

*Table 4*
Multi-model inference coefficients for predicting the effect of family help on PISA results

| | Estimate (SMD) | Std. Error | z value | p(>\|z\|) | Importance predictor |
|---|---|---|---|---|---|
| Intrcpt (*) | 0.332 | 0.022 | 14.857 | .000 | |
| Reg: Southeast Asia | -0.214 | 0.022 | 9.529 | .000 | 1.000 |
| Reg: Latin America & the Caribbean | -0.110 | 0.023 | 4.860 | .000 | .999 |
| Reg: other | -0.184 | 0.057 | 3.214 | .001 | .983 |
| PISA Year (2009 = 0) | -0.006 | 0.004 | 1.634 | .102 | .823 |
| Subject: Science | -0.001 | 0.007 | 0.157 | .875 | .103 |
| Subject: Read | 0.000 | 0.006 | 0.055 | .956 | .090 |

(*) Intrcpt: Region = Europe; Subject = Mathematics; PISA year = 2009

## Discussion

One of the most usual forms of parental involvement in children's education is homework assistance, although the results of research on this topic are usually inconsistent, and there are no universally accepted conclusions (Wilder, 2014). In general, the narrative reviews of research (Boonk et al., 2018) indicate that parental help with homework is negatively associated with educational results. Nonetheless, quantitative meta-analyses offer all kinds of results: positive effects (e.g., Jeynes, 2003; Patall et al., 2008), negative effects (Barger et al., 2019; Hill & Tyson, 2009), and non-significant effects (Castro et al., 2015; Jeynes, 2005, 2007; Kim, 2020; Kim & Hill, 2015; Tan et al., 2020). It is likely that these inconsistent findings come about because, as Desforges and Abouchaar (2003) noted, often researchers are "measuring different 'things' under the same name and measuring the same 'thing' with different metrics" (p. 14). When dealing with parental involvement in homework, meta-analyses include a variety of behaviours within a single codification that demonstrate contrasting effects. For example, having a single category that combines help with homework and styles of communication about school topics, which seem to have differential effects (Fernández-Alonso et al., 2017; Rosenzweig, 2001). This has led to calls for research to stop using very general categories and instead focus on specific aspects (Boonk et al., 2018).

The present meta-analysis focused on a very specific aspect, the relationship between parental help with homework and academic achievement. The results indicate that the amount of parental help with homework is negatively correlated with academic achievement, in line with indications from narrative reviews of the research and other summary studies (Boonk et al., 2018; Higgins & Katsipataki, 2015), as well as with some quantitative meta-analyses (Barger et al., 2019; Hill & Tyson, 2009). Family involvement with homework being negatively related to academic achievement is somewhat paradoxical. There are two types of explanation given for this result (Fernández-Alonso & Muñiz, 2021). The first suggests that seeking help frequently with homework is the consequence, rather than the cause, of low achievement. In other words, difficulties in learning increase the likelihood that children or teachers would ask for more support and engagement from parents (Hoover-Dempsey

et al., 2001) who would respond to that call and change their behaviour to suit the academic circumstances. Both naturalistic research (Wingard & Forsberg, 2009), and quantitative, repeated-measures studies (Dumont et al., 2014; Valero-Aguayo et al., 2021) have documented this. When children present problems with motivation, concentration, difficulties in organizing their work, or a prior history of poor performance, parents tend to be more controlling and interventionist. Similarly, other studies have highlighted maturity and intelligence, personality traits, and self-regulation strategies as key factors in achievement (Morales-Vives et al., 2020; Xu et al., 2020) which may affect family behaviour in relation to homework. The second type of argument note that in homework involvement, the "how" is much more important than the "how much". Studies into styles of family involvement in homework assistance have noted the importance of the quality of the assistance, much more than how often it is offered (Cooper et al., 2000; Morini et al., 2015). Not all help is harmful, but there are forms of involvement that, whether by unskilled teaching on the part of the parents, or through the use of excessively controlling, meddling, or punitive styles, have negative repercussions on academic performance.

Other reviews have indicated the need to gather evidence that provides transcultural validity to family involvement (Kim 2020). Once again, our results seem to be consistent, family help with homework has a negative effect in all regions, although the size of the effects is not the same in all of them. The effect is larger in Europe and more moderate in Asian countries, which is in line with the data from Kim (2020) and Jeynes (2017). Additional evidence would be needed to confirm whether this smaller effect has any relation to beliefs in the role of the family in education or other cultural questions which moderate the effect of parental help on academic results.

Most research confirms the hypothesis that the effects of family help with homework are similar for all subjects (Castro et al., 2015; Erion, 2006; Fan & Chen, 2001; Jeynes, 2016, 2017; Kim, 2020; Nye et al., 2006). In PISA 2009, the question about family involvement was generic, while in the other editions, the questions focused on the main subject being evaluated in each study. The moderator analysis found no differences between the years or between the subjects, which may indicate that, at least for the way in which PISA constructs student scores, the estimations of the effect of family involvement are similar, regardless of whether the measures of involvement are generic or aimed at some specific subject.

In short, helping children with homework more is associated with poorer school performance. This effect was similar in the three subjects analysed, it was invariant over the last ten years, and was replicated in all of the geographical-cultural groups compared. Nonetheless, in terms of the latter case, it seems that help with homework has more negative effects in European samples and somewhat more moderate effects in Southeast Asian countries.

There are some limitations to our study. The most notable is a result of its specificity, given that in order to present valid comparisons, we opted to severely restrict the population of studies of interest. This limits the reach of the conclusions, which cannot be generalized beyond the population which is finishing compulsory education, or lower secondary at most. In addition, PISA uses a cross-sectional design but despite that, in this meta-analysis we did not consider any adjustment variables to control for differences between groups because our aim was to present a gross effect of the differences. An analysis is still pending which deducts the influences of socio-economic determinants and students' families, and thus produces a net effect of the differences (García-Crespo et al., 2019). Looking towards the future it is impossible to ignore the current situation. The COVID-19 pandemic has created the largest disruption to modern education systems in history, closing schools and imposing regimes of mixed in-person and remote classes. Parents have often been asked to facilitate their children's learning at home, which may mean widening the equality gap in terms of parental competency for educating their children and the resources available in the home (Orgilés et al., 2021; The United Nations Educational, Scientific and Cultural Organization [UNESCO], 2020). Future lines of research should aim at detailing the strategies and tools families used for school support, although the data from this study seem to indicate that that homework help is not a necessary ingredient for children's success, no matter where one lives.

## Supplementary Material

The appendices for this article are available online.

- Appendix A. Standardized mean difference by effect: https://osf.io/ycd2k/
- Appendix B. Syntax to replicate the analysis (R-Studio): https://osf.io/hx6sy/
- Homework Meta-analysis PISA. Data file: https://osf.io/kghsw/

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