



Does homework design matter? The role of homework's purpose in student mathematics achievement



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ABSTRACT

This study used a randomized pretest–posttest clustered design to examine the effect of 3 homework purposes (i.e., *practice*, *preparation*, and *extension*) on 6th graders' mathematics achievement and how this relationship was modulated by the amount of completed homework. A total of 27 mathematics teachers and their 638 students participated in this study. Once a week for six weeks, the teachers assigned tasks that had a specific type of homework purpose according to their treatment condition. At the end of the six weeks, the students completed a non-standardized mathematics achievement test. The results of multilevel modeling showed that after controlling for student characteristics and class-level variables, extension homework positively impacted students' mathematics achievement, while practice and preparation homework did not. These findings were not related to the amount of homework that was completed by the students. The findings highlighted the importance of the teacher's role in the first phase of the homework process (i.e., designing homework with a specific purpose) and provide important data for teachers and school administrators to reflect upon when conducting actual homework practices.

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1. Introduction

The Russians' launch of the Sputnik satellite in the late 1950s provided an opportunity to reflect on the quality of educational systems, specifically the American system, for preparing new generations for a technological and competitive world (Cooper, 1989; Cooper, Robinson, & Patall, 2006). Homework policies were among the American educational system's response for addressing these educational challenges (Cooper, 1989; Cooper et al., 2006). In the literature, homework is defined as the set of school tasks that are assigned by teachers for students to complete outside of school hours (Cooper, Steenbergen-Hu, & Dent, 2012) and viewed as an important instructional tool (Cooper & Valentine, 2001; Fernández-Alonso, Suárez-Álvarez, & Muñiz, 2015; Hagger, Sultan, Hardcastle, & Chatzisarantis, 2015; Marzano & Pickering, 2007). The homework process is complex and involves three actors (i.e., students, parents and teachers), who have goals and behaviors that can sometimes be misaligned and in conflict (e.g., Cooper, 1989; Cooper et al., 2006; Núñez et al., 2015; Trautwein & Köller, 2003; Warton, 2001). Previous research has primarily focused on students' perceptions of homework behaviors (e.g., homework management, homework

effort, homework completion, homework emotions) (Dettmers et al., 2011; Goetz et al., 2012; Rosário et al., 2011; Trautwein, Lüdtke, Schnyder, & Niggli, 2006; Xu, 2011; Xu & Wu, 2013) and parental involvement in homework (e.g., Dumont, Trautwein, Nagy, & Nagengast, 2014; Patall, Cooper, & Robinson, 2008). Despite the importance of teachers' variables on the homework process, there is limited research on the impact of teachers' homework practices on students' learning and achievement (e.g., Bang, 2012; Epstein & Van Voorhis, 2012; Trautwein, Niggli, Schnyder, & Lüdtke, 2009). Thus, the present study aims to fill this research gap with a study of the impact of homework purposes on students' academic achievement.

1.1. Factors that influence homework

The Cooper homework model (1989) synthesizes factors that have the potential to influence the effect of homework on students' homework behaviors and academic achievement (e.g., exogenous factors, such as student characteristics, assignment characteristics, initial classroom factors, home-community factors, and classroom follow-up).

Due to limited space, we only address the variables that encompass homework assignment characteristics. According to Cooper (1989), homework assignments can vary in the following aspects: the amount (empirically measured by the amount of time students spend completing homework and the frequency students are assigned homework), purpose, degree of individualization, degree

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of choice, completion deadlines, and social context (i.e., the way that students complete the homework—individually, in a group, asking for help).

Recently, research on homework has analyzed the relationship between several of the previously mentioned homework variables, students' homework behaviors and their relationship to academic achievement (e.g., Cooper, Lindsay, Nye, & Greathouse, 1998; Cooper et al., 2006; Núñez, Suárez, Cerezo, Rosário, & Valle, 2013; Trautwein, Köller, Schmitz, & Baumert, 2002; Xu, 2008). The amount of time spent on homework is one variable that has attracted attention from researchers (e.g., Cooper et al., 2006; Keith, 1982; Trautwein & Lüdtke, 2007; Trautwein, Schnyder, Niggli, Neumann, & Lüdtke, 2009). There have been mixed results for the relationship between the amount of time spent on homework and homework effectiveness (e.g., Dettmers, Trautwein, & Lüdtke, 2009; Núñez et al., 2013; Trautwein, 2007). For example, Keith (1982) reported a positive association between the amount of time spent on homework and students' academic achievement in high school, while other authors found low, null or negative relationships in elementary, middle and high schools (e.g., Cooper et al., 2006; Núñez et al., 2013; Rosário et al., 2009, 2011; Trautwein, Schnyder et al., 2009). In contrast, research that has examined homework frequency has consistently shown a positive association between homework frequency and academic achievement (e.g., Coleman, Hoffer, & Kilgore, 1982; Dettmers, Trautwein, Lüdtke, Kunter, & Baumert, 2010; Farrow, Tymms, & Henderson, 1999; Fernández-Alonso et al., 2015).

There are extensive data on the relationship between homework behaviors (e.g., the amount of time spent on homework and homework frequency) and students' academic achievement; however, there is limited research on the relationship between different types of homework purposes and academic achievement (Epstein & Van Voorhis, 2001, 2012; Hallam, 2004; Warton, 2001). In fact, the phase of homework preparation (e.g., the design and purpose of the assigned tasks) has not yet been extensively studied despite its importance to the subsequent steps in the homework process (e.g., Bang, 2012; Epstein & Van Voorhis, 2001, 2012; Warton, 2001).

1.1.1. The role of homework purposes

Despite the relationship between homework behaviors and students' academic achievement, assigning more homework does not lead to better homework performance when teachers do not consider other homework characteristics, specifically the purpose for each homework task (Epstein & Van Voorhis, 2001). Lee and Pruitt (1979) proposed a description of homework assignment purposes to increase the benefits of homework tasks. These authors described four types of instructional homework purposes: practice (i.e., practicing the material that is covered in class to master skills), preparation (i.e., preparing the next lesson), extension (i.e., transferring prior learning to new situations) and creative (i.e., integrating several competencies into one task as a research project) (Lee & Pruitt, 1979, p. 32). The same authors call for teachers to attend to the importance of assigning homework tasks that are aligned with purposes that can promote students' engagement and meaningful learning.

Epstein and colleagues' research on the topic (see Epstein & Van Voorhis, 2001; Van Voorhis, 2004) identified 10 homework purposes that can be organized into three groups: instructional (i.e., practice, preparation, participation, and personal development), communicative (i.e., parent–child relations, parent–teacher communication, and peer interactions), and political (i.e., policy, public relations and punishment). Recently, Epstein and Van Voorhis (2012) reinforced that homework purposes are an essential aspect of homework's ability to maximize impact on students' learning and academic success. According to these authors, when homework tasks are devoid of clear homework purposes, students are more likely not to complete the homework. Thus, as Epstein and Van Voorhis

(2012) suggested, there is a call to clarify the effects of homework's contrasting purposes on students' academic results. These findings could provide information on teachers' and school administrators' homework practices, schools' homework policies and, consequently, improve homework practices.

Based on previous research (e.g., Epstein, 1988, 2001; Epstein & Van Voorhis, 2001; Lee & Pruitt, 1979), Cooper (2001) defined homework purposes as an assignment characteristic that could potentially influence homework's utility. He proposed four instructional homework purposes, as follows: practice or review, preparation, extension and integration (for a full description, see Cooper, 2001). Moreover, Cooper (2001) stated that homework can serve other purposes that are not related to instruction: parent–child or parent–school communications, directives from school administrators and student punishments. Several years later, Cooper et al. (2006) concluded that practicing and reviewing the material taught in class was the most frequent homework purpose used by teachers. Other studies that were conducted in different academic domains (e.g., mathematics, language, physics, science) and with different grade levels (i.e., elementary and middle school) support these findings (e.g., Danielson, Strom, & Kramer, 2011; Kaur, 2011; Tas, Sungur-Vural, & Öztekin, 2014). However, these studies did not address the impact of homework purposes on students' academic achievement.

More recently, Xu (2008) proposed a taxonomy that comprised fifteen homework purposes that were then reduced to three (i.e., peer-oriented, adult-oriented and learning-oriented reasons) as a result of a factor analysis that assessed the validity of the homework purposes scale (Xu, 2010a). In a multilevel study, Xu (2010b) analyzed the relationship between 8th- and 11th-grade students' perceptions of homework purposes and found several variables that were related to the homework process (i.e., interest in homework, feedback perceived by students, affective attitude toward homework and homework help from the family). The author found that the three homework purposes (i.e., peer-oriented, adult-oriented and learning-oriented reasons) were positively associated with affective attitude toward homework, interest in homework, teacher feedback and homework help from the family. The studies by Xu (2008, 2010a, 2010b) focused on students' perceptions and did not examine teachers' reports on the purpose of the homework. Moreover, the relationship between homework purpose and academic achievement was not addressed in Xu's studies (2008, 2010a, 2010b).

To our knowledge, only two studies have analyzed the influence of homework purposes on students' academic achievement, with conflicting results (i.e., Foyle, Lyman, Tompkins, Perne, & Foyle, 1990; Trautwein, Niggli et al., 2009).

Foyle et al. (1990) used an experimental design in a classroom with 64 5th-grade social studies students. They found that homework purposes (i.e., homework for preparation and practice) combined with cooperative learning improved 5th graders' social studies achievement compared to a group with no assigned homework. The authors concluded that students in the group with assigned homework increased the amount of time spent on task and benefitted from the two types of homework assignments (Foyle et al., 1990). However, there were no significant differences between the two types of homework purposes (i.e., practice and preparation). The authors suggested that there is a need for additional research to verify whether their findings could be generalized to other subjects. In contrast, Trautwein, Niggli et al. (2009) used teachers' reports of 8th-grade French as a second language students to analyze the predictive effects of homework objectives (including homework purposes), other variables that were related to teachers' practices and beliefs toward homework, and students' homework effort, emotions and academic achievement. The results indicated that students had lower grades in classes that assigned homework tasks with drill and practice objectives compared to classes that had homework

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