

# HOW DOES THE ‘DIGITAL GENERATION’ GET HELP ON THEIR MATHEMATICS HOMEWORK?

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## ABSTRACT

Homework is a daily activity for at least twelve years of most students’ school experience, and every assignment requires the time, energy, and emotional engagement of all those involved. Traditionally, students seeking homework help could refer to their class notes and textbooks, or ask their friends, tutors, and, perhaps, as last resort, their parents. Now, however, the Internet has greatly extended the set of resources to which students have ready access. By going online, students can read tutorials, watch videos, and even seek personalized homework help from a large community of others in online forums. Students who are currently in high school have grown up with computers, mobile devices, and other technologies that make Internet access a convenience, if not an expectation. Given their exposure to technology, together with an expanded pool of readily available resources, how do students today seek help on their homework? In particular, what resources (digital versus non-digital) do they favor and to what extent? This paper documents how a large population of USA high school students seeks help on their mathematics assignments. Comparisons between students in remedial, core, and advanced courses are also made.

## KEYWORDS

Digital resources, Help seeking, Homework, Mathematics, Net Generation.

## 1. INTRODUCTION

For at least twelve years, homework is a daily activity in most students’ schooling experience. Every assignment requires the time, energy, and emotional engagement of all those involved. Traditionally, students in need of help could refer to their class notes or textbooks, or they could ask their teacher, their friends, and, perhaps, as a last resort, their parents (Cosden, Morrison, Albanese, & Macias, 2001; Epstein & van Voorhis, 2001; Hoover-Dempsey et al., 2001; Solomon, Warin, & Lewis, 2002). Now, however, the Internet has greatly extended the set of resources to which students have ready access. By going online, students can read tutorials, watch videos, and even seek personalized homework help from a large community of others who take part in online forums. Students who are currently in U.S. high schools have grown up with computers, mobile devices, and other technologies that make Internet access a convenience, if not an expectation. Given their exposure to and familiarity with technology, together with an expanded pool of readily available resources, how do students today seek help on their homework? In particular, what resources, digital versus non-digital, do they favor and to what extent?

This paper addresses these questions by documenting the help-seeking habits of high school students on their mathematics assignments. Drawing together themes that have emerged from research on homework, the ‘Net generation,’ and digital resources, we sought to answer four major questions through a survey of more than 1800 students:

- 1 What resources do high school students use for mathematics homework help, and with what frequency? a) How does their use of online versus offline resources compare?, and b) Are there differences in resource usage between students in remedial, core, and advanced mathematics courses?
- 2 In what locales do high school students complete their mathematics homework?
- 3 How much help do students perceive they need compared with what they currently receive?
- 4 How is desire for help related to resource use and awareness of existing free digital resources?

## 1.1 Previous Research

A theoretical framing of help seeking as a legitimate learning activity (Nelson-Le Gall, 1985) with a broad impact across varied educational settings sets the stage for our study which hones in on the homework help-seeking habits of today's high school students.

### 1.1.1 Homework

Homework is a shared part of the daily school routine for students across different grade levels, generations, and even nationalities. Because homework plays such a central role in instruction, it has been an active area of educational research for almost a century (Cooper & Valentine, 2001). Although the findings of individual studies from within this corpus are often conflicting, syntheses of this body of work give a good sense of the relationship between homework and achievement, attitudes toward homework, and homework help (Cooper, 1989).

One of the major purposes of homework is to provide students with additional academic practice and learning opportunities outside of class. Without homework, most instructors find it impossible to cover curriculum content, and thus view it as an essential ingredient for learning and achievement (de Jong, Westerhof, & Creemers, 2000). Indeed, in a quantitative synthesis of numerous studies comparing homework with no-homework, homework with supervised study, and measuring differing amounts of homework completed, Cooper (1989) found support for a positive relationship between doing homework and achievement with few exceptions. Furthermore, the evidence from all three types of study suggested that the relationship between homework and achievement was influenced by the students' age or grade level. Doing homework was more strongly associated with achievement in high school than middle school, and in middle school than in elementary school. Of course, any positive association between homework and achievement is also mediated by whether or not students receive feedback on their work (de Jong et al., 2000) and by the quality of the assignments (Epstein & van Voorhis, 2001).

Given the increasing role homework plays in achievement over the course of schooling regardless of student ability (Keith, 1982; Keith, Reimers, Fehrman, Pottebaum, & Aubey, 1986), it is unfortunate that on average few students in higher grades do all of their homework. They may be suffering from sheer frustration (Anesko, Schoiock, Ramirez, & Levine, 1987) or simply not ascribe to the same beliefs about the benefits and purposes of doing homework as do adults (Warton, 2001). In particular, students do not view homework as a way of learning valuable time-management or study skills, even though parents may reduce the amount of help that they provide in the expectation that their children will become progressively more autonomous and personally responsible. In addition to perceiving their support role as becoming more emotional rather than academic over time, parents may also become less actively involved in homework because of feelings of inadequacy (Epstein & van Voorhis, 2001), inadequate information (Hoover-Dempsey et al., 2001), and the tension that often results when they become involved (Solomon et al., 2002). Some of the slack in providing students with homework help has been taken up recently by after-school programs and tutor centers (Cosden et al., 2001). Here, tutors can offer effective face-to-face help and support as students work on their homework assignments.

However, technology now provides the opportunity to expand help seeking support from such small-scale, local tutoring locales to much larger, geographically dispersed communities and learner networks (van de Sande & Leinhardt, 2007). The question here is whether, given their familiarity with and exposure to sophisticated technology, the ability to relocate homework help and expand available resources is something that students today value and of which they take advantage.

### 1.1.2 The Digital Generation

The last decade has seen a massive proliferation of increasingly sophisticated information communication technology (ICT). This boon in ICT has naturally led to questions and concerns regarding the fit between the educational system and the wants and needs of students who became young adults at the time. Although authors differ on the exact date brackets, students born roughly between the early 1980's and the early 2000's are said to belong to the "Net generation" (Tapscott, 1998, 1999, 2008) and are characterized as "digital natives" (M. Prensky, 2001a, 2001b) because of their familiarity with and reliance on ICT. Other authors use the term "millenials" to emphasize that it is exposure to technology, rather than age alone, that characterizes developing trends in how students learn (Howe & Strauss, 2000; Oblinger & Oblinger, 2005). However,

whether using a definition based on age or exposure, proponents for the ‘digital movement’ hypothesize that today’s students have distinct characteristics that set them apart from previous generations and that radically shape how they learn. The claim is that students are now active experiential learners who are facile with multi-tasking and who rely on communication technologies to access information and interact with others. Based on this characterization of new learning styles, commentators warn that the current educational approach is ill suited for the task of helping students learn and must be overhauled in order to adequately serve this new cohort of students: “Our students have changed radically. Today’s students are no longer the people our educational system was designed to teach” [emphasis in original] (Marc Prensky, 2001, p. 1). The prediction is that dire consequences will result if there is not a radical change in how students are taught all subjects at all levels.

However, not all researchers agree with these exhortations for full-scale educational transformation. Bennett, Maton, and Kervin (2008) scrutinize two major assumptions underlying the claim made for the existence of a generation of ‘digital natives.’ Specifically, they question whether students in this generation possess truly sophisticated technological skills and whether they have different learning styles compared with previous generations of learners. Based on their critical review of the research, they find little support for these assumptions. The conclusion reached is that the outcry for the necessity of radical educational reform to meet the needs of the ‘Net generation’ instead can be construed as a form of ‘moral panic’ or hype, rather than being empirically and theoretically informed. In its place, they advocate for a more thorough characterization of how today’s students interact with ICT, a goal that can only be achieved through “considered and rigorous investigation that includes the perspectives of young people and their teachers, and genuinely seeks to understand the situation” (p. 784). Accordingly, several researchers have answered this call with attempts to flesh out the role ICT actually plays in students’ lives, and specifically with regard to ways in which they learn (Helsper & Enyon, 2009; Jones, Ramanau, Cross, & Healing, 2010).

### **1.1.3 Digital Resources**

How might students of the Net generation use ICT to get help on their homework in ways that differ from the help available to previous generations? There are numerous digital resources that relate to homework help, many of which are available at no cost. Students who have questions on their coursework can readily find either generic help (e.g., by watching an instructional tutorial) or more personalized help (e.g., by interacting with others on an online forum). By typing their query into a search engine, students can almost instantaneously get a list of documents or webpages that might contain the sought after answer, or they can get answers to factual queries directly by using a sophisticated computational engine (such as Wolfram Alpha). These are just a few of the ways in which ICT has made it possible for students seeking help on their homework to have a wealth of information and communities at their fingertips.

However, although we know that 95% of students ages 12 – 17 access the Internet (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013) much less is known about how students are using the Internet for homework help. For instance, although Khan Academy ([www.khanacademy.org](http://www.khanacademy.org)) has published more than 4,000 instructional videos covering K-12 school topics, we do not know (other than anecdotally) how watching these videos translates into learning or resolving student questions. With regard to the use of open online homework help forums, we know a little more. In particular, members of some of these forums demonstrate a strong sense of virtual community in that they share responsibility for participation, take on different roles, and work to create a safe place for people to share their thoughts and (lack of) understanding (van de Sande & Leinhardt, 2007). Furthermore, because forum exchanges are archived as discussion threads, it is possible to make inferences about the effect of the interaction on student understanding (van de Sande, 2010). In a sample of 100 discussion threads on the topic of the limit from one mathematics help forum, it was possible to infer something about how the student perceived the helpfulness of the interaction in 36 cases; the student demonstrated increased understanding of the problem solution in 23 of these threads, expressed gratitude and thankfulness in 10 of the threads (which may or may not have signaled deeper understanding), and only indicated remaining uncertainty and confusion as the last communication in 3 of the threads. Naturally, these percentages will vary depending on the culture, norms, and practices of the site being investigated (van de Sande, 2010) and do not say anything about long-term learning outcomes, but such studies of resolution and participation do contribute to our understanding of how students who belong to the ‘Net generation’ are using at least some types of digital resources for seeking homework help.

## 2. PARTICIPANTS AND METHODS

Students and teachers in all mathematics classes at a large public high school (enrollment of approximately 3000 students in grades 9 – 12) in the southwestern region of the US were surveyed on their homework practices. The school was chosen because it is one of the most representative campuses in the state, with a racial and economic distribution that matches the state average: 51% white, 34% Hispanic, 7 % African American, 4% Asian, and 3% Native American and 60% of the students qualify for Free/Reduced lunch. This study was approved by the Institutional Review Board at the researchers' university, and permission to collect the data and report the findings was granted by the principal and the school district.

The purpose of surveying both teachers and students was to establish the nature of the relationship between teacher policies and self-reported student help-seeking activities. For instance, if teachers approve a particular help-seeking activity, such as taking and using detailed class notes, students may be more likely to gravitate toward using that resource. This paper focuses on the results of the student survey; the results of the teacher survey will be published separately.

The researchers asked all mathematics teachers at the school to administer the student survey during a normal class session late in the semester, and teachers did so voluntarily. Classes at all levels were surveyed: Remedial, consisting of Standard Mathematics I and Skill Builder; Core, consisting of Algebra I, Algebra II, Geometry, Trigonometry and College Math, and; Advanced, consisting of Honors Algebra I, Honors Algebra II, Honors Geometry, Pre-calculus, and AP calculus. Findings are reported across these different course types because we hypothesized that help-seeking strategies might differ depending on how advanced the course material was. The anonymous written student survey consisted of four questions in which students reported on the location where they completed their homework, the type and amount of help-seeking resources that they used, and their perceived need for help. In addition, students were asked about their familiarity with and usage of several popular digital resources. The survey was intentionally designed to be very brief in order to take up only a minimal amount of instructional time and encourage participation.

Exact binomial 95% confidence intervals were calculated for proportions. Independence of two categorical variables was assessed using a Chi-squared test. Averages are calculated with linear regression with bootstrapped confidence intervals, to accommodate lack of normality of residuals. Significance is reported at the 5% level. All data manipulation and statistical analyses were carried out in Stata MP v12 (StataCorp., 2012).

## 3. RESULTS

A total of 39 teachers and 2473 students participated, giving a response rate of 75%, with representation from every course with the exception of Consumer Mathematics. Participant students were between 14 and 19 years old. The overwhelming majority of the students (~85%) were enrolled in core courses, only approximately 10% were taking advanced math courses, and very few (~4%) were enrolled in remedial courses.

### 3.1 Resources

Figure 1 shows the percentage of students across course types (remedial, core, and advanced) who reported using a resource for seeking help and to what degree the resource is used for help in a typical homework assignment (for two or fewer problems, for some problems, or for most or all problems). In Figure 1, the results are collapsed across frequency of use: The graph on the left (never or infrequent) represents reported use of a resource for two problems or less, the graph in the middle (occasional) represents reported use for some of the problems, and the graph on the right (frequent) represents reported use of a resource for most or all of the problems on a typical homework assignment.

Below are the major finding for what resources students commonly use and the extent to which they use them:

- Digital resources are much less popular than traditional, non-digital resources for students enrolled in all levels of high school mathematics courses.
- Students do not generally seek help from others at home or from a tutor.
- Students in core or remedial courses who do have a tutor are more likely than students in advanced courses to ask for help on substantial portions of their assignments

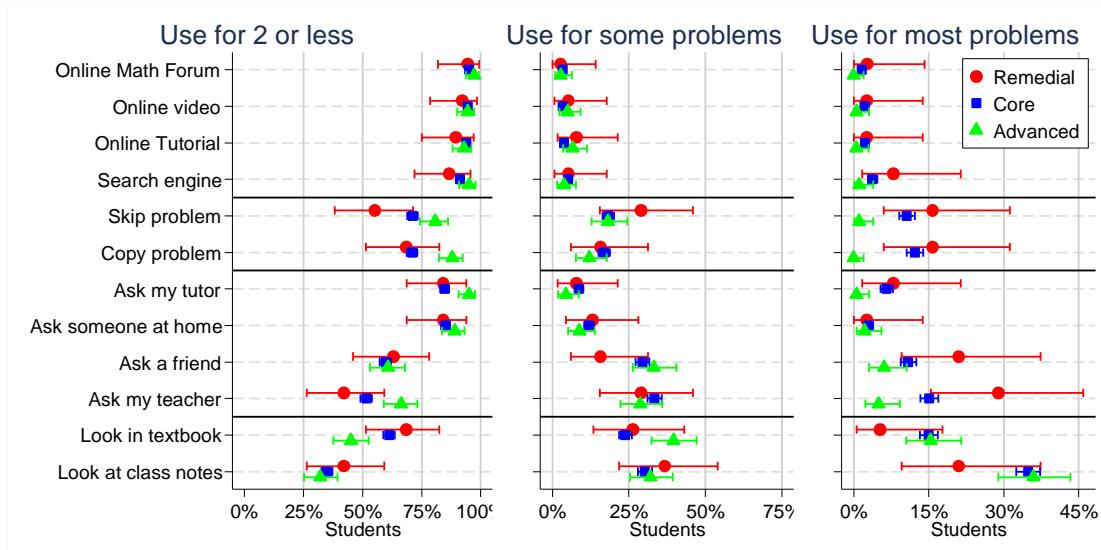


Figure 1. Percentage of students who reported using each resource on a typical homework assignment, by course level (Remedial, Core or Advanced) and level of usage, with 95% exact binomial confidence interval.

- Students seek help from friends and teachers more frequently than others at home and tutors, and this is especially true for students in remedial courses.
- Students in core and remedial courses are more likely than students in advanced courses to seek help from friends and teachers on substantial portions of their assignments.
- Students in advanced courses skip or copy solutions for only one or two problems on an assignment, whereas students in core and remedial courses are more likely to engage in these activities for substantial portions of their assignments.
- Textbooks are used infrequently by students at all levels, and this is especially true for students in remedial courses.
- Class notes are the most popular resource for seeking help on substantial portions of their assignments for students enrolled in core and advanced courses.

### 3.2 Locale

Table 1 shows the percentage of students enrolled in difference levels of courses by the locale in which they do their homework. Course level was a characterizing factor for where the majority of homework assignments are typically completed.

Below are the major findings for where students complete their homework assignments:

- Students in advanced courses generally complete their assignments at home and very seldom during class, whereas students in remedial courses complete large portions of their assignments in class and very little of their assignments at home.
- Students in core courses complete portions of their homework assignments in varied locations, although the largest portions of their assignments are completed at home.
- Study hall is not used frequently for completing homework by students at any level, and particularly not by students in remedial courses.
- In general, students who do homework in study hall complete less than half of their assignments there

Table 1. Percentage of students using each location to do a typical homework assignment and the amount of help wanted. P-values are from a Chi-square test of independence (Remedial N=37, Core N=1584, Advanced N=182).

Location	Course Type	Amount of homework				P-value	Chi-sq
		None	Quarter	Half	Most		
<b>At home</b>	Remedial	29	37	16	13		
	Core	22	22	19	35		
	Advanced	5.5	11	14	69	0.00	
<b>In class</b>	Remedial	2.6	26	39	32		
	Core	18	36	23	19		
	Advanced	47	40	7.1	2.7	0.00	
<b>In study hall</b>	Remedial	58	16	7.9	11		
	Core	39	26	16	15		
	Advanced	43	37	9.9	6	0.00	

### 3.3 Resource Awareness

Figure 2 show the percentage of students aware of various popular homework help websites. Below are the major findings for how aware students are regarding several popular digital resources:

- In general, students are completely unaware of the existence of several popular online homework help sites.
- Depending on course level, some online sites are more popular than others.

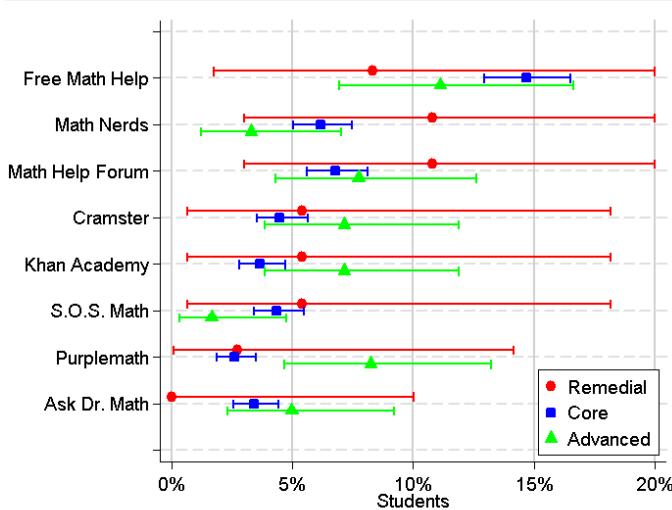


Figure 2. Percentage of students who reported having heard of each online resource, by course level (Remedial, Core or Advanced), with 95% exact binomial confidence interval (Remedial N=37, Core N=1584, Advanced N=182).

### 3.4 Need for Additional Help

Figure 3 depicts the relationship between the amount of help needed and awareness of digital resources. In general, students reported wanting more help than they are getting. Below are the major findings for how much additional help students perceive that they need:

- In general, students want more help on their math homework than they are receiving.
- As the level of course decreases the perceived need for additional help increases.
- The amount of extra help desired is independent of the awareness of digital resources for students in core and advanced courses.
- Students in remedial courses who are aware of at least two digital resources perceive that they need less extra help than those who have only heard of one at most or none at all.

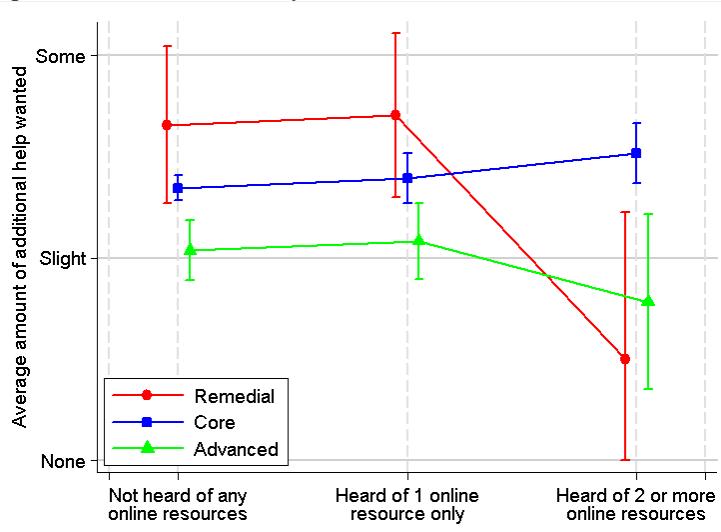


Figure 3. Average amount of additional homework help wanted, by the amount of online resources heard of, and by course level (Remedial, Core or Advanced), with 95% confidence intervals estimated from bootstrapped linear regression model (N=1,729).

## 4. CONCLUSIONS

### 4.1 Limitations

The use of a brief survey instrument to investigate homework help-seeking resources allowed us to gather information from a large number of students with relative ease. However, this design choice has several limitations that lead to open questions. Because results were based on self-reporting, there is no way to assess the validity of students' descriptions of their help-seeking habits. This said, we are cautiously optimistic that students were for the most part honest in their reports; on the questionnaire, they freely admitted to the unsanctioned practice of copying problem solutions from others. In addition, though, even if students were straightforward in their responses, they may have had differing interpretations of the terminology used in the survey, such as 'similar problem type' or 'online tutorial.' Related to this, students may only have known some of the digital resources listed by their logo, and may not have recognized them by name.

The survey also did not address questions about general technology availability and use. The assumption made was that students would gravitate toward resources that were viewed as most helpful. However, it is also possible that circumstances, beyond just the location where homework is done, dictate how students seek help. Items that ask students to describe their access to the Internet and their use of technology would be informative additions to this survey.

Furthermore, it would be useful to consider how various resources relate to achievement. If students are able to perform well in math class by relying almost exclusively on their class notes for homework help, then they presumably have no need for other available resources. The results of this study suggest that students may be learning through experience that any 'important' information can be found in their notes. This calls for an investigation of what students' class notes look like, how the content of their notes compares with class instruction as well as with homework and exam questions, and how all of these factors relate to learning and understanding.

## 4.2 Summary

This study shows that students seem to gravitate toward using traditional rather than digital resources for seeking homework help. At the same time, although many students express desire for more help, they are unaware of the existence of several popular, freely available digital resources. These patterns of resource familiarity and use may reflect students' beliefs about homework, governed by the level of course they are taking, as a school-centered activity, as well as the nature of the resources themselves. In particular, it would be worth researching what digital resources are being used and how by remedial courses since they reported needing less help as their awareness of available resources increased. Another line of research concerns note-taking and how this activity relates to achievement, particularly as students transition from a more structured high school setting to that of university, and, even perhaps online instruction.

In sum, these results raise important issues about resources and their use in instruction. It is important for instructors and researchers to discuss the role of available resources for providing homework help, the quality and affordances of different resources – both digital and non-digital, and to find ways to help support students in their use of these resources. The point is not whether students in the 'Net generation' are doing their homework differently than other generations – but rather how we can maximize their opportunities to develop deeper understandings of mathematics as they work on their assignments.

## REFERENCES

- Anesko, K. M., Schoiock, G., Ramirez, R., & Levine, F. M. . (1987). The homework problem checklist: Assessing children's homework difficulties. *Behavioral Assessment*, 9, 179-185.
- Cooper, H. (1989). Synthesis of research on homework. *Educational Leadership*, 47(3), 85-91.
- Cooper, H., & Valentine, J. C. (2001). Using research to answer practical questions about homework. *Educational Psychologist*, 36(3), 143-153.
- Cosden, M., Morrison, G., Albanese, A. L., & Macias, S. (2001). When homework is not home work: After-school programs for homework assistance. *Educational Psychologist*, 36(3), 211-221.
- de Jong, R., Westerhof, K. J., & Creemers, B.P.M. (2000). Homework and student math achievement in junior high schools. *Educational Research and Evaluation*, 6(2), 130-157.
- Epstein, J. L., & van Voorhis, F. L. (2001). More than minutes: Teachers' roles in designing homework. *Educational Psychologist*, 36(3), 181-193.
- Hoover-Dempsey, K. V., Battiatto, A. C., Walker, J. M. T., Reed, R. P., DeJong, J. M., & Jones, K. P. (2001). Parental involvement in homework. *Educational Psychologist*, 36(3), 195-209.
- Keith, T. Z. (1982). Time spent on homework and high school grades: A large-sample path analysis. *Journal of Educational Psychology*, 74(2), 248-253.
- Keith, T. Z., Reimers, T. M., Fehrmann, P. G., Pottebaum, S. M., & Aubey, L. W. (1986). Parental involvement, homework, and TV time: Direct and indirect effects on high school achievement. *Journal of Educational Psychology*, 78(5), 373-380.
- Nelson-Le Gall, S. (1985). Help-seeking behavior in learning. *Review of Research in Education*, 12, 55-90.
- Solomon, Yvette, Warin, Jo, & Lewis, Charlie. (2002). Helping with Homework? Homework as a Site of Tension for Parents and Teenagers. *British Educational Research Journal*, 28(4), 603-622.
- van de Sande, C., & Leinhardt, G. (2007). Online tutoring in the Calculus: Beyond the limit of the limit. *Éducation et Didactique*, 1(2), 115-154.
- Warton, P. M. (2001). The forgotten voices in homework: Views of students. *Educational Psychologist*, 36(3), 155-165.