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Validity and reliability of the Parental Homework Management Scale

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Abstract

Background: Prior research has shown that parents help their children manage homework (i.e. environment, time, motivation and emotion management), especially in elementary school. However, researchers have not developed and validated a scale focused on those dimensions. **Method:** The purpose of the present study is to validate the Parental Homework Management Scale (PHMS) for parents of elementary school children in the domain of mathematics. A sample of 2,118 parent-child dyads was split randomly into two groups to conduct the analysis in two stages: (i) exploratory factor analysis on Group 1 and (ii) confirmatory factor analysis on Group 2. **Results:** PHMS is comprised of two distinct but related factors (i.e. environment-time and motivation-emotion management). Results further indicated that the PHMS was positively related to homework self-regulation and positive emotions, and negatively related to math achievement. Contrary to expectations, no relationship was found between PHMS and amount of student homework completed. **Conclusions:** The scale revealed good psychometric quality.

Keywords: Homework management, parental involvement, parents' reports, math, elementary school.

Resumen

Validación y fiabilidad de la escala de gestión de tareas para casa para padres. **Antecedentes:** investigaciones previas revelaron que los padres ayudan a sus hijos a gestionar las tareas para casa (i.e., el ambiente, el tiempo, la motivación y las emociones), especialmente en la escuela primaria. Sin embargo, la investigación no ha construido y validado una escala enfocada en esas dimensiones. **Método:** el presente estudio valida el Parental Homework Management Scale (PHMS) para padres de niños de escuela primaria en el dominio de las matemáticas. Una muestra de 2,118 díadas padres-hijos se dividió aleatoriamente en dos grupos para realizar el análisis en dos etapas: (i) análisis factorial exploratorio en el Grupo 1 y (ii) análisis factorial confirmatorio en el Grupo 2. **Resultados:** PHMS está compuesto por dos factores distintos pero relacionados (i.e., gestión del ambiente-tiempo y de la motivación-emoción). Los resultados indicaron además que el PHMS se relacionó positivamente con la autorregulación y las emociones positivas en las tareas para casa, y se relacionó negativamente con el rendimiento en matemáticas. Contrario a las expectativas, no se encontró relación entre PHMS y la cantidad de tareas completadas por los estudiantes. **Conclusiones:** la escala ha revelado una buena calidad psicométrica.

Palabras clave: gestión de las tareas para casa, participación de los padres, informes de los padres, matemáticas, escuela primaria.

Homework, which is understood as an activity to complete during non-instructive hours (Cooper, 1989), requires self-regulatory competencies from students in order for them to hand in the assignments to their teachers in a timely manner (Núñez, Suárez, Cerezo et al., 2015; Valle et al., 2016; Xu, 2010; Zimmerman & Kitsantas, 2005). In fact, among several student and class variables (e.g., homework interest, teacher feedback), homework management strategies are one of the strongest indicators of students' homework completion (Xu, 2011; Xu & Wu, 2013). In this process, parents may play an important role helping their children manage homework (e.g., Cunha et al., 2015; Deslandes & Rousseau, 2008; Xu & Corno, 1998), especially at elementary school age when students are less able to self-regulate their learning and homework behavior (Zimmerman & Kitsantas, 2005; Zimmerman & Martinez-Pons, 1990). For example, Xu and Corno (1998) videotaped elementary school students doing homework and found five homework management strategies that engaged both students and parents: arranging the environment, managing time, monitoring attention, monitoring motivation and monitoring emotion. The authors concluded that in some cases, the strategies used by students seemed to be modeled by their parents.

Subsequent work, based on the self-regulated learning theoretical framework (e.g., Schunk, 2005; Zimmerman, 2008), was focused on the development (Xu & Corno, 2003) and validation of homework management scales for middle and high school students (Xu, 2008a,b). These studies found that each homework management strategy is a distinct, yet related, factor. Xu and colleagues also conducted studies to analyze the relationships between students (e.g., homework interest) and context-related variables (family help, teacher feedback) and homework management strategies (e.g., Xu, 2011; Xu, Du, & Fan, 2017).

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In regards to parental involvement, a significant influence of parents' help in homework on elementary and secondary students' reported homework management strategies was found (Xu & Wu, 2013), namely environment, time, motivation and emotion management (Deslandes & Rousseau, 2008; Xu & Corno, 2003, 2006). Notwithstanding these findings, studies conducted with Chinese students in mathematics (8th, 10th and 11th grades) showed mixed results: no relationship between middle school students' homework management and parents' help frequency was found (Xu et al., 2017); however, a positive and significant relationship was found between parents' help frequency and high school students' time management (Xu, Yuan, Xu, & Xu, 2014).

Taken together, this set of studies showed that parents' involvement in homework is positive. However, these studies largely focused on homework management strategies as reported by middle and high school students. However, to the best of the authors' knowledge, researchers did not develop and examine a scale focused on parental homework management. A study such as this would be valuable to shed some light on mixed results found on parental homework involvement (see Fernández-Alonso, Álvarez-Díaz, Woitschach, Suárez-Álvarez, & Cuesta, 2017; Patall, Cooper, & Robinson, 2008) and help scrutinize the differential influence of parents' homework involvement on students (e.g., Moroni, Dumont, Trautwein, Niggli, & Baeriswyl, 2015). The current study intends to address this gap in previous research on parental homework involvement. This line of research is particularly important given that parents are likely be involved in their children's education through homework (Pomerantz, Moorman, & Litwack, 2007; Wilder, 2014).

Hence, the current study aims to conduct a psychometric evaluation of the Parental Homework Management Scale (PHMS) focused on the following four dimensions in which parents usually engage: environment, time, motivation and emotion management (Cunha et al., 2015; Xu & Corno, 1998). Specifically, it was intended to: i) analyze the factor structure of the PHMS, ii) evaluate its internal consistency, and iii) examine its concurrent and predictive validity by measuring the relationships between the PHMS, students' homework variables (i.e. self-regulation strategies, positive emotions, and amount of homework completed) and math achievement.

Recent studies have analyzed parental homework involvement through students' reports, and they argue that students' perceptions are more related to their own behavior than their parents' reports (see Moroni et al., 2015). However, parents' reports could display useful data to further understand parental involvement, and these reports are expected to provide guidelines when designing preventive educational interventions on this topic. Moreover, and according to Núñez, Suárez, Rosário et al. (2015), elementary school students may struggle to clearly understand parental involvement in their homework, which may explain the non-significant relationships found between parental homework involvement and students' homework behaviors and achievement. For these reasons, we chose parents of elementary school children as the source of information for the current research.

According to a meta-analysis by Patall et al. (2008), the direction and strength of the relationships between parental homework involvement and students' outcomes are influenced by the content domain investigated (e.g., parental homework involvement is positively associated with reading skills, though negatively associated with math achievement), among other variables, which make a case to focus the current study on a specific domain. The reason for focusing on mathematics is twofold: i) students report that their parents help them more frequently in mathematics than in subjects such as physics, biology, history or languages (e.g., Trautwein & Lüdtke, 2009); and ii) students tend to be assigned more homework from their mathematics class than from other subjects (e.g., Xu et al., 2017).

According to extant literature, we hypothesized that the PHMS would be positively related to homework self-regulation (e.g., Cunha et al., 2015; Xu & Corno, 1998, 2003). As students who received family help reported higher emotion management strategies (Deslandes & Rousseau, 2008; Xu & Corno, 2003, 2006), we hypothesized that the PHMS would be positively related to positive homework emotions. As parents help to cope with the basic physical and motivational conditions to complete homework, we hypothesized that the PHMS would be positively related to amount of homework completed (e.g., Xu & Corno, 1998; Xu, 2011; Xu & Wu, 2013). Despite the positive expected relationships between PHMS and the referred variables, previous meta-analyses (Hill & Tyson, 2009; Patall et al., 2008) and a recent large-scale study (Fernández-Alonso et al., 2017) showed that parental homework involvement and math achievement is negative. Grounded on this data, we hypothesized that the PHMS would be negatively related to math achievement.

Method

Participants

A total of 2,118 dyads of sixth graders (N = 133 classes) and one of their parents or guardians (82% of mothers; M_{age} = 40.70; SD = 5.97) participated in this study. One thousand and forty (49.1%) parents of the students enrolled had completed compulsory education (9th grade), 529 (25.0%) completed the 12th grade, 283 (13.4%) held a college degree, and 59 (2.8%) held a postgraduate degree. The participant students (50.6% of boys) were aged between 10 and 13 years (M = 11.38; SD = 0.60) and attended three math classes per week (90 minutes each class). Students' final mathematics grades in the fifth and sixth grades ranged between 1 and 5, M = 3.44 (SD = 0.92) and M = 3.18 (SD = 0.92) respectively. In Portugal, the grades delivered in the end of each school term range between 1 (*negative*) and 5 (*excellent*), with 3 as a passing grade.

Instruments

PHMS. This scale consists of eight items involving a five-point option (see Table 1): never (1), rarely (2), sometimes (3), often (4), and very often (5). We developed these items based on previous research on homework management strategies of elementary school students (e.g., Xu & Corno, 1998) and middle school students (e.g., Xu, 2008a; Xu & Corno, 2003). The items of the students' homework management original scale (Xu, 2008a) were translated into Portuguese by an English-Portuguese teacher who is knowledgeable on homework research, then we adapted the items to reflect parents' behaviors in helping their child manage homework. These strategies include arranging the environment (e.g., helping my child find a quite area), managing time (e.g., helping my child set priority and plan ahead), monitoring motivation (e.g., praising my child for good effort), and monitoring emotion

(e.g., telling my child to calm down). Initially, we incorporated 12 items for the current study; we removed four items from the final analysis due to high bivariate correlation among pairs of items (e.g., motivation management: "I praise my child when he/she has completed his/her math homework" and "I praise my child for the good effort he/she puts into his/her math homework").

Homework self-regulation strategies. This variable was assessed using the six items related to homework (e.g., "For example, if I have homework, I think if I have the necessary information, when I will do it, who I will ask for help…'') from the SRL Strategies Inventory by Núñez, Rosário, Vallejo, and González-Pienda (2013). Responses were given on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*) (α = .79 for this study). The model fits very well (χ^2 = 25.965; *df* = 9; $p < .01$; GFI = .996; AGFI = .990; TLI = .990; CFI = .994; RMSEA = .030, 90% CI (.017, .044)), which supposes a strong support to the construct validity.

Homework positive emotions. This variable was assessed through four items focused on homework emotions developed by Goetz et al. (2012): two items for enjoyment (e.g., "I enjoy my mathematics homework.") and two items for pride (e.g., "I take am proud of being able to do the homework in mathematics."). These four items were translated into Portuguese by an English-Portuguese teacher who is knowledgeable on homework research. Then these items were translated back by another English-Portuguese teacher who was blind to the original version of the instrument. The original and the translated versions of the items were compared, and the discrepancy found in one item was resolved through consensus among the research team. Responses were given on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*very much)* (α = .83 for this study). Most indexes suggest a good fit of the measurement model (χ^2 = 19.474; *df* = 1; $p < .001$; GFI = .995; AGFI = .954; TLI = .964; CFI = .994; RMSEA = .093, 90% CI (.060, .132)), supporting construct validity.

Amount of homework completed. This variable was examined using a single item ("How much of your mathematics homework do you usually do in a typical week?"; Núñez, Suárez, Cerezo et al., 2015), ranging from 1 ("*I didn't do any of my homework*") to 5 ("*I did all my homework*").

Math achievement. Researchers collected students' grades on the national standardized exam in mathematics (end of 6th grade) in the schools' secretary offices. Grades in national exams range from 1 to 5, where 1 and 2 were identified as failure, 3 was identified as passing, 4 as good, and 5 as excellent.

Procedure

The Portuguese Ministry of Education authorized the present study, and afterwards, we randomly contacted 50 elementary public schools from various regions of Portugal. Thirty schools agreed to participate in the research (return rate of 60%). Parents with children in those schools were contacted and invited to participate with their children in the current research (72% agreed to participate voluntarily).

Data were collected by the first author and 10 research assistants who were distributed throughout the country. Before data collection began, all researchers and collaborators participated in a two-hour meeting to set the protocol for data collection.

Students and parents were informed by the research assistants about the aims of the study and were assured the confidentiality of data. The students' data was collected during a regular lesson in the second term of the school year (February-March) by the research assistants and without the teachers' presence. At the same period of time, parents' data was collected in schools before a parent-teacher conference. Parents were encouraged to call the researcher with questions about any item they found to be unclear.

Data analysis

Exploratory Factor Analysis (EFA)

In the present study, 2,118 students came from 133 classes; these classes were divided into two groups randomly. Responses from Group 1 (*n* = 1,049 parents) were subject to principal components analysis with direct oblimin rotation (delta = 0). The appropriate number of factors for retention was determined by several criteria such as the scree plots, eigenvalue > 1.0, and conceptual meaningfulness of items on each factor.

Confirmatory Factor Analysis (CFA)

Responses from Group 2 (*n* = 1,069 parents) were subject to CFA to examine the factor structure of the PHMS, which was based on EFA findings from Group 1. CFA were conducted in Mplus 7.31 using robust maximum likelihood estimation to correct non-normality in the measures (Muthén & Muthén, 1998-2012). To address the nesting of students within schools, standard errors were adjusted by using analysis option "type is complex" in Mplus.

Table 1
Rotated Factor Pattern (Structure) Matrix for the PHMS

Item		Factor	
		Environment-time	**Motivation-emotion**
1	I help my child locate the materials he/she needs to complete math homework	.728 (.724)	-.009 (.339)
2	I help my child find a quiet area for doing math homework	.727 (.786)	.125 (.472)
3	I help my child keep track of homework tasks remaining to be done	.786 (.739)	-.098 (.277)
4	I help my child set priorities and plan ahead math homework to optimize time	.722 (.759)	.078 (.423)
5	I tell my child that he/she is able to do math homework even when he/she feels that it is too hard	-.063 (.333)	.829 (.799)
6	I praise my child for the good effort he/she puts into his/her math homework	-.053 (.339)	.822 (.796)
7	I tell my child to calm down when he/she has math homework difficulties	.155 (.471)	.663 (.737)
8	I try to encourage my child when he/she has math homework difficulties	.057 (.440)	.802 (.829)

Note: Group 1 (*n* = 1,049). PHMS = Parental Homework Management Scale

Several goodness-of-fit indicators were applied in the present study. These consisted of: (a) comparative fit index (CFI) ≥ .95 (Hu & Bentler, 1999), (b) root mean square error of approximation (RMSEA) ≤ .05 (Browne & Cudeck, 1993), and (c) standardized root mean square residual (SRMR) ≤ .08 (Hu & Bentler, 1999).

Concurrent and predictive validity evidence

We examined Pearson correlations between the PHMS and four external measures: homework self-regulation strategies, positive homework emotions, amount of homework completed, and math achievement.

Results

EFA

For Group 1 (n = 1,049), the Kaiser-Meyer-Olkin measure of sampling adequacy (.864) indicated that this group was appropriate for EFA. EFA results revealed a two-factor solution that accounted for 60.2% of the total variance. All items loaded rather highly (> .66) on the two factors that can be appropriately referred to as (a) Environment-time, and (b) Motivation- emotion. Table 1 presents the factor pattern and structure coefficients.

CFA

With respect to Group 2 (n = 1,069), CFA findings showed that, compared with one-factor solution ($MLR\chi^2$ = 516.360; df = 20; CFI = .827; RMSEA = .121; 90% CI [.110 - .133]; SRMR =.074), the two-factor solution yielded a much better fit to the data ($MLR\chi^2$ = 137.026; df = 19; CFI = .959; RMSEA = .060; 90% CI [.048 - .073]; SRMR =.036). In addition, as displayed in Table 2, the chi-square difference test showed that the difference between these solutions was highly significant, $\Delta MLR\chi^2$ (Δdf = 1) = 129.113, p < .001. Thus, the two-factor solution yielded far better results than did the one-factor solution, suggesting that Environment-time and Motivation-emotion were empirically distinguishable for Group 2.

As each of the eight items was specified to load on only one factor in the two-factor solution (either Environment-time or Motivation-emotion), the structure coefficients estimated indicator–construct correlations (Kline, 2010). As displayed in Table 3, the standardized estimates for each of eight indicators was acceptable (ranging from .532 to .818), thus providing additional empirical support for convergent validity (Maruyama, 1998). The estimated correlation between Environment-time and Motivation-emotion was .648, p < .001.

Reliability

The means for the two groups combined (N = 2,118) were 3.47 (SD = .95) for Environment-time and 3.88 (SD = .89) for Motivation-emotion. Alpha reliability estimates were .747 (.728-.764) for Environment-time and .809 (.795-.822) for Motivation-emotion. These reliability coefficients are normally considered as good to very good in measurement practice (DeVellis, 1991; Henson, 2001). Item-total correlations ranged from .490 to .694, showing good homogeneity.

Concurrent and predictive validity

Table 4 shows the Pearson correlations coefficients of the relationships between PHMS and four external measures (i.e. homework self-regulation strategies, positive homework emotions, amount of homework completed, and math achievement). The relationships between the two factors of PHMS and students' homework self-regulation strategies and positive emotions were positive and statistically significant. However, the amount of homework completed showed no relationship with environment-time factor and a marginally statistically significant relationship with the motivation-emotion factor. In addition, both factors of PHMS were negatively and statistically related with math achievement.

Table 2
Model Comparison: Summary of Goodness-of-Fit Statistics

Model	χ^2	MLRχ2	df	RMSEA [90% CI]	CFI	SRMR	MC	Δdf	Δ$MLR\chi^2$
One-factor model	516.360	332.895	20	.121 [.110-.133]	.827	.074	–	–	–
Two-factor model	137.026	92.685	19	.060 [.048-.073]	.959	.036	2 vs 1	1	129.113***

Note: Group 2 (n = 1,069). *RMSEA* = Root Mean Square Error of Approximation; *CI* = Confidence Interval; *CFI* = Comparative Fit Index; *SRMR* = Standard Root Mean Squared Residual; *MC* = Model Comparison
*** p < .001

Table 3
Standardized Coefficients for the Two-Factor CFA Model

Latent construct	Item	β
Environment-time	1	.532
	2	.710
	3	.600
	4	.784
Motivation-emotion	5	.689
	6	.662
	7	.732
	8	.818

Note: Group 2 (n = 1,069)

Table 4
Pearson correlations between PHMS and four external measures

External measures	PHMS	
	Environment-time	Motivation-emotion
Homework self-regulation	.097***	.124***
Homework positive emotions	.046*	.091***
Amount of homework completed	.025	.039†
Math achievement	-.084***	-.067**

Note: PHMS = Parental Homework Management Scale. $N = 2{,}118$
† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$

Discussion

Extending prior research focused on validating homework management scales for students (Xu, 2008a,b), the purpose of the current study was to validate the PHMS focused on math domain for parents of elementary school students. Results indicated that PHMS has good psychometric quality regarding validity and reliability evidence. Moreover, the two-factor model proved to be a much better fit than the one-factor model. Unlike data validation of the students' homework management scales (Xu, 2008a,b), the current findings indicated that each homework management strategy did not saturate in one factor. In this study, environment and time management items saturated in the same factor, and motivation and emotion management items saturated in another factor. The environment-time management factor describes parents' physical structure provision; meaning, parents' efforts to help their children organize their environment and manage their work time. The motivation-emotion management factor describes the psychological structure provision; meaning parents' efforts to help their children manage motivation and emotion to focus on the task and overcome obstacles related to homework completion (see review by Hoover-Dempsey et al., 2001).

Concerning the concurrent validity, and consistent with theoretical expectations (Cunha et al., 2015; Xu & Corno, 1998, 2003, 2006), the PHMS was positively associated with homework self-regulation strategies and positive homework emotions. Specifically, Pearson correlation coefficients were higher for the motivation-emotion factor than for the environment-time factor. Notwithstanding these findings, it is important to note that Pearson correlation coefficients are low. According to literature, parents' reports compared with students' reports show weaker relationships with students' variables (see Moroni et al., 2015). However, the current scale may be valuable to examine parents' homework management strategies, especially in elementary school when children may struggle to respond to Likert scales (e.g., Mellor & Moore, 2014; Núñez, Suárez, Rosário et al., 2015), particularly if they seem unaware of self-regulatory strategies associated with homework at this developmental stage (e.g., Xu & Corno, 1998).

Contrary to expectations, no significant relationship between PHMS and the amount of homework completed was found. This data suggests that parents' help in homework management may not be sufficient to help students complete math homework. In fact, to learn math successfully, students need to develop skills (e.g., execute procedures accurately) and abilities (e.g., logical thought) to understand math concepts (National Research Council & Mathematics Learning Study Committee, 2001). Specifically, in order to perform math homework independently, students should be able to execute procedures correctly (National Research Council & Mathematics Learning Study Committee, 2001). Thus, if children struggle to do homework and parents lack the content knowledge or teaching methods needed to help their children, homework completion may be compromised (e.g., Patall et al., 2008; Wilder, 2014). This may also be related with the following results (see Castro et al., 2015).

A negative and statistically significant relationship was found between PHMS and math achievement. The former finding is consistent with the meta-analyses (e.g., Hill & Tyson, 2009; Patall et al., 2008) and recent studies (e.g., Fernández-Alonso et al., 2017; Silinskas, Niemi, Lerkkanen, & Nurmi, 2013) that found a negative relationship between parental homework involvement and math achievement. In fact, these studies as the current research are correlational; so, caution must be taken regarding inferences. As prior researchers noted, negative correlations can mean that children's poor achievement lead to more parental homework involvement (Castro et al., 2015; Cooper, Lindsay, & Nye, 2000; Núñez et al., 2017; Patall et al., 2008; Pomerantz et al., 2007). Moreover, recent research reported that distal parental involvement (e.g., communication about school), and, to a greater degree, students' autonomous homework completion, positively contributes to mathematics achievement (e.g., Fernández-Alonso et al., 2017; Fernández-Alonso, Suárez-Álvarez, & Muñiz, 2016).

Data stressed that parents may play a valuable role in homework management by promoting physical and motivational/psychological conditions crucial for their children to approach math homework. This is a very positive message for parents from all educational backgrounds since this kind of involvement in homework is not dependent on their educational level (e.g., Deslandes & Rousseau, 2008; Xu & Wu, 2013).

School administrators, teachers, and counselors may wish to use PHMS as a tool to examine parents' homework involvement and may subsequently design preventive or remedial interventions according to school and students' needs. Moreover, researchers may further analyze the relationships between different types of parental homework involvement regarding homework management, and other students' homework variables throughout the school year, extending prior research in different school levels (e.g., Moroni et al., 2015; Núñez, Suárez, Rosário et al., 2015; Xu et al., 2017). Despite the contributions of the current study, the sample was based on sixth grade students. It would be valuable to include a representative sample throughout elementary school grades. Moreover, further research is needed to validate the PHMS in other subjects and cultures as parental involvement may play out differently in other domains (e.g., reading; Dumont, Trautwein, Nagy, & Nagengast, 2014; Patall et al., 2008) and cultural settings (e.g., Huntsinger & Jose, 2009).

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