

**A systematic review of literature
examining the impact of homework on
academic achievement**

Canadian Council on Learning
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1. Introduction

1.1 Background

The impact of homework on students is a contested and polarizing issue. Gill and Schlossman (2004) examined the history of homework in the United States and found that a homework debate had begun as early as the 19th century. The dominant influence of the progressive political movement upon education between 1890 and 1940 meant that homework was harshly criticized and discouraged by educators. Not only was it deemed harmful to health, character and family, it was also considered an ineffective instructional tool. By the 1930s, measurement experts used evidence to confirm that in the pre-high school grades, homework had no beneficial effect on student achievement. This reinforced the pervasive discourse in education circles that homework represented a serious problem – and “the less of it the better” (Gill & Schlossman, 2004).

Harris Cooper (1989) charted the movement of the homework debate since the middle of the last century. During the 1950s, the USSR’s launch of *Sputnik* generated striking changes to North American education policies and attitudes in general. Part of *Sputnik*’s legacy was an increased call for students to focus more, and perform better, in school, particularly in science and math. Homework was seen as a necessary condition of guaranteeing learning, achievement, and future national accomplishments.

During the 1960s and 1970s however, opposition to homework grew, possibly as part of a greater backlash against the authority and rigidity of institutional structures. Some perceived homework as simply an added pressure on students. Opponents began to question the value of homework and its strong link to an ideological focus on achievement and production.

The attention to global economic competition in the 1980s and 1990s once again made the argument for homework’s necessity fashionable. Currently though, anti-homework sentiment in the United States appears to be on the rise. Several American publications such as *The Homework Myth* by Alfie Kohn, *The Case Against Homework* by Sarah Bennett and Nancy Kalish, and *The End of Homework* by John Buell and Etta Kralovec illustrate the continued popular interest, and current scepticism about homework. This systematic review examines both the empirical evidence and media attention surrounding homework.

Homework has become an issue of research and media attention in jurisdictions all over the world. In the United Kingdom, the news media follow this issue closely and new research continues to be conducted (Hallam, 2004). In Australia, both governments and independent researchers have analyzed homework (Government of Queensland, 2004; Alanne & Macgregor, 2007). In the United States, researchers (Cooper, 1989; Cooper et al., 2006), governments (United States Department of Education, 2007), and advocates (Kohn, 2006) all pronounce upon the issue. In Canada, there has been substantial media attention over the past two years, and new research has been published (Canadian

Council on Learning, 2007; Cameron & Bartel, 2008). Clearly, homework is an important issue both inside and outside of academia.

Cooper has completed two influential systematic reviews about homework in the United States (1989; 2006). These reviews have led to the widely referenced recommendation of no more than ten minutes of homework per grade level per day. The present review does not question these figures; instead, it examines empirical evidence from research conducted between 2003 and 2007 (the period post-Cooper) to investigate if there is an academic benefit to homework in the K-12 setting. In addition, the review analyzes media articles to present a popular portrayal of homework. Together, these two domains of analysis illustrate the impact of homework on individual student achievement, as well as on society at large.

The homework question is particularly interesting because students generally accept that their educational experiences will include homework, while parents, educators and decision-makers nonetheless routinely take sides on the issue. Media tends to get involved only when the pendulum appears to be swinging and a 'new' stance is taken by someone with some social and/or political clout. This review attempts to illuminate the issue through empirical evidence.

1.2 Homework in the Canadian context

Research

Homework has long been of interest to students, parents, and teachers across Canada, although the empirical research has typically been conducted outside this country. Recently, however, researchers within Canada have begun to examine homework in our context. First, the 2007 *Survey of Canadian Attitudes towards Learning (SCAL)*, conducted by the Canadian Council on Learning, revealed both positive and negative perceptions of homework. Over 5,000 Canadians were surveyed by telephone in the spring of 2007 for SCAL. While parents viewed homework as an important feature of education, they also reported that it was also a cause of household stress.

Second, a recently published report by Cameron and Bartel (2008), while outside the date range for inclusion in this review, offers pertinent Canadian information. Cameron and Bartel surveyed over 1,000 Canadian parents, mostly in Ontario, about their perceptions of homework. The authors found that parents are unsure about the effect of homework on achievement, especially in the intermediate grades. Also, the survey results showed that children's enthusiasm for homework wanes as they grow older. These data signify researchers' awareness that evidence specific to Canada is required to develop best homework practices for Canadians.

Current Canadian guidelines

Explicit homework policies are not centralized in any provincial or territorial jurisdictions in Canada. Instead, the setting of homework guidelines is left to school boards, or in most cases, individual schools and teachers. This lack of cohesive direction

on homework may lead to vastly different experiences for students and families depending on the school attended.

The question and purpose of this review

This review addresses the question, ‘is there an academic benefit to homework for students enrolled in the K-12 school system?’ The homework debate has increased in prominence as a result of Cooper’s (2006) review of evidence, the SCAL 2007 report, and several books that argue against homework published over the last four years. This review seeks to understand first, the latest empirical evidence regarding the possible academic benefits of K-12 homework, and second, the popular nature of this issue.

Cooper (2006) summarizes research conducted in the United States between 1987 and 2003 on the effects of homework on student achievement from Kindergarten through Grade 12. To avoid overlap with Cooper and to examine recent contributions to the research literature, this review examines studies published from 2003 to 2007. Cooper’s selection of studies provides interesting points of comparison which will be outlined in the discussion section.

1.3 Defining terms

Homework

This review requires a clear definition of ‘homework.’ The most common is Cooper’s (1989) “[h]omework can be defined as any task assigned by schoolteachers intended for students to carry out during non-school hours.” Marzano and Pickering (2007), Trautwein and Köller (2003), Pool (2005), and the United States Department of Education (2007) all follow this definition. While it is clear, concise, and well used, other definitions of homework are also available.

Alanne and Macgregor (2007) define homework as “the time students spend outside the classroom in assigned activities to practice, reinforce or apply newly-acquired skills and knowledge and to learn necessary skills of independent study” (p.2). More simply, Meyer (2005) defines homework as “acts of researching, studying, or completing assignments,” (p.9). The Queensland Government (2004) in Australia defines homework as, “any activities that school students are asked to complete outside of lesson time,” (p.6). Finally, the Bakersfield City School District (2005) uses a definition of homework borrowed from Keith and DeGraff (1999) that contains an important difference from Cooper’s, namely, “Homework may be defined as work assigned for completion outside of the normal class period whether completed at home or at school” (p.2).

While many definitions of homework exist, this review adopts Cooper’s because: a) it is the most commonly accepted definition in the literature; b) many other definitions simply adapt it; and c) it provides simplicity, inclusiveness and clarity.

Academic benefit

For the purposes of this review, academic benefit means student achievement. Student achievement can be measured in a number of ways, including standardized test scores,

student grades or GPAs, and class-based tests or quizzes. In order for an academic benefit to be present, the homework intervention must be linked with an appreciable effect size, discussed below. To be safely generalizable, the outcome must be statistically significant.

K–12

This term refers to the focus population of the review. Only studies and articles that focused on students enrolled in kindergarten to Grade 12 were included for analysis. The review is not concerned with homework that exists in early childhood education settings or the impact of homework on college and university students. This age focus follows previous reviews of evidence and addresses the primary concern of the popular discourse on homework.

1.4 Media

This review examines not only empirical research evidence, but also the way in which the media portray homework. The review team examined print media from 2006 and 2007, predominantly from Canada, in order to determine how closely it relates to the empirical evidence, and to understand the public perception of the homework debate. Including the media's perspective illuminates the strong public sentiment surrounding homework that became apparent while preparing this review.

The decision to include media articles is supported by scholarly writing on the importance of the media in modern society. According to Lingard and Rawolle (2004) the media can steer policy agendas. In other words, an issue that assumes importance in the media can become a priority for decision-makers. Moreover, the media can influence both the policy-making agenda and the public's perspective on this process. Blackmore and Thorpe (2003) contend that the public, and even professionals in the field, are most often informed of policy through the media. Blackmore and Thomson (2004) also claim that the media has become particularly important for manufacturing consent and promoting education policy agendas. In short, the media may often shapes the public perception of decision-making, especially in relation to education issues.

The conflict over homework among parents, educators, and students offers an opportunity for the media to not only inform, but also to steer the debate and, ultimately, to shape decision-making (Lingard & Rawolle, 2004). This review compares the media's portrayal of homework to the implications suggested by the evidence.

1.5 Using research to inform decision-making

Homework's controversial nature makes relying on research evidence and proven best practices even more important for those who may be considering the establishment of interventions or the improvement of existing initiatives. Decisions designed to affect learning outcomes should be informed by evidence to ensure maximum benefit for scarce resources. Time and resource constraints lead to additional concerns about gathering quality information to inform decision-making. A systematic review is an effective way of gathering, assessing, and learning from evidence-based research within a limited timeframe.

1.6 Being systematic

Essential components of systematic reviews are documentation and transparency. Procedures are followed to ensure an organized approach to the review process. CCL's approach to conducting reviews of evidence follows well-established review protocols which include thorough, transparent and systematic procedures for collecting and analyzing evidence-based research.

To ensure consistency, transparency and accountability when conducting systematic reviews, CCL's research and review team uses a variety of documentation tools, including EPPI Reviewer.¹ Replication and updates are important features of systematic reviews. Therefore, each review conducted by CCL includes the use of a search diary by the Information Retrieval Specialist to document and comment on all the searches conducted for each review. In the same fashion, all inclusion/exclusion criteria and decisions are documented, as are reasons for any exclusions of citations from the review. CCL has also developed a document control instrument to track and monitor the movement of all studies from their initial capture through to their final inclusion and analysis. A flow chart illustrating the movement of studies through the review is provided in section 3.1.

1.7 Stages of the systematic review

The following list provides a short description of each stage of the systematic review process. The results of each stage and their subsequent applications are described in greater detail in the methodology section.

Identification of the research question(s) and conceptual framing

Consultation with the client to identify the key concepts and emphases of the research is the first step. At this stage, the key terms used to formulate the question are clarified and defined. In addition, relevant databases along with key fugitive literature websites are identified with the assistance of experts and practitioners in the field.

Search strategy development

Search strategies are structured broadly to maximize the capture of articles. They are developed by identifying terms that represent the core categories of population, issue and outcome in the research question, and querying the thesaurus and subject heading functions in each of the electronic databases to be searched. Relevant 'key terms' are compiled and grouped according to the population, issue, and outcome of interest. These categorical terms are then linked together using Boolean logic and final search strategies are developed for the individual databases in order to maximize the retrieval potential in each of the subject specific databases. Search strategies differ slightly according to the capacity of each database.

¹ EPPI Reviewer is a web-based Systematic Review Program developed by Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre)

Searching

CCL's search procedures include a search diary. The diary documents all searches, their results and any decisions to adapt the search. Search results are imported to a citation management program and sorted for duplicate references.

Searching for fugitive literature (research not published in commercial databases) requires the collaboration of experts and practitioners in the field. Key websites are gathered and reviewed for relevant publications, references, and links to other pertinent sites. The reference lists of included articles are also reviewed for relevant studies.

The initial review of results

Once all the search results have been imported to the citation management program and sorted for duplicates, inclusion and exclusion criteria are developed to remove irrelevant material. The criteria are developed collaboratively by the review team and sent to the client for editing and approval.

The initial inclusion/exclusion criteria are applied to titles and abstracts only. Reviewers are instructed to include studies in cases where it is difficult to decide whether they meet the criteria so as not to eliminate relevant studies in error. Exclusion decisions are recorded in an inclusion/exclusion spreadsheet.

Document retrieval

Once the initial inclusion/exclusion stage is complete, the full texts of all included articles are retrieved for the second stage. The majority of studies are obtained via the internet. The reviewer saves an electronic copy of each retrieved study. Studies not available via the internet are located through university libraries whenever possible. The Information Retrieval Specialist tracks the retrieval of the studies using the document control sheet. Each study is tagged for the identification of its origin, which may be a database link, the Web (typically Google Scholar), the library or inter-library loan.

Secondary review

Retrieved articles are screened a second time based on a more thorough reading of the full text of the study. At this stage, more studies are excluded due to inappropriate research designs or a focus unsuitable to the research question.

Coding

After the initial studies are read in greater detail and the determination of included articles is finalized, the review team meets to develop coding and data extraction criteria in accordance with the question. During coding, detailed information and data reflecting the design, method, statistics, and results of each study are extracted.

Summaries and quality analyses

Each study is summarized by the reviewer. A rubric of quality is developed, applied to each study and included in the report. Evaluations of the studies are based upon the information gathered during the coding.

Synthesized findings

Studies are synthesized using a variety of techniques and methods appropriate to the question and the resulting capture of studies. Effect sizes for results are calculated where possible and necessary. In some cases statistical meta-analysis is possible; in other cases results are synthesized via a combination of qualitative and quantitative techniques. Using the coding sheet, studies are grouped and synthesized according to focus, results, and study quality. General statements on the findings are made accordingly.

2. Methods

2.1 Search strategy and inclusion/exclusion of studies and media

The search strategy for this review was developed by the research team. The initial search was structured broadly to maximize the capture of articles. At this point both media articles and academic studies were sought simultaneously through database and fugitive literature searching. The search term used was “homework.”

Using this term, final search strategies were developed for the following 16 databases: ERIC, PsychINFO, Academic Search Premier, Linguistic and Language Behaviour Abstracts, Sociological Abstracts, Proquest Dissertation Abstracts, CBCA Education, Education Index Full Text, International ERIC (Australian Education Index), International ERIC (British Education Index), Web of Science, Canadian Research Index, Biblioline Basic Family and Society Studies Worldwide, EPPI Centre, Campbell Collaboration, and Social Sciences Index. A date limiter of 2003 to 2007 was imposed on all searches. These 16 databases yielded 1,386 articles.

An initial search of newspapers was conducted using the Canadian Newsstand and the EBSCO Communication & Mass Media Complete databases. Due to the prevalent nature of homework in the media and the release of CCL’s second annual *Survey of Canadian Attitudes toward Learning* (SCAL) in late November 2007, a supplementary search of media was conducted in mid-December. This search captured articles published between the end of the previous search (October 15, 2007) and the date of the supplementary search (December 17, 2007). The databases searched were Canadian Newsstand and Lexis Nexis. Furthermore, Influence Communications’ daily media coverage report was searched for homework articles. The newspaper search yielded 856 articles.

In addition to the initial database searches, a ‘fugitive literature’ search to capture relevant research not published in academic journals was conducted in the following 40 research oriented websites from Canada: *Human Resources and Social Development Canada, Institute for Research on Public Policy, Educational Policy Institute, Atlantic Institute for Market Studies, CD Howe Institute, Caledon Institute on Social Policy, Canada West Foundation, Canadian Centre for Policy Alternatives, Canadian Council on Social Development, Canadian Foundation for the Americas, Canadian Policy Research Networks, Canadian Institute for Research on Regional Development, Carleton School of Public Policy and Administration, Conference Board of Canada, Fraser Institute, Montreal Economic Institute, Canadian Adolescents at Risk Research Network, Council of Ministers of Education, Canada, All Education Ministries in Canada, Canada Millennium Scholarship Foundation, Statistics Canada, Frontier Centre for Public Policy, Public Policy Forum, Institute for Advanced Policy Research, Ontario Institute for Studies in Education, Canadian Education Association, The McCreary Centre Society, Encyclopaedia of Language and Literacy Development, and Educational Policy Institute.*

The following 17 websites from the United States were searched: *American Institutes for Research, TCRecord, Economic Policy Institute, American Association of Colleges for Teacher Education: Education Policy Clearinghouse, RAND Institute on Education and*

Training, New York University's Institute for Education and Social Policy, Institute of Education Sciences, National Education Association, Manhattan Institute for Policy Research, Hoover Institution, The Cato Institute, National Center for Education Statistics, What Works Clearinghouse, National Institute for Early Education Research, Consortium for Policy Research in Education, Association for Supervision and Curriculum Development, and Center for Research on Learning and Training.

The following 9 international websites were also searched: *The Economic and Social Research Institute (Ireland), National Foundation for Educational Research, Institute for Public Policy Research, Centre for the Economics of Education, National Education Research Forum, Education-Line, Organization for Economic Co-operation and Development, Australian Council for Educational Research, and International Institute for Educational Planning.*

The fugitive literature search yielded 29 articles. All citations were entered into a single citation management program. The combined results of all the searches produced 2,271 initial articles; 332 were identified as duplicates and removed. The final number of articles included in the initial inclusion/exclusion process was 1,939. The agreed-upon criteria for the inclusion and exclusion of studies for this review were as follows:

- *Population:* studies were included provided the focus was on kindergarten through Grade 12 students in public or private schools. Studies that focused on special needs students or ESL students were excluded.
- *Outcomes:* studies were included if they assessed achievement outcomes. Studies that solely examined stress or psycho-social benefit were excluded.
- *Issue:* studies examining the effects of homework (school work assigned by the teacher to be completed at home) were included. Studies that examined counseling homework, home-schooling, and homework classes were excluded.
- *Methods:* empirical correlational, experimental, or quasi-experimental studies were included. Case studies, descriptive studies, and editorials were excluded.

The print media faced less stringent inclusion/exclusion criteria because the method and outcomes criteria were not applicable. Print media items were required to focus on K-12 students and homework.

2.2 Identification of studies and media

The initial database, newspaper, and fugitive literature searches produced 1,939 articles. The first application of inclusion/exclusion criteria disqualified 1,761 articles. One hundred seventy-eight articles remained for further analysis.

The next step in the process was document retrieval. Time and resource constraints did not permit the retrieval of documents that were inaccessible online; therefore, 16 articles were unobtainable. A total of 161 articles were collected for further analysis.

2.3 Secondary inclusion/exclusion of studies and media

During the secondary inclusion/exclusion stage, the entire article was read to apply the inclusion/exclusion criteria with greater specificity. Articles that did not meet the inclusion criteria but provided relevant background on homework were also marked at this time. These included relevant reviews of literature and studies providing background information, but perhaps unrelated to achievement outcomes. The secondary application of the inclusion criteria disqualified a further 64 articles. Among the remaining 97 articles, 83 were included for analysis and 14 were considered relevant background articles.

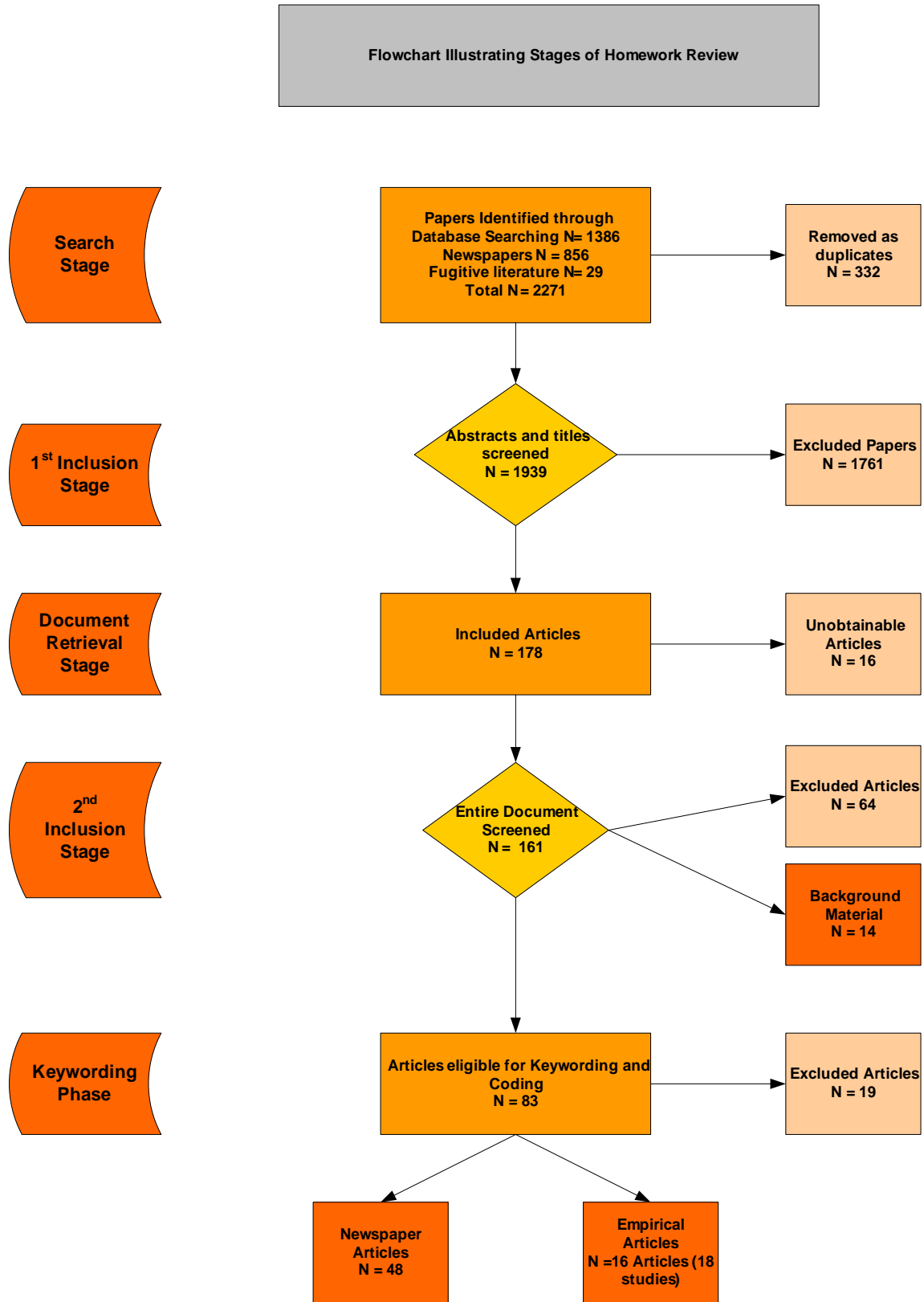
2.4 Review and analysis of research studies and media

Keywording guidelines were developed to organize the results of all studies and allow for cross-study comparisons. For each study, the author, the country and year of publication, the population, the design, and the focus were specified. Following keywording, a coding matrix was developed to allow for a more detailed analysis in terms of study aims, methodology, statistics, and findings. All studies were keyworded by two researchers. The results were then assessed for reliability and any differences were resolved through discussion. A sample of five studies was double-coded to test reliability. This test revealed strong reliability (over 90%). The remaining studies were single-coded.

Keywording guidelines for the print media were developed to organize the studies and to allow for comparisons and analysis across studies. For each article, the source, prevalence, country of publication, main focus, key issues, focus population, age group of focus, curricular area of focus, general framing, references and citations, headline, and framing structure were assessed. All print media articles were double-keyworded and checked for reliability. All discrepancies in keywording were resolved prior to analysis.

During the keywording process a further 19 articles were excluded. These were articles that, upon closer inspection, did not meet inclusion criteria. As a result, the final review included 48 print media items and 18 empirical studies, three of which occurred in a single published article. Figure 2.1 graphically summarizes the flow of literature through the review process.

Figure 2.1: The flow of literature



3. Mapping the Results: Identification and Description

The purpose of this review is to identify and evaluate the research examining the impact of homework on academic achievement. This chapter describes the origins, characteristics, and foci of the 18 research studies that met our criteria for inclusion.

Figure 3.1 summarizes the sources of the studies. Journals were the most common with a total of nine. Five sources were dissertations or theses, and the remaining four were fugitive literature.

Figure 3.1 Study sources

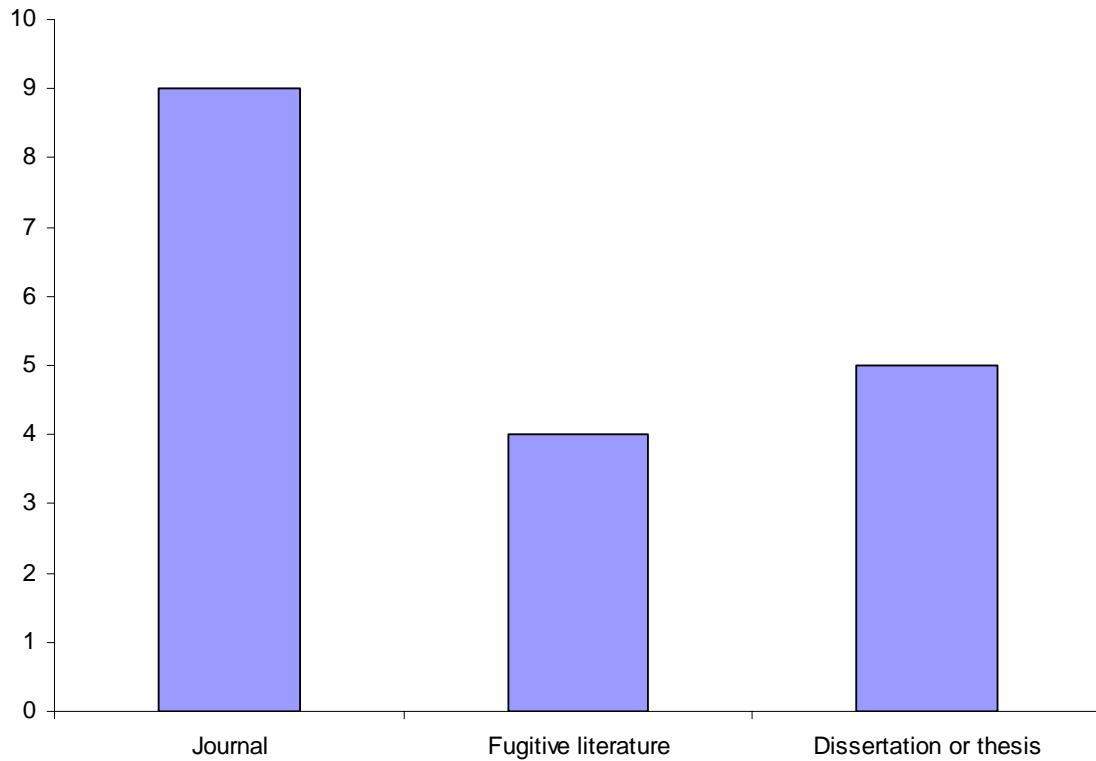


Figure 3.2 shows where the empirical studies were conducted. Fourteen studies originated in the United States and used American data. The remaining four were conducted in Germany using German data. The absence of Canadian data should be noted when interpreting results. Results from the highly stratified German schooling system may only be minimally or partially generalizable to the Canadian context. American school systems also differ from those in Canadian jurisdictions in demographics, funding, and levels of teacher-education.

Figure 3.2 Country of origin for the studies

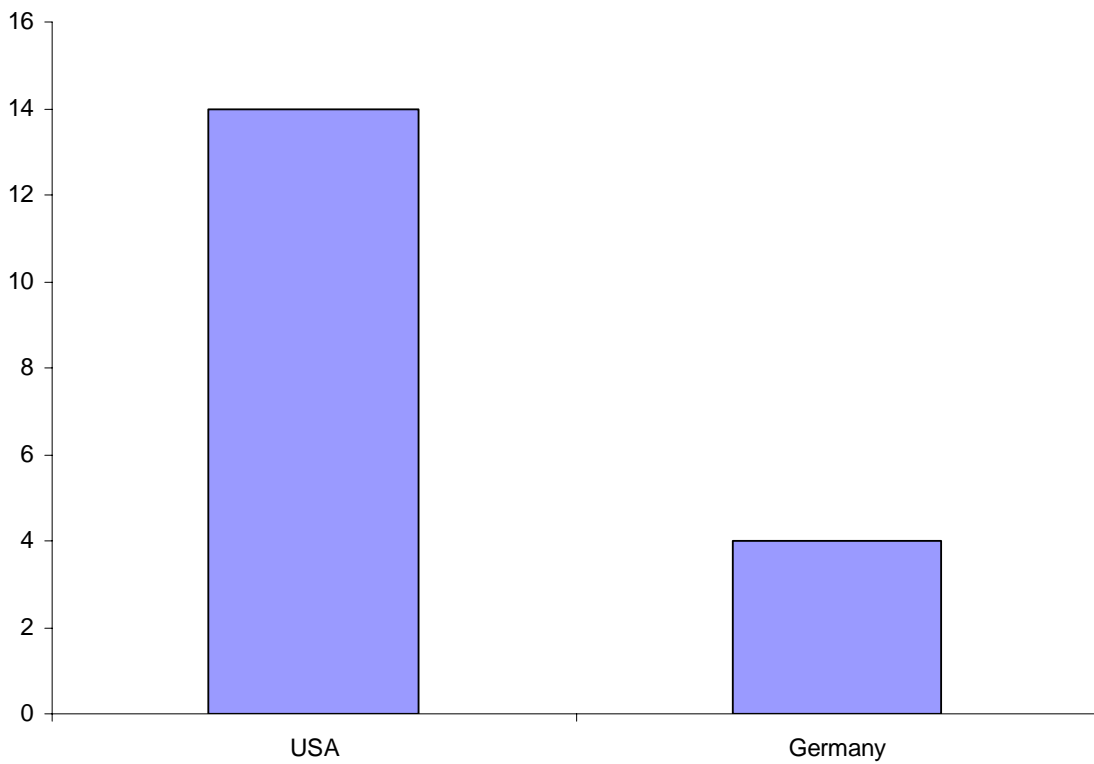
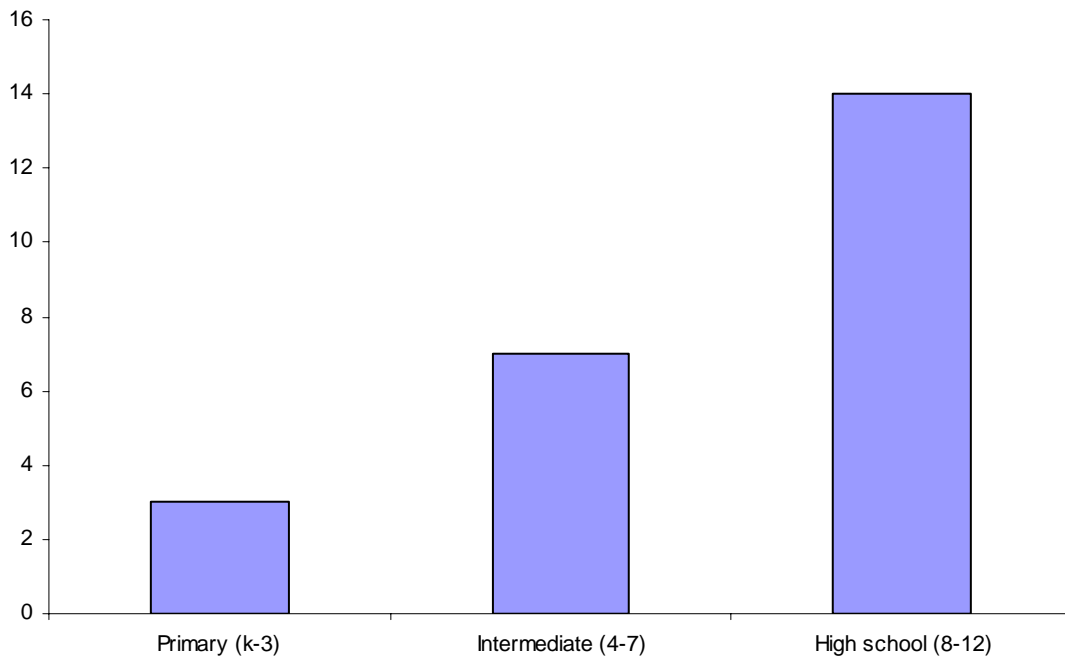


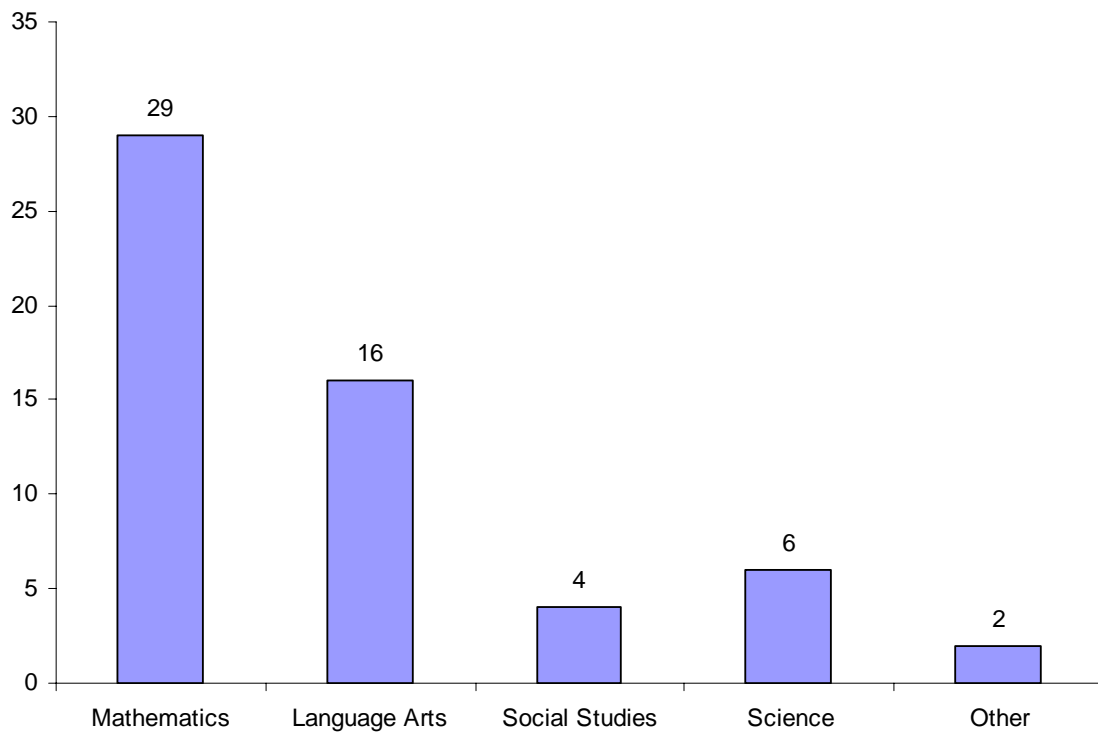
Figure 3.3 illustrates the grade level of the population across the 18 studies. Fourteen studies focused on grades eight to 12. Seven focused on the intermediate grades and three were concerned with kindergarten to Grade 3. The total does not sum to 18 because of overlap between intermediate and high school, which occurred when a study focused on middle school grades. These studies were assigned to both the intermediate and high-school categories.

Figure 3.3 Grade level



Most studies contained more than one measure of achievement. In total, we uncovered 57 distinct academic outcomes. Figure 3.4 shows their distribution across academic subjects. Mathematics outcomes were most often measured, followed at some distance by language arts, which includes both reading and writing. There were far fewer science and social studies outcomes, perhaps owing to the relative lack of standardized tests in these fields. The ‘Other’ category included GPAs and combined test scores.

Figure 3.4: Frequency distributions of academic outcomes

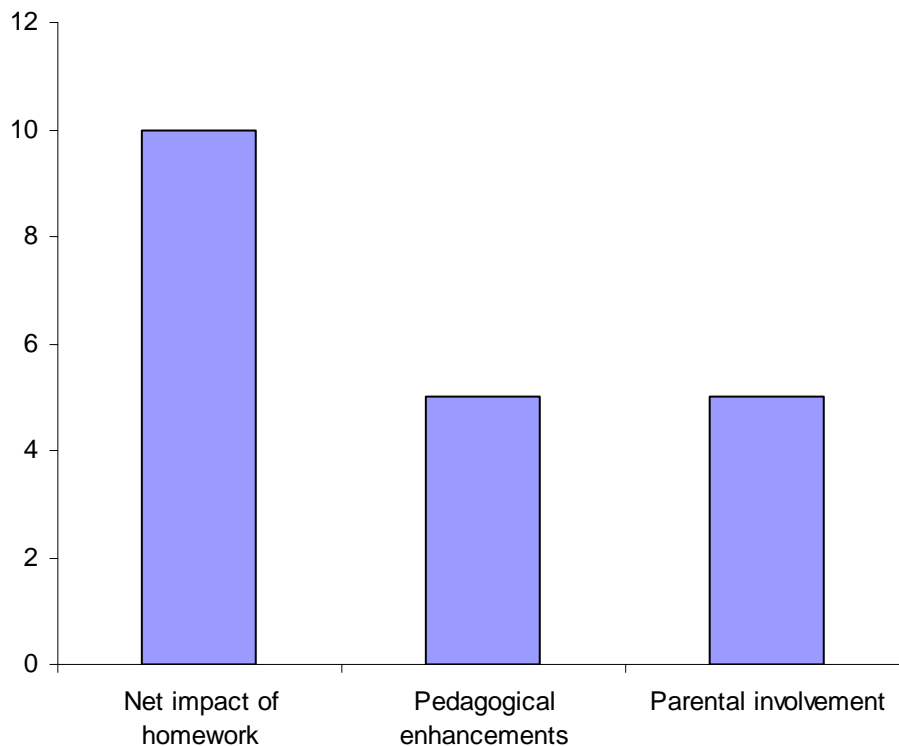


During the keywording process, the research questions were identified for each study. Sixteen publications yielded 20 research questions upon which we imposed three categories: net impact of homework; pedagogical enhancements; and parental involvement (see figure 3.5). These research question categories are employed throughout the remainder of the review for ease of synthesis.

The net impact studies directly address this review’s research question: what is the net impact of homework on achievement? They examine different dimensions of ‘doing homework,’ including: time spent on homework; effort exerted on homework; frequency of homework; and, frequency of homework completion. Figure 3.3 shows 10 studies examined net impact evidence. Three of these studies were contained within a single paper (Trautwein, 2007). A further two addressed the net impact of homework tangentially (Meyer, 2005; Mooring, 2004), while their main research questions involved pedagogical enhancements, discussed below.

Research questions addressing pedagogical enhancements examined, quasi-experimentally, if assigning innovative types of homework, - i.e. web-based, or learning strategy based - improved performance, relative to traditional types of homework. Five studies had this focus. A final five studies compared the effects on achievement of involving parents in homework to not involving them. These latter two study categories examined important dimensions of homework and achievement, but did not directly compare the effects of doing homework to not doing it.

Figure 3.5: Frequencies of research questions



4. Study Summaries and Quality Assessments

4.1 Overview

In this section, we explain how the studies were evaluated and provide an evaluation score for each; describe the need to calculate effect sizes for authors' results; and finally, summarize the research studies, calculate effect sizes where necessary and possible, and assess authors' claims in light of these analyses. Lastly, we synthesize the findings from the 48 media articles.

4.2 Quality assessment

We evaluated the quality of a research study by examining key aspects of the research model and the reporting. Five criteria described the quality of the model, and three the quality of reporting. For model quality, we evaluated the selection method, treatment fidelity, research design, outcome measures, and confounding variables. For reporting, we evaluated conclusions, limitations, and statistical results. Although some criteria are related to each other, we believe meeting each criterion is essential for producing a study with valid and reliable results.

Therefore, equal scoring weight was assigned to all criteria. A score of 3 indicates high quality with reference to a particular criterion. A score of 2 indicates medium quality, and 1 low quality. In order to determine the studies with the best qualities, the scoring was downward biased: that is, if a study was judged between medium (2) and low (1) for a particular criterion, it was scored as low (1).

Table 4.1 shows the quality assessment rubric, and defines each criterion. Table 4.2 shows the score of each study on each criterion and its overall quality score. With eight criteria, the possible scores range from 8 to 24. A study with a score of 20-24 is considered 'high quality;' the research design, data and results are rigorous. The findings are reliable (i.e. not under or overstated) and relevant to decision-makers. A study with a score between 16 and 19 is considered 'medium quality.' While some methodological flaws exist, the results still illuminate the research question. However, the findings should be interpreted with caution when used to inform decision-making. A study with a score of 15 or below is considered 'low quality.' Because a low quality study typically has one or more major methodological flaws, the findings are often unreliable and should not be used in isolation for decision-making.

Table 4.1: Criteria for assessing study quality

	Study scored 1 if	Study scored 2 if	Study scored 3 if
Research Model			
Selection method and assignment to groups	Sample too small or single group study; non-random, non-matched assignment OR Small and/or non-representative sample for secondary analysis	Pre-existing (intact) groups (i.e., all classrooms in one school); matched groups OR Sample representative of a very limited population.	Random selection/ Regression design/ Intact groups with a specific treatment in place OR Sample large and representative of a wider population.
Treatment fidelity OR Construct validity (in correlational studies)	Inappropriate or no training to teachers; training provided did not result in appropriate implementation of the treatment or intervention; more time given to the intervention group OR Indicators do not appear to measure the concepts they intend to measure.	Assessing the experimental group, but not the control group OR Indicators are limited operationalizations of their concepts	All groups observed or otherwise ensured that treatment protocol is followed; assessed existing behaviours or practices OR All indicators valid operationalizations of concepts
Research design	Single group pre-test/post-test, or post-test only OR Bivariate or univariate statistics only.	Pre-test and post-test with the matched groups OR Multiple regression design with only one level of analyses when two are required by data.	Pre-test and post-test with control group OR Regression design with appropriate levels of analyses

	Study scored 1 if	Study scored 2 if	Study scored 3 if
Outcome measure	Outcome measure(s) are irrelevant or very general. Only measures included are aligned to the treatment Intervention is teaching to the test	Single measure used for outcome and dependent variables.	Multiple variables (or highly relevant variable) are used for measuring the outcome and dependent variable.
Confounding variables	No confounding variables are considered (including pre-test scores).	Only demographic variables are considered and/or pre-test score is not controlled for.	All relevant variables are considered or controlled for. If pre-test, that score is controlled for.
Reporting			
Conclusions	Conclusions are not supported by evidence.	Conclusions are over- or understated.	Conclusions are supported by evidence presented in the study.
Limitations	No or too little discussion of limitations.	Some, but not all, of the limitations are acknowledged.	Limitations of the study are acknowledged and accurate.
Statistical results	No statistics are reported or inappropriate statistics are used.	Reporting of statistics is incomplete and/or inconsistent. Effect sizes cannot be calculated.	Relevant statistics and descriptives are presented.

Table 4.2: Summary of methodological quality

Authors	Selection method	Treatment fidelity	Research design	Outcome measure	Confounding variables	Conclusions	Limitations	Statistical results	Total	Rating
Bailey (2006)	2	1	3	2	1	3	3	2	17	Medium
Davis (2004)	2	1	1	2	1	3	3	3	16	Medium
Dean (2004)	2	3	2	3	2	3	3	3	21	High
Eren & Henderson (2006)	3	3	2	2	3	2	2	2	19	Medium
Keith, Diamond-Hallam, & Fine (2004)	3	2	3	2	2	2	3	2	19	Medium
LeTendre & Akiba (2007)	3	2	2	2	1	2	2	2	16	Medium
McMullen(2007)	3	2	2	2	3	2	2	2	18	Medium
Meyer (2005)	1	3	1	3	1	3	2	2	16	Medium
Minotti (2005)	2	2	2	2	2	2	2	2	16	Medium
Mooring (2004)	2	1	2	3	2	2	3	2	17	Medium

Authors	Selection method	Treatment fidelity	Research design	Outcome measure	Confounding variables	Conclusions	Limitations	Statistical results	Total	Rating
Pool (2005)	2	3	2	3	1	3	1	3	18	Medium
Swezey (2004)	2	2	3	3	2	3	2	3	20	High
Trautwein <i>et al</i> (2006)	2	3	2	3	2	3.	3	3	21	High
Trautwein (2007), 1	3	2	3	2	2	3	3	3	21	High
Trautwein (2007), 2	3	2	2	2	2	3	2	3	19	Medium
Trautwein (2007), 3	2	1	3	3	3	3	3	3	21	High
Van Voorhis (2003)	2	2	2	3	3	3	3	3	21	High
Xu & Corno (2003)	2	1	1	3	1	3	3	2	16	Medium

4.3 Effect sizes and significance testing

Most experimental research in education contents itself with testing for the statistical significance of a hypothesis. A statistical test that strongly indicates the results derived from the experimental treatment, and not by chance, is reported as ‘significant.’

Typically, social science researchers look for a significance level indicating there is a 95% likelihood that results did not occur by chance. This level is often expressed $p < .05$ (meaning, such a result would occur by chance only 5% of the time). Statistically significant results are thus thought to be generalizable to their populations.

Statistical significance is important, but limited in a number of ways. First, it is a theoretical mathematical calculation whereby it is very easy to achieve statistical significance with large samples, and very difficult to achieve it with small samples. In the former case, then, statistically significant results may have little or no practical significance. To know if a treatment (like a homework assignment) has practical significance, we need to know the magnitude of its impact, or how much change/improvement is produced by the treatment. In the latter case, potentially interesting results of large magnitude are routinely dismissed as “insignificant” usually because sample sizes weren’t large enough to achieve statistical significance. While statistically non-significant results cannot be safely generalized, they are often misinterpreted, or even misreported, as results of “no effect” which is not the case.

To counter these two limitations of hypothesis testing with only tests of significance, some scholars (e.g. American Psychological Association) argue a measure of magnitude (an effect size) should always be reported along with significance results. As yet however, this recommendation is not often followed in experimental social research. However, although few of this review’s studies reported an effect size, we were able to extract relevant data from most reported outcomes to calculate effect sizes independently. We report these below in the study summaries.

Our effect size statistics are either Hedges’ g or Cohen’s d , depending on the data reported by the author. When interpreting either effect size statistic, Cohen’s (1988) rule of thumb may be followed. Effect sizes of .8 or greater are large; effect sizes of .5 are medium, and those around .2 are small. Effect sizes can be positive or negative. In our summaries we code all effect sizes favouring the homework intervention as positive. Except where noted, all effect sizes were also statistically significant.

In some cases, authors did not provide enough information for us to calculate effect sizes; we interpreted this omission as a quality flaw, and deducted one point from the ‘Statistical results’ criterion in our quality assessments when it occurred. In other studies, the statistical models used, especially multi-level models, did not provide data amenable to effect size calculations. No penalty in quality assessment score was levied in such instances.

4.4 Study summaries: Net impact of homework (time, frequency, quantity, effort)

The net impact studies directly address the question of homework’s effect on achievement. Unfortunately, none of these studies is experimental; all are correlational. While they are well constructed, by definition they cannot show causality, which both prevents definitively answering the research question, and leads to contradictory results among the studies.

The net impact studies subsume eight publications; however Trautwein (2007) comprises three distinct studies and Meyer (2005) and Mooring (2004) each examine a single net impact outcome tangential to their main purpose. Therefore, a total of eight articles are assessed and summarised in full here. The Meyer (2005) and Mooring (2004) results are noted but their full summaries occur in the ‘pedagogical enhancements’ subsection. As table 4.3 shows, five studies have medium quality ratings, and three have high. Meyer and Mooring both rate medium.

Table 4.3: Quality ratings of net impact studies

Study	Score	Quality Category
Eren & Henderson (2006)	19	Medium
Keith <i>et al.</i> (2004)	19	Medium
LeTendre & Akiba (2007)	17	Medium
McMullen (2007)	18	Medium
Trautwein <i>et al.</i> (2006)	21	High
Trautwein (2007), Study 1	21	High
Trautwein (2007), Study 2	19	Medium
Trautwein (2007), Study 3	21	High
Meyer (2005)	16	Medium
Mooring (2004)	17	Medium

Eren & Henderson (2006) examined the role of homework on student achievement using both parametric and non-parametric analysis. The authors claimed that a non-parametric study in this field was needed due to the theoretical “non-monotonic relationship between homework and student achievement” (p.2) - i.e. the time spent on homework may not consistently affect achievement in the same manner. As a result of this inconsistent relationship, the authors state that a parametric model that fully captures

the true relation between homework and achievement may be difficult to find. The authors also argued a high likelihood of biased estimates obtains when using a parametric model to examine the effect of homework on student achievement. Therefore, they conducted both parametric and non-parametric analyses of the effect of time spent on homework on student achievement.

Using data from the U.S.A.'s *National Educational Longitudinal Study* of 1988 combined with follow-up surveys in 1990, and 1992, the authors analysed the correlation of homework and student achievement in Grade 10 mathematics. The final sample included only students who attended public schools for whom all data were available for the study's defined variables (n= 6,913).

Eren and Henderson found that homework was an important correlate of Grade 10 mathematics achievement. Furthermore, their non-parametric results indicated that additional homework was more beneficial for high and low achievers than for average achievers. Beyond certain limits of time spent on homework however, there were diminishing returns in achievement. Higher achievers were able to productively use longer amounts of time. Lower achievers could productively use a shorter amount of time before it was beneficial for them to 'give up.' The authors cautioned that it is unclear whether extra homework will reduce inequalities in achievement – extra homework may actually increase the gap between the best students and the average students; as a result further research is required. Their statistical model was too complex to allow for trustworthy independent secondary effect size calculations.

The rigorous statistical design of the study was compromised by the authors' decision not to use multi-level modelling, the most appropriate way to isolate a student level effect like 'doing homework,' from potential school or classroom level effects such as 'attending a school/class that assigns a lot of homework' While they did use a school fixed effects model, which only compares students with other students within their school, variations in homework practices among classrooms were not appropriately accounted for. This is important because the positive statistical effect of doing more homework may result from attending a classroom where more homework is assigned, whereas just spending more time doing homework than one's classmates may have little or no effect.

Keith et al.'s (2004) study was focused on the influence of 'in-school' and 'out-of-school' homework on students' grades. The authors used structural equation modelling (SEM) to determine the magnitude of influence of in-school and out-of-school homework on grade 10 and 12 grade point averages (GPA). GPA was derived from grades in mathematics, science, social studies, and English. This study utilized a large sample of 13,546 students taken from three phases of the U.S.A.'s *National Education Longitudinal Study* (NELS), 1988, 1990 and 1992.

The authors found that while in-school homework had little or no effect on learning outcomes, out-of-school homework had a strong, positive impact on Grade 12 GPAs; it also positively affected Grade 12 achievement test scores. We were able to calculate

effect sizes for each Grade 12 mark independently, for both time spent on homework in grades 10 and 12, both in and outside of school. As the authors claimed, the statistically significant out-of-school effects were much larger than the statistically insignificant in-school effects. We report the out-of-school homework effects only as ‘in-school homework’ does not meet our working definition of homework (see section 1.3).

- Out-of-school homework 10 and Social Studies 12 (Hedges’ $g = .59$);
- Out-of-school homework 10 and Science 12 (Hedges’ $g = .51$);
- Out-of-school homework 10 and Math 12 (Hedges’ $g = .53$);
- Out-of-school homework 10 and English 12 (Hedges’ $g = .65$);
- Out-of-school homework 12 and Social Studies 12 (Hedges’ $g = .51$);
- Out-of-school homework 12 and Science 12 (Hedges’ $g = .42$);
- Out-of-school homework 12 and Math 12 (Hedges’ $g = .40$);
- Out-of-school homework 12 and English 12 (Hedges’ $g = .53$).

The authors provided limitations of their study, including the following: GPA may not be the best measure of high-school learning – particularly if grades are *awarded* for doing homework; the causal sequence of homework leading to GPA could be questioned; the difference between in-school and out-of-school homework was not clearly defined for students on the NELS; and finally, the NELS data used in this study are dated and may not apply in today’s context.

The more serious limitation may be that the authors’ SEM did not account for the multi-level nature of the NELS data. In other words, some of the variation in homework time almost certainly resulted from the classes and schools attended by the students. Therefore, it may have been a classroom or school effect more than an individual effect that accounted for homework’s predictive power on achievement. This caveat does not refute the fact that more homework completed was nonetheless associated with higher achievement.

LeTendre & Akiba’s (2007) study used the Third International Math and Science Studies (TIMSS) 2003 data to examine how homework contributes to national academic achievement levels in math and science in grades three and four as well as grades seven and eight. The authors noted a gap in the literature of empirical studies that examined the effect of homework on achievement from a cross-national perspective. As a result, they broadened a former study to more closely assess the place of the United States vis-à-vis other countries.

LeTendre and Akiba tested the correlation of time spent on homework with national achievement levels using a dataset that included 18 countries, the TIMSS. The national level of their analysis precluded discussion about individual achievement, but the authors did find that, in the United States, doing more homework was not associated with higher achievement either at the elementary school or middle school level. In fact, it was associated with lower achievement. We were able to calculate Cohen’s $d = -.18$ for elementary school and Cohen’s $d = .01$ for middle school.

They hypothesized that increased amounts of homework are associated with the need for remediation. Homework tended to be correlated with higher achievement more often in developing countries, which the authors hypothesized had weaker educational systems – thereby benefiting students who spent more time working at home. Nonetheless, developed East Asian countries’ school systems also favoured students who did more homework.

Letendre and Akiba’s study is methodologically the most limited of all the net impact homework studies. They did little to control for other possible causes of achievement differences, preferring to present global comparisons of homework/achievement correlations across countries. They did not describe many limitations to their study, but did note that the results should not be used for a discussion of the relative benefits of homework at the student level, where they observe research indicates doing homework increases students’ grades.

Instead, their results were related to homework’s impact on achievement at the national level; therefore, they question whether national policies ought to favour increasing homework. Overall though, their scepticism appears misguided as they admit homework has been shown to increase achievement. The fact that more homework does not correlate positively with achievement at the national level (because in reality students use it as a remedial measure) does not suggest doing more homework would not benefit students.

McMullen (2007) examined the effects of students’ time spent on math homework, and the amount of math homework assigned, on student achievement. He used the three waves of the U.S.A.’s *National Education Longitudinal Study*, 1988, 1990, 1992; the final sample comprised 17,610 observations of 7902 students.

McMullen found that the return on mathematics achievement for doing homework for low-achieving students was much higher than for other students. Similarly, students in low performing schools received a bigger homework benefit than students in high performing schools.

In direct response to the question of this review, McMullen reported a greater amount of time spent on math homework was found to increase achievement outcomes, but only to the limit of eleven hours per week. Similarly, the amount of homework assigned was positively related to achievement; again, students from low performing schools benefitted the most from having more homework assigned to them. Overall, McMullen found teacher assignment of homework and student completion of it had more impact on achievement than reducing class sizes or raising teachers’ salaries. Unfortunately, data reported were insufficient to calculate effect sizes.

Like Eren and Henderson (2007), McMullen analysed data only at the student level, leaving open the possibility that classes and schools that assigned more homework contained students who earned higher grades. This possibility does not falsify the claim that assigning more homework may be a helpful policy in increasing achievement, though it is possible that homework intensive schools were comprised of students who achieved

highly for other reasons, but it tempers the interpretation that any student who spends more time on homework is likely to be a higher achiever than his classmates.

Trautwein's (2007) article included three separate studies. Here they will each be summarized separately.

The first study was designed in part to determine whether time spent on homework at the school and student level is related to Grade 9 student achievement in mathematics. The rationale for conducting this study was to resolve problems with the 'time on homework' measure by controlling for variables that have been omitted from many studies, including school type, cognitive abilities, and gender.

Using data from the German extension of the PISA 2000 (n=24,273) study, Trautwein employed hierarchical linear modelling (HLM) to examine both school level and student level impacts of homework time on the mathematics achievement of German 15 year-olds. The survey contained within the PISA instrument yielded homework time responses.

The results showed that, at the school level, after controlling for school 'track,' homework time had moderate predictive power on student achievement; in other words, schools that assigned more homework averaged higher mean scores than schools that assigned less homework. However, at the student level, Trautwein found that the relationship between homework time and achievement was negative. Students who spent more time on homework achieved lower scores than their peers who spent less time on homework. These results were statistically significant. The HLM model did not provide data amenable to a secondary calculation of effect size.

This study was limited by the cross-sectional nature of the PISA data. This precluded any determination of a causal direction of the observed effects. Using schools as sampling units may have yielded weaker effects than might be found when classes are used as the unit of observation. Nonetheless, Trautwein does show the importance of accounting for effects above the student level when interpreting homework's correlation with achievement. A final limitation of this study was that the PISA instrument collapsed 'time spent on homework' with 'homework frequency' despite the possibility that, understood differently, these two variables may be associated differently with achievement.

In the second Trautwein study, an effort was made to address some limitations from the first study. A longitudinal aspect was added to the second study by including a pre-test from the year prior to the data for this study, which was the Third International Mathematics and Science Study (TIMSS). Classes (n=91), rather than schools, were used as the level 2 sampling units and homework frequency was separated from homework time to predict German Grade 8 students' (n= 2,216) mathematical achievement.

Using HLM, Trautwein found that homework frequency (i.e. the number of occasions the teacher assigned homework per week) was a modest but statistically significant predictor

of achievement at the class level. Homework time had a very small and insignificant correlation with achievement at the class level. At the student level, increased homework time was again statistically significantly associated with decreased achievement. Homework frequency was not reported at the student level as it did not differ among students in the same class. Again, the HLM model was too complex to allow a secondary calculation of effect sizes.

Despite the author's efforts to resolve the weaknesses of the first study, the second study was limited by a restricted set of variables that existed in the TIMSS dataset. As a result, the exact relationship between time on homework and effort on homework could not be studied.

The third study by Trautwein was designed to allow for this examination of the relationship between time on homework and effort on homework. This was accomplished by using a specially constructed longitudinal dataset. Effort was indicated by student self reports of their degrees of agreement on survey items such as "I always do my best in my mathematics homework." Student achievement for this study was measured by both grades and test scores in mathematics, whereas the previous two studies used test scores only. Path analysis was also employed to test the reciprocal relationships between homework and achievement. He examined 483 Grade 8 *gymnasium* (i.e. high track) students in 20 classes.

The results of the third study indicated that homework effort was significantly and positively related to mathematics achievement as measured by both grades and test scores (school grade, Hedges' $g = .75$; test score, Hedges' $g = .87$). Again, homework time was negatively related to student achievement (math test, Hedges' $g = -.61$; school grade, Hedges' $g = -.39$). Furthermore, by testing the relationship between homework time and homework effort, Trautwein was able to determine that homework time is not a suitable indicator for the amount of effort that students put into homework.

The third study is limited by the exclusively 'high track' sample. Results cannot be generalized to the entire population. Causality is again impossible to determine; it is indeed equally likely that high achievers are motivated to put more effort into their homework. As with any survey, student self-reports demand cautious interpretation.

Overall, the Trautwein studies indicate the amount of homework assigned at the class or school level and the effort students put into it are the strongest, if still moderate, correlates of achievement. The time spent on homework within a particular class is a poor or negative correlate of achievement.

Trautwein, Lüdtke, Schnyder, & Niggli's (2006) study examined the domain specificity of homework effects and the role of conscientiousness as a possible predictor of behaviour that is related to achievement. Of interest for this review, however, is the small part of the study that was concerned with the relationship between homework behaviour and achievement, evidenced by school grades. Student participation was voluntary and lasted for 45 minutes. Participants completed a test and questionnaire from

a specifically designed test booklet that included homework assignment and parental support items. The authors examined homework effort and homework time. Homework effort was operationalized as three constructs in the questionnaire: compliance, concentration, and percentage of assigned homework attempted.

Using data from 414 eighth grade gymnasium (i.e. high track) students from 20 different classes in eight schools in Berlin, Germany, the authors found that homework effort was positively related to current school grades in math and English and the previous year's grades. Time spent on homework was found to be negatively related to school grades in math and English. We calculated the following effect sizes. The mathematics effects are larger than the English effects.

- Compliance and math (Hedges' $g = .85$);
- Concentration and math (Hedges' $g = .70$);
- Percent homework attempted and math (Hedges' $g = .75$);
- Time spent on homework and math (Hedges' $g = -.63$);
- Compliance and English (Hedges' $g = .39$);
- Concentration and English (Hedges' $g = .41$);
- Percent homework attempted and English (Hedges' $g = .32$);
- Time spent on homework and English (Hedges' $g = -.28$).

The authors noted that the study had a sample size that was too small to examine the variation between classes and instead focused on student level observations. These results are clearly from the same sample as Trautwein (2007) study 3, above; they share the limitations of that study and should not be interpreted as a replication of its findings, but an extension of them. They add the English as a foreign language dependent variable to the analysis, indicating the homework effort effects are not restricted to mathematics.

Mooring (2004) is described more fully below as her main research question concerned a pedagogical enhancement. In brief, she found homework completion rate was significantly correlated with student achievement (Pearson's $r = .52$). From her data we were able to calculate a large effect size of Cohen's $d = 1.43$.

Meyer (2005) is also categorized and summarized fully below as a pedagogical enhancement study; however, in a secondary finding, she reports that proportion of homework completed was significantly positively related to Social Studies grade points. We calculated a large effect size (Hedges' $g = 1.10$), but note grades may actually have been partially awarded for homework completion.

4.5 Study summaries: Pedagogical enhancement studies

All pedagogical enhancement studies examine an innovation or improved way of conceptualizing or assigning homework. They ask if these methods are more effective in increasing achievement than traditional homework routines. These studies do not directly address our more basic question: does homework increase achievement?

Four of the five pedagogical studies received quality scores in the ‘medium’ range. Two of these four were awarded the lowest score in that range; they should be interpreted cautiously. The fifth was ‘high’ (see Table 4.4).

Table 4.4: Quality ratings of pedagogical studies

Study	Score	Quality Category
Dean (2004)	21	High
Meyer (2005)	16	Medium
Minotti (2005)	16	Medium
Mooring (2004)	17	Medium
Pool (2005)	18	Medium

Dean’s (2004) study was conducted to determine the effectiveness of web-based, constructivist-oriented homework versus traditional homework assignments for ninth and tenth grade biology students. As a rationale for the study, Dean suggested that web-based assignments could encourage collaboration, critical thinking, and increase the interest of homework for students. This study included two classes in a predominantly Caucasian suburban high school in a southern U.S. state (treatment n=20; control n=23). Outcome measures included teacher-made quizzes, and science pre-test, post-test and post-posttests.

The treatment group participated in online homework activities that substituted all homework assignments for a period of approximately eight weeks. These online activities included teacher and peer feedback through email, chat, and a discussion board. The control group completed traditional paper and pencil assignments. The researcher taught both classes.

The author found that the scores for the treatment group on teacher-administered quizzes improved statistically significantly more than scores of the control group. Effect sizes could not be calculated for this outcome. While there was no statistically significant difference between the two groups for pre-test, post-test, and post-posttest scores, we calculated an effect size of Hedges’ $g = .73$ favouring the web-based group.

The author suggested that the small sample size may have precluded the identification of statistically significant group differences in terms of achievement, reflectivity levels, homework completion rates, and student attitudes. The small sample of a socio-economically homogenous population also limits generalizability. Nonetheless, all participants were students of the same teacher, thereby limiting teacher effects. As the researcher was the teacher, he was also able to control treatment fidelity. The multiple outcome measures also allowed the relative (in)consistency of effects to be observed.

Dean's study indicates that web-based homework is at least as effective in enhancing achievement in biology as traditional homework, and may well be more effective, as it was for his group.

Meyer's (2005) dissertation evaluated the effect of a self-regulation homework intervention to increase academic achievement amongst at-risk students in Grade 7 social studies. At-risk seventh grade students (n=36) in a southern U.S. high school were exposed to the 'self-regulation' intervention, including social involvement, organizational, and self-monitoring strategies. Dependent variables were percentage of homework completed and semester GPAs. The research methodology was a one group pre-test, treatment, post-test design.

Results included a statistically significant gain in GPAs in the semester after the treatment occurred compared to the semester before, although our effect size calculation was small (Hedges' $g = .18$). Meyer also found that percentage of homework completed was significantly positively related to Social Studies grade points; indeed we calculated a large effect size (Hedges' $g = 1.10$). Teachers also reported that academic achievement in social studies increased after students participated in the self-regulatory homework intervention.

These findings are limited by the research design, which did not compare the intervention group to a control group. The improvement of the students, modest in any case, may be attributable to factors, the most obvious is maturation, other than the homework intervention. Further, the large effect on GPA of completing homework may result in part from marks awarded for completing homework, rather than improvement in ability.

Moreover, the study was conducted only on a relatively small at-risk sample; results in any case could not be generalized to a mainstream population. Meyer did however, ensure the homework intervention was well implemented and her use of multiple outcome measures provides convincing evidence that students improved after the intervention; nonetheless, her one group design prevents verifying that the intervention was the reason. At most, Meyer's study indicates that introducing at-risk seventh graders to self-regulation strategies may increase their ability to complete homework effectively, thereby enhancing achievement.

Minotti's (2005) study was conducted to examine the effects of individualized learning-style based homework prescriptions on the math, language arts, science, and social studies achievement and attitudes of students in grades six through eight in a parochial school in New York City. Students were predominantly minority and low SES (n=167).

Intact classes were used but these classes were randomly assigned to the control or experimental condition. Each condition contained one male-only and one female-only class. Mean scores of previous unit tests formed the pre-test mark; a unit test formed the post-test mark.

The experimental group received an introduction to 'learning styles' - the way in which students process, internalize, and retain new information - from a slide show, while the control group viewed a slide show on traditional homework strategies. Parents of both groups also received a copy of the presentation for their group. Computer generated homework prescriptions were given to the students and parents in the experimental group based on their completion of a learning styles instrument. Teachers administered post-tests without knowing which students were in the experimental and control groups.

The author found that both groups made statistically significant gains in all four content areas; however, the learning styles homework group made statistically significantly larger gains than the control group in all four areas. Unfortunately, data reported did not allow effect size calculations.

However, these results were overstated due to noteworthy, though not fatal, study limitations. First, the intervention was only two weeks long. Lasting effects are unknown. Second, students from the control and experimental groups were in contact with each other, leading to potential problems of 'contamination,' and finally, the teacher tests used as outcome measures may not be as reliable as globalized standardized achievement measures. These limitations were not discussed by the author. Minotti did however, use multiple outcome measures and conduct her experiment on sizable sample. Her study indicates that understanding one's own learning style and doing homework using techniques appropriate to that style probably provides achievement gains.

Mooring's (2004) study was designed to determine if answer-supplied homework led to improved chemistry scores in high school when compared with answer-delayed homework. Mooring examined two classes, one low-performing (n=24) and one high-performing (n=26), where each class alternated in receiving answer-supplied or answer-delayed homework over a period of five units of study. Achievement was measured by a combination of quizzes and multiple choice questions for each unit. These groups were not compared experimentally; rather, the effects of answer-supplied vs. answer-delayed homework were tested on each group.

Evidence from multiple regression analyses showed a positive, statistically significant result for answer-supplied homework in the low-performing class, but not for the high-performing class. Effect sizes could not be calculated from the data available.

Limitations detailed by Mooring were the small sample size, which prevented uncovering effects of control variables in the regression, such as gender, ability and available class time. The small sample also limits generalizability to the wider population. Moreover, it is fairly unclear that students who were not supposed to have answer-supplied homework could not have received it from friends in the answer-supplied classes. Despite these limitations, the difference in effects - i.e. the benefit answer-supplied homework seems to provide to low-performing students - is noteworthy. Answer-supplied homework may be a way to help students master problem solving.

In a finding relevant to the 'net impact' question, Mooring pooled both classes to analyse the effect of daily homework completion on a combined assessment score based on quizzes and multiple step questions. A simple correlation revealed homework completion rate was significantly correlated with student achievement (Pearson's $r = .52$). From her data we were able to calculate a large effect size of Cohen's $d = 1.43$. Further analysis by Mooring revealed homework completion was not as strong a predictor of achievement as prior test scores, but still substantial.

Completing the homework assigned by the teacher seemed to affect achievement positively, even with prior ability controlled, but as with all correlational research, causal direction could not be determined.

Pool's (2005) dissertation sought to assess the impact of a Homework Intervention Program (HIP) on students' completion of homework and subsequent achievement. She compared a Texan district's fifth and sixth graders of the Class of 2006 ($n=832$) to the fifth and sixth graders of the Class of 2008 ($n=840$). The former group did not have the treatment (HIP). The latter group did. Student achievement was measured by the results of standardized tests in reading and mathematics as well as pass/failure rates for the same two subjects.

The HIP included an advisory period each day, teacher training, and a focus on communication and cooperation between teachers, parents, and students. HIP contained guidelines that each teacher not assign more than 15 minutes of homework each night and that no more than two tests be given on one day. Non-completion of homework was not tolerated, which was evidenced by the fact that students were detained during their elective time to complete homework that was not done the night before. Parents were included in the HIP through conferences with students, teachers, and counsellors. Parents could also access a telephone hotline or a website for homework and class information.

The results showed that the group receiving the HIP significantly outperformed the control in Grade 5 reading and math on standardized tests and on pass rates in both these subjects. Results for Grade 6 students were the same. This result was true for both reading and mathematics.

We calculated the following small to moderate effect sizes:

- Grade 5 standardized reading (Hedges' $g = .44$);
- Grade 5 standardized math (Hedges' $g = .19$);
- Grade 5 reading pass rates (Hedges' $g = .49$);
- Grade 5 math pass rates (Hedges' $g = .35$);

- Grade 6 standardized reading (Hedges' $g = .54$);
- Grade 6 standardized math (Hedges' $g = .56$);
- Grade 6 reading pass rates (Hedges' $g = .37$);
- Grade 6 math pass rates (Hedges' $g = .37$).

These results were limited by lack of random assignment; two intact cohorts from different years were compared, so there may have been pre-existing differences between them. Similarly, there appeared little account for other variables which may have accounted for the difference in achievement between the two groups. Nonetheless, the large sample mitigates some of the likelihood that other factors caused the achievement differences, and increases the generalizability of the results. A homework intervention program, as described, may increase student achievement.

4.6 Study summaries: Parental involvement studies

Five studies examine the effects of parental involvement in homework. They do not directly examine the net benefit of homework. Three have medium quality ratings, two high (See table 4.5). Two of the medium quality studies have the lowest possible score in this category. Results from these two studies demand more cautious interpretation. The other three studies are fairly trustworthy.

Table 4.5: Quality ratings of parental involvement studies

Study	Score	Quality Category
Bailey (2006)	17	Medium
Davis (2004)	16	Medium
Swezey (2004)	20	High
Van Voorhis (2003)	21	High
Xu & Corno (2003)	16	Medium

Bailey (2006) examined Interactive Homework Assignments (IHA), homework assignments designed to increase parental involvement. The study was designed to determine the impact of parent training in working with IHAs on the ability of second grade students to draw inferences from reading. This study looked at three classes of second grade students (n=84) and their parents over four weeks to determine the effect of IHAs on a reading inference test. Students from the experimental class were required to draw inferences from reading selections four nights each week. This was to be accomplished after doing the reading and discussing the reading with their parents who received IHA training. The inferences were recorded in a diary, but were not graded by the teacher. The control class did not feature IHA. A third class featured IHA but no parent workshops.

Bailey determined that there was a statistically significant difference between pre- and post-inference test scores for children of parents who completed IHA parent workshops. IHA students also scored significantly higher than the comparison groups. However, there was no correlation between inference scores and the number of minutes parents helped with homework. We calculated the following effect sizes for the former outcomes:

- IHA vs. no IHA (Hedges' $g = 1.66$);
- IHA vs. IHA with no parent training (Hedges' $g = .88$);
- IHA with no parent training vs. no IHA (Hedges' $g = .74$).

Bailey noted that because parental participation data was not collected from the control group, there was no way of knowing whether parental participation increased in the experimental group in comparison to the control group. This is a significant treatment fidelity problem. Furthermore, the classes were already intact rather than randomly assigned. There may therefore have been pre-existing differences beyond those accounted for by the pre-tests. The sample size is not large once the 84 are divided into three classes, therefore generalizability is somewhat limited.

Davis' (2004) dissertation studied the effect of parental completion of "School Home Links" (SHL) homework on kindergarten students' Texas Primary Reading Inventory (TPRI) scores. SHL is a series of sheets consisting of literacy and reading activities that parents complete with their children. This study involved 34 classes, fourteen of which received the SHL treatment for twelve weeks (student experimental $n = 147$; control $n = 147$).

Davis found no statistically significant differences between the experimental and control groups in scores or gains in reading. Our effect size calculation indeed indicated no difference (Hedges' $g = .008$). She concluded that the results were inconclusive for kindergarten students.

The author speculated that a larger sample size may have yielded results that were statistically significant, though our effect size calculation suggests there were in fact negligible effects. Davis acknowledges further limitations of this study, including the limited measurements available from the TPRI and a lack of control over additional homework given to either the experimental or control group. In addition, there was little control for potentially confounding variables, and the use of intact classes would suggest a multi-level model would have been a more appropriate analytical method. We cannot definitively conclude from this study that parental involvement in kindergarten homework has no impact on achievement.

Swezey's (2004) dissertation was conducted to contrast the effects of learning-style self-awareness and homework prescriptions with traditional homework on the achievement levels of low-performing middle school students ($n=153$) in mathematics and language arts in New York City.

Swezey argued that traditional education falls short of effectively facilitating learning and therefore individual learning styles should be examined within the instructional process. Swezey attempted to determine whether learning-style awareness and homework prescriptions improved student achievement for sixth and eighth grade students in mathematics and for seventh grade students in reading. Students in the experimental group received learning style awareness training and homework prescriptions while students in the control group received traditional study skills training and a traditional study tips package. Achievement was measured by pre- and post-tests in the applicable subject areas. Teachers delivered the intervention with parental involvement.

Swezey found that the experimental group made statistically significantly greater gains in all achievement and attitude outcomes in all grades than students in the control group. Effect sizes calculated by Swezey were categorized as very large for Grade 6 (Cohen's $d = 1.50$) and large for both Grade 7 (Cohen's $d = 0.829$) and Grade 8 (Cohen's $d = 0.95$).

Swezey noted that the generalizability of the results may be restricted to urban public middle-school students with similar characteristics to the participants of this study. Swezey's sample also included pre-existing classes that may have shared unaccounted for characteristics, and there was little assurance that no 'contamination' occurred between the control and experimental groups. Even so, the impact of learning style awareness and parental involvement on achievement, via effective homework completion, is clearly indicated by this study.

Van Voorhis (2003) examined the effects of a weekly interactive science homework program called TIPS (Teachers Involve Parents in Schoolwork) on family involvement in homework, student attitudes towards homework, and student achievement. He sampled 253 students in ten classes (six Grade 6 and four Grade 8) in a mid-Atlantic state.

The control group completed non-interactive assignments while the experimental group received the same assignments except with prompts and instructions for students regarding family involvement. These instructions included an explanation letter regarding the assignment for the parents, the objectives explaining the learning goals, a procedure guide for the student, two-way forms of communication for parents or the family partner, and a discussion between students and their family partner regarding the assignment and its real-world applications

Van Voorhis found that family involvement in science homework increased for TIPS students when compared with those completing non-interactive assignments. This study also found that TIPS homework was completed more accurately than non-interactive homework. Finally, TIPS students had statistically significantly higher report card grades in science than non-TIPS students. The statistical model was too complex to allow secondary calculations of effect size.

There were limitations to this study: standardized achievement tests in science were not available by the end of the period under study, and teachers varied in how they followed the TIPS procedure, a non-trivial limitation in treatment fidelity. It is also unclear that confounding variables did not affect the results. Nonetheless, the large sample and overall statistically significant gain (regardless of treatment fidelity) suggests family involvement led to homework that had a positive impact on achievement.

Xu & Corno's (2003) study examined a number of factors related to family help and homework management of middle school students. For the purposes of this review, the most important questions asked in this study were what are the effects on student achievement of: getting help with homework; the education level of the helper; and, using homework managing strategies, i.e. arranging environment, managing time, focusing

attention, monitoring motivation, and monitoring and controlling emotion. Achievement was measured by standardized tests in math and reading.

This study analyzed sixth, seventh, and eighth grade students in math, humanities, writing, and science (n=140) at one New York middle school. According to an informal policy, teachers were supposed to assign no more than 30 minutes of homework per class, which led to an average of one to one and a half hours of homework each night per student.

The authors found no difference in achievement between students who said they had help with their homework and those who did not; indeed, for the combined reading and math scores, we calculated a trivial Cohen's $d = .054$. Furthermore, the helper's education level related to academic achievement. Finally, there was no correlation found between homework management as defined in this study and student achievement.

The authors note that their findings are limited in terms of generalizability; participants attended one small urban school. Also, the tests that measured student achievement were not administered following the survey and therefore a causal analysis using achievement as the dependent variable could not be conducted. Furthermore, there was little control for confounding variables. The operationalization of 'homework assistance' was not sensitive. Students who received one minute of help could have answered the survey the same way as those who received one hour. These results must be interpreted cautiously.

4.7 Media results and analysis

An analysis of the print media from 2006-2007 was conducted to add context to the homework debate. Empirical evidence is essential for decision-making, but an indication of public perceptions can also be useful. This is particularly true for controversial topics like homework. Analyzing its portrayal by the media illuminates the popular politics surrounding the issue.

Forty-eight newspaper and trade magazine articles were included for final analysis. Thirty articles came from local dailies, ten from trade magazines, three from local non-dailies, three from international newspapers, and two from national dailies. Canada was the country of publication for 36 articles; the United States for 11; and, the United Kingdom for one.

The main focus of the print media was homework quantity; 17 articles were keyworded for this area. Quantity was followed by 'parental involvement' and 'parental concern' as the most common areas of focus with 16 print media items discussing these topics. Achievement, stress, amount of time spent on homework, pedagogical practice and the environment within which homework is completed also appeared as topics of major and secondary focus. Students represented the population focus of 30 print media items, followed by parents for 17 items. Two items centred on teachers and one was focused on researchers. Two articles contained overlapping foci.

Analysis determined that while only eight headlines portrayed homework positively, 23 were negative and 17 were neutral. Full text analysis produced 20 articles keyworded entirely negatively. Seven began negatively but ended with an affirmation of homework's value, while one article was the reverse. Four articles related arguments against homework, but contained some positive descriptions of its benefits. Eight articles were keyworded as entirely positive. A final eight articles presented neutral perspectives on homework.

Overall, these findings indicate a negative media portrayal of homework in 2006 and 2007, focused on two major issues: the excessive quantity of homework, and the concerns of parents with homework. The controversial nature of homework suggests empirical evidence of its academic benefit is vital to decision-makers and other stakeholders.

The articles were also keyworded for the age group, curricular area, and socio-demographic discussion. Twenty-nine articles did not state the age group. Fifteen articles focussed on intermediate grades and 16 on high school grades. Thirteen articles mentioned the primary grades. Curricular area was not stated by the large majority of the media articles. The remaining articles focussed on math or language arts / English. Discussions of socio-economic status, ethno-cultural and/or home language background were almost entirely absent in the print media, with 42 of 48 articles making no mention of these issues.

The absence of discussion of curricular, social, or cultural issues in the print media is significant. These topics appear of markedly less concern to the media and public than the quantity of homework being assigned. This illustrates the current predominance of issues pertaining to parental involvement and quantity of homework in the media's homework discourse.

5. Discussion and Implications

The discussion presented here is divided into the three sections suggested by the research question categories: net impact studies, pedagogical enhancement studies, and parental involvement studies. The substantive differences in purpose among these three groups suggest each be analysed separately. Results from studies experimentally comparing types of homework cannot be compared to studies that correlate (non-experimentally) effects of doing or not doing homework.

Each section describes the frequency and magnitude of effect size calculations for its studies. In place of statistical meta-analysis, this presentation of data provides an easy-to-understand synthesis of the results produced by each of the three research questions.

5.1 Net impact of homework on achievement

Eight studies attempted to isolate the net impact of homework on achievement through examinations of time, frequency, effort and completion. A further two, Meyer (2005) and Mooring (2004), reported an outcome addressing the relation of homework completion to achievement, although their research questions were different.

Although no studies received a score indicating low quality, it is also the case that none tested for net impact (quasi-)experimentally. Except for Meyer and Mooring, all established correlations – not causation – between homework and achievement via secondary analyses of large data sets. Furthermore, three studies drew their samples from the same data set, the two decades old NELS:88 and its follow up waves. These limitations are somewhat unfortunate as it is this group of studies that directly addresses our research question.

Table 5.1 describes the effect size findings across studies. Twenty-four outcomes, including 18 calculable effect sizes suggest doing homework increases academic achievement. Sixteen of these effect sizes appear large enough to suggest practical significance to these findings. Eight findings, by contrast, suggest a negative effect results from homework. Although these contradictory findings are less numerous, they need to be reconciled with the others.

Table 5.1: Distribution of outcomes and effect size magnitudes across net impact studies

	Favours homework				Counters homework			
	Large ES	Medium ES	Small ES	ES n/a	Large ES	Medium ES	Small ES	ES n/a
Meyer (2005)	1							
Mooring (2004)	1							
Eren & Henderson (2006)				1				
Keith <i>et al</i> (2004)		8						
Letendre & Akiba (2007)							2	
McMullen (2007)				2				
Trautwein (2007), 1				1				1
Trautwein (2007), 2				2				1
Trautwein (2007), 3	1	1				1	1	
Trautwein et al. (2006)	1	3	2			1	1	
Total	4	12	2	6		2	4	2

Findings from NELS:88 by Keith et al. (2004), Eren and Henderson (2006), and McMullen (2007) suggest that, depending on the focus population, additional homework can help students attain better grades. Eren and Henderson’s study showed that more time spent on homework was most beneficial for high and low achievers, while McMullen estimated that, for mathematics, one extra hour of homework per week can increase a student’s test score by nine percentile points. By contrast, the four Trautwein (2006 & 2007) studies and Letendre and Akiba (2007) all found more time on homework was negatively correlated with achievement at the student level.

This contradiction can largely be explained by methodology. Keith et al.(2004), Eren and Henderson (2006), and McMullen (2007) did not use multi-level modelling. Therefore, all their data were analysed exclusively at the student level. As a result, the differences in achievement which appeared to be predicted by the student’s personal homework time were perhaps actually predicted by the amount of homework assigned by the class or school attended by the student. In other words, in these three studies, the positive correlation between homework and achievement may have resulted from students attending classes and schools where more homework was assigned outperforming students attending classes or schools where less homework was assigned.

By contrast, the Trautwein studies employed multi-level modelling – which allowed Trautwein to distinguish between the effects of quantities of homework assigned by teachers and the effects of the amount of time spent on homework by students – and found that indeed, the classes and schools that assigned more homework produced higher achieving students, but, within these classes and schools, the students who did more

homework were generally lower achievers. This was not likely because homework hurt them, but because doing extra homework was a remedial strategy. Letendre and Akiba also make this latter point. They conclude their U.S. study with some emphasis, stating “doing more homework in the U.S. is not associated at either the elementary or middle grades with higher achievement” (p.25).

Still, because homework frequency or quantity was found to be a statistically significant predictor of achievement at the class and school levels, we might say results suggest teachers retain homework as an instructional strategy to increase achievement. However, the classes and schools that assign more homework may be attracting students who achieve highly for other reasons; for example, these students may be the sons and daughters of socio-economically advantaged parents who can access prestigious schools.

In sum, the fact that it appears to be the quantity of homework emanating from the class or school that is correlated with (not causative of) achievement suggests decision-makers should think carefully about what other factors might be contributing to high student achievement. The effect of homework at the class and school levels in the Trautwein studies was significant but indeed modest, once the track of the school was controlled. This finding suggests the ‘track’ of the school – even if it is a *de facto* track in North American contexts – carries much of the variation in both achievement and homework quantity.

A further nuance is in the dimension of homework examined. The Trautwein studies along with the outcomes reported in Meyer and Mooring indicate that homework effort, be it operationalized as percentage of homework completed, or concentration, or compliance, appears to be the best predictor of achievement. A student can easily spend a great deal of ineffective time on homework, and teachers can assign homework with great frequency, but absence of student effort will suppress any benefit.

In sum, to properly assess the magnitude of the effect of homework time, effort, quantity and frequency on achievement requires a (quasi-) experimental research design that compares achievement on the same content between two or more similar groups who differ on one of those four independent variables. The correlational studies and outcomes here do not facilitate such an assessment.

5.2 Pedagogical enhancement studies

Five studies from the United States (Dean, 2004; Meyer, 2005; Minotti, 2005; Mooring, 2004; Pool, 2005) examined different ways in which homework assignment and regulation affect student grade levels and, in some studies, teacher perceptions and student attitudes. One was categorized ‘high’ quality; four were ‘medium.’ These studies each examined a pedagogically enhanced homework intervention and determined its effect on student achievement. The interventions included web-enhanced assignments (Dean, 2004), self-regulated homework (Meyer 2005), learning style-based homework assignments (Minotti, 2005), supplying numeric answers to homework (Mooring, 2004) and a homework intervention program (Pool, 2005). Sixteen outcomes were reported, ten

of which allowed effect size calculations. All outcomes favoured the enhanced intervention (see table 5.2).

Table 5.2 Distribution of outcomes and effect size magnitudes across pedagogical enhancement studies

	Large ES	Medium ES	Small ES	ES N/A
Dean (2004)		1 (ns)		1
Meyer (2005)			1	
Minotti (2005)				4
Mooring (2004)				1
Pool (2005)		4	4	
Total		5	5	6

Regardless of the intervention, findings across the studies reveal that when homework assignation or regulation is delivered with an enhanced pedagogical technique or strategy, the result appears to be a small to moderate improvement in student achievement. Web-enhanced homework was the only intervention amongst the five studies to have mixed results, having produced no significant statistical difference between the pre-test and post-test scores of the treatment and control groups. However, the effect size within Dean’s population was substantial, and students in the experimental group scored significantly higher on teacher created quizzes. The other four studies offered stronger evidence of the benefits of pedagogically enhanced homework assignments, showing strong achievement results for the students who had participated in these interventions.

These studies demonstrate that homework with an enhanced pedagogical technique is likely to increase, and unlikely to impede, academic achievement. Common across the interventions was a component of meta-cognition or constructive learning. These homework assignments demanded active learning, rather than rote repetition of classroom material.

These findings complement Cooper (2006). The evidence around the effects of variations in homework design widens the academic debate beyond Cooper’s focus on the net impact of homework. Homework is a diverse activity with a range of potential for affecting student achievement. Of additional interest, several studies revealed that pedagogical support in homework regulation had a significant and beneficial impact on the motivation and self-esteem levels of students (Dean, 2004; Minotti, 2005) as well as on the school climate (Pool, 2005).

Nevertheless, it remains problematic to assess homework’s impact on achievement using these studies. While it is credible that the enhanced homework designs, which increased achievement more than traditional homework designs, would also have increased

achievement more than a ‘no homework’ option, this hypothesis was not tested by the studies we reviewed.

Generally it appears that a thoughtful assignation of homework, which includes ways to increase active student engagement, has benefits over and above a ‘traditional’ or default approach of simply assigning mechanical tasks that echo the work completed in the classroom. Nonetheless, the small sample size and other limitations of these studies should be borne in mind when considering this conclusion.

5.3 Parental involvement studies

Five U.S. studies centred on the effects that parental involvement with homework has on student achievement (see table 5.3). These studies are Xu and Corno (2003), van Voorhis (2003), Bailey (2006), Davis (2004), and Swezey (2004). Parental involvement is of particular interest due to homework’s impact on families in terms of time and stress. Therefore, although this type of study was not included in Cooper’s (2006) review, the parental involvement studies address an important research area. This is evidenced by Walker et al.’s (2004) literature review, which provides strategies for increasing parental involvement in homework.

Table 5.3 Distribution of outcomes and effect size magnitudes across parental involvement studies

	Large ES	Medium ES	Small ES	ES n/a	No effect
Bailey (2006)	2	1			
Davis (2004)					1
Swezey(2004)	3				
Van Voorhis (2003)				1	
Xu & Corno (2003)					1
Total	5	1		1	2

Our five studies provide no consensus on parent-involvement effects on achievement. They arrived at differing conclusions depending on the kind of parental intervention. Although seven outcomes were positive for parent participation, and only two showed no effect, the former seven derived from only three studies, while the ‘no effect’ outcomes came from two. Had these latter two studies contained more outcome variables, results would likely have appeared more balanced.

Xu and Corno (2003) examined general factors related to family help and homework management of middle school students. They found no differences in achievement between middle school students who said they received help with homework from parents and those who did not. However, this study neglected to measure certain confounding variables, such as the helper’s capability as a tutor. Conversely, van Voorhis (2003), examined the effects of a more targeted weekly interactive science homework

program called TIPS (Teachers Involve Parents in Schoolwork), and found higher rates of homework completion and significantly higher report card grades for the students whose parents participated in the program.

In the same way, the targeted parental involvement programs tested in the studies by Bailey (2006) and Davis (2004) yielded conflicting results in regards to achievement. For Bailey, parent training workshops, aimed at teaching parents how to interact with their children during the completion of reading homework, resulted in the higher ability of students to make inferences from reading selections. Davis, however, who studied the effect of parental completion of the School Home Links (SHL) activity guide homework on kindergarten student reading scores, found no statistically significant results for the effect of SHL on student achievement. As a result, Davis concluded that the results were uncertain for kindergarten students. However, parents received no training on how to complete the SHL activity guides with their children, simply a letter of explanation.

Swezey's (2004) study reports impressive effect sizes for his learning styles intervention, but it is unclear if parental involvement was the key factor in the intervention's success; it may have been the learning style training that produced the positive results.

While the findings of these studies are inconclusive, they do encourage further research on parental involvement in homework. At present though, we can only conclude no harm results from involving parents with homework.

5.4 Media articles

An interesting finding from the review of the print media was that out of 40 articles which portrayed homework negatively or neutrally, quantity of homework, stress, parental involvement and parental concern were the principal framing issues. What matters to the public appears not to be the relationship between homework and academic achievement, but rather the ramifications of homework upon the quality of families' home lives.

Media's focus on parents may be a caution to decision-makers that homework's impact reaches beyond students to families, due to scheduling demands and the resultant stress. Decision-makers may wish to consider familial concerns when making choices about homework practices intended to benefit students.

The print media's repeated reporting of the burden of homework is borne out by findings in the Canadian Council on Learning's 2007 *Survey of Canadian Attitudes towards Learning* (SCAL). SCAL data allowed for an exploration of reasons explaining why parents hire tutors for their children. Interestingly, the hiring of tutors was connected to parents' perceptions of homework as a burden or a source of stress.

Parents who hired tutors for their children were nearly twice as likely as parents who had not hired a tutor to report spending too much time helping their children with homework. Parents who hired tutors were also more likely to agree that homework was a source of

stress than those who did not. This stress surrounding homework appears to be created by the large amount of homework being assigned.

Curricular issues such as appropriateness of the homework being assigned, its effectiveness, and its necessity are largely excluded from media's focus on issues that lead to homework-related stress, as are any issues rooted in social and cultural differences.

5.5 Comparison

Examined together, the analyses of the media and the academic studies permit interesting observations. First, the research studies and the print media frame the "how much - how often" question differently. While the research attempts to connect homework quantity and quality with achievement, media appears to report on the emotional burden experienced by students and parents, suggesting that it is brought about by too much homework.

Similarly, while both the research and the media are interested in parental roles, the academic literature examines parents' impact on achievement while the media question how homework affects parent-child interactions, familial concerns, and parental stress. In sum, research asks if parental help with homework may boost student achievement while the media warns that their help may come at the cost of family time, emotional well-being, and increased stress.

Third, neither the research nor the media adequately account for socio-demographic differences such as gender, SES, ethnicity or ESL status, which may interact with homework effects. Possibly, the social groups for whom class, cultural and ethnic concerns play a part in their attitudes to homework, do not find a voice as easily in the academic or popular literature.

A final observation concerns the difference in age groups examined by the research and the media. The media articles concentrated on primary, intermediate, and high school relatively equitably, and a substantial number of articles did not focus on any age group in particular. However, 14 of 18 research studies focused exclusively on high school students. The academic literature appears not to share the media's concern with homework at the elementary level.

At least one of two things is occurring. Either the media is not paying attention to the most recent evidence on this issue, or the research is not responding to the public's concerns. Given that homework is a politically charged issue, in order for decision-makers to effectively respond to public concerns, empirical research might focus more on the dimensions of homework of concern to the public. By the same token, if the media is reporting selectively on research, this may alter public perception. In fact, fewer than half the media articles referred to any research, and none of what was reviewed here. More commonly, if citing research at all, they relied on Cooper (2006).

This review found a gap between the empirical evidence on homework and its public perception as reported by the media. This is not surprising; popular opinion and academic evidence often do not intersect. However, this gap may be problematic when decision-makers develop homework policies or practices. While the media and public appear to be interested in facets of the debate that differ from the research evidence, all voices need to be considered in homework decision-making. Families are involved the homework process. Without the support of informed parents, the task of modifying homework practices for maximum achievement is unlikely to be easy.

5.6 Implications for policy and practice

Together, the 18 research studies depart from Cooper's (2006) important synthesis of research. Ten examine how different kinds of homework and ways of completing it affect achievement levels. These studies introduce additional areas of academic inquiry which merit further attention, but they do not directly assess the impact of 'doing or not doing homework' on achievement. The eight studies that do address this question are correlational, not causal, and in fact reveal some surprisingly complicated results. Nonetheless, the apparent complexity of homework need not intimidate decision-makers. Our analysis has identified some clear trends.

Homework that demands active student engagement is likely to be effective

Homework that increases active student engagement with the homework task likely boosts achievement. A meta-cognitive component where the students must think about their own learning may be an important part of this engagement. This was the primary result of the 'pedagogical enhancement' studies, as well as the net impact studies that indicated the importance of 'effort' rather than 'time.' While unsurprising, since inducing active learner engagement is typically considered a core principle of teaching and learning, lived experience may suggest it is a principle that homework assignments often do not instantiate.

This review indicates, then, that homework policies ought to be continually evaluated to ensure their success in any given context. The evidence shows that thoughtful homework assignments may be effective at increasing student achievement; however, assigning homework for the sake of homework appears an unsupportable practice. Indeed, a preoccupation with how long students spend on homework may mask more important issues. Homework type rather than homework quantity may increase academic achievement depending on students' age, other demographic characteristics and, the subject matter.

There is probably an academic benefit to the judicious assignment of homework

Classes and schools that assign more homework appear, to a point, to produce students with better achievement than classes and schools that assign less. As common sense indicates, classes where students spend more time on task seem to produce students with higher scores. Nonetheless, some studies indicated a point of diminishing returns for amount of homework assigned. Furthermore, we use the word 'appear' in the first sentence advisedly, as the studies that produce this implication are correlational, not

experimental, and while of good or better quality, cannot totally control for other possible causes of the correlation, most pertinently that students selected into classes and schools that assign the most homework may be higher achievers for other reasons. Overall, empirical evidence connecting homework quantity to higher achievement was qualified. This fact, along with the negative perceptions of portrayed in the media suggest teachers and schools be judicious in their homework assignments.

Homework will impact different students differently

Homework will likely produce different results in different student groups. Older students, i.e. Grade 8 and above, seem most likely to benefit. All the 'net impact' homework studies were conducted on older students. Lower achieving students appear to have the most to gain from homework. Not only did Eren and Henderson find bigger gains from lower achievers, and McMullen find students from low performing schools benefiting more from homework than those at high performing schools, other studies indicated homework was a widespread remedial activity.

Effort is more important than time

Homework's impact on achievement likely stems from effort more than time, as Trautwein (2007) indicates. This finding accords with the pedagogical studies that indicate that more motivating tasks lead to a beneficial homework effect. When students focus on their homework – because it is intrinsically motivating or because they have good study habits – achievement increases.

Parental involvement in homework does not harm younger students

The evidence indicates there is no harm to involving parents in children's homework at the earlier stages of their schooling. Parents of older children were not involved in any of the studies, so no claims can be made. The mixed results – resulting perhaps in part from methodological limitations – of the parental involvement studies prevent us from making the intuitive claim that parental involvement in homework positively impacts achievement. We can only say that it may help and certainly does not appear to hurt. There would likely be no academic downside to assigning homework that deliberately involved young students' parents.

5.7 Implications for further research

The policy implications outlined here are tentative due to the need for more research to replicate and strengthen the findings analysed here. Aspects of homework further research might consider include:

Type of homework

The 'enhanced' pedagogical interventions examined here were largely successful at increasing student achievement. Indeed, this empirical finding was perhaps the strongest of the review. Further research might continue to examine what makes homework tasks effective.

The role of parents

The results of parental involvement in homework were mixed. It is difficult to say if these interventions provided an academic benefit, making it challenging to reach any firm conclusions regarding best practices with parents yet.

Age/grade level

None of the studies here examined the net impact of homework vis-à-vis young students. The moderate beneficial effect for older students may extend to different degrees among younger populations. Furthermore, regardless of time spent, it seems likely that a homework intervention that is effective in Grade 12 may not be effective in Grade 4, or even in Grade 8. As a result, the generalizability of any research on a specific type of homework intervention is very limited without an assessment of age. Furthermore, the role of the parent is almost certainly very different among different age ranges.

Socio-demographics

Ten studies did not effectively account for gender, SES, ethnicity, or ESL status in their analysis. In fact, only one study examined SES, and two studies looked at ethno-cultural issues. This is a substantial gap in the literature that could be filled with relative ease. Many studies had access to these data but neglected to include them in their analysis. As with the age gap, it is reasonable to speculate that different homework interventions may lead to different results for different demographic groups. Effective evidence-based decisions demand research account for these considerations.

The quantity question

As shown by our analysis of the media, this issue, more than any other, is gathering the most vocal attention in the homework debate. However, it is also difficult to estimate the impact of homework on achievement in the absence of (quasi-) experimental studies. A careful reading of the correlational studies indicates moderate achievement benefits to students in classes where more homework is assigned; however, the data are often old - Eren and Henderson (2006), Keith et al. (2004) and McMullen (2007) all use NELS: 88 data - or from school systems very different from Canada (esp. Trautwein's German studies, but also the American studies). Modern Canadian quasi-experimental research would be welcome.

Parent perceptions

The media articles illustrated parent concern over homework, especially at the lower grades, is high. Substantive research verifying and uncovering the levels and nuances of these concerns would help decision-makers separate 'real' public concern from perceptions filtered through the media. Further, it would be research responsive to the public.

Other academic and non-academic outcomes.

The studies here focussed heavily on mathematics and to a lesser degree reading. Other subject areas warrant further study. In line with the media preoccupation with stress and psychological effects, further study into non-academic outcomes is also warranted.

5.8 Strengths and limitations of this review

Strengths

The major strength of this review is its methodology. Twenty databases and 66 websites were searched for empirical studies and print media articles about homework. This approach yielded an excellent capture of articles and is unlikely to have neglected important studies addressing our research question. The thorough search permits confidence in our conclusions.

Further strengths lie in the inclusion/exclusion, keywording, and coding stages. Each stage was completed concurrently by two reviewers to increase reliability and confidence in the results. Human error was strongly mitigated by this process, and the problem of subjectivity in qualitative research was reduced.

One important feature of a systematic review is the quality assessment of the included studies. An in-depth analysis was made of the 18 empirical studies in this review. Each study was evaluated on eight criteria and assigned an overall quality score. This system allowed for a focused and nuanced reporting of results and enables decision-makers to focus on the highest quality studies without completely discounting those studies that may have contained some methodological problems.

A final strength is the inclusion of media articles to illuminate public perception of homework. While the media is an imperfect indicator of public perception, it does offer broader context to a politically charged debate – vital information for decision-makers.

Limitations

Any review of literature is limited by the literature it has to review. The studies in this review were mostly sound methodologically, but like all social science research restricted in what they were able to accomplish by a variety of factors.

Not least, homework is surprisingly multifaceted. Most research sensibly defines homework as a task that teachers assign to students that is intended to be carried out during non-school hours. This definition is clear, but also too broad to allow conclusive generalizations. Not all homework is the same, and the same homework may affect different students in different ways. Homework time and quantity are not the only pertinent issues. Variations in the style and substance of homework can yield varying results, which can change again depending on who is receiving the intervention.

The challenge of properly implementing homework interventions is another difficulty. Implementing well designed interventions in education is difficult; the homework domain is no exception. Schools are not designed to allow for randomized controlled trials, which would provide the best evidence with which to make decisions. Further, stakeholders can influence the methodology of an intervention. If an intervention is perceived as positive, and teachers or parents are aware of it prior to its implementation, they may want all the students in the study to receive the intervention, as in Meyer (2005). This is an issue because it would be unethical to deny students an intervention that is believed to be

beneficial, merely to advance the research. Similarly, it may be particularly difficult in high school to assign ‘no homework’ to a control group for an extended period of time.

These limitations suggest conclusions about the academic benefit of homework are likely to remain elusive and qualified. Certainly, claims must be contextualized in terms of grade level, socio-demographics, and subject area, as well as the limitations inherent in implementing homework interventions for research purposes.

Beyond substantive limitations in the literature, any systematic review necessarily has procedural limitations, despite the review team’s best efforts at comprehensiveness. First, the search restrictions placed on media sources may have excluded some important articles. By restricting the search strategy to newspapers, electronic media were missed. Media were excluded primarily from television stations that produce written news online, due to difficulties with accurately searching network websites. The included media were accessed through database searches, which ensured accurate capture. Second, the media search, although not restricted to Canada, captured predominantly Canadian articles as a result of the databases searched. This, along with the date range (2006-2007 for media and 2003-2007 for studies) may have contributed to the previously discussed gap between the empirical evidence and the media articles.

None of these limitations preclude this review from effectively distilling relevant information from research and media for decision-makers. We merely caution them to keep these caveats in mind.

5.9 Conclusion

This systematic review analysed eighteen empirical research studies from 2003-2007 and 48 print media articles from 2006-2007 to address the question ‘Is there an academic benefit to K-12 homework?’ Major findings included: moderate evidence that homework which engages students in active learning (rather than rote repetition) increases achievement; credible evidence that students in classes that assign more homework perform modestly to moderately better than those in classes that assign less, though no causal link could be established; evidence that effort spent on homework is a stronger correlate of achievement than time spent on homework; and, inconclusive evidence that involving parents in homework helps achievement, but no evidence that they impede it.

The analysis of print media indicated that public concern with homework revolves less around achievement and more around the stress that it places on students and their families. Popular opinion in Canada appears to be swinging against homework, particularly at younger grades.

Policy implications include the need for judiciousness in homework assignments. Homework appears modestly to moderately beneficial, at least in higher grades, and homework that promotes active learning appears desirable, but given the unclear returns to spending large amounts of time on homework, and the significant strand of public

opinion that homework costs outweigh benefits, our results suggest the amount and frequency of homework assignments be carefully considered.

Given the limitations inherent in educational research, and a topic as broad as homework, research implications were fairly numerous. To properly assess homework's academic effects, many more experimental, or quasi-experimental, studies covering different grade levels, demographics, curricular areas, and outcomes will need to be conducted.

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