THE ROLE OF HOMEWORK AND PARENTS IN MIDDLE SCHOOL MATHEMATICS EDUCATION

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INTRODUCTION

Homework is a regular part of the classroom routine in many middle school mathematics classrooms. Teachers use homework to accomplish a variety of functions from further practice of the lesson to enriching the lesson through real-world connections to preparing for the next lesson. Even though the idea of homework suggests that it is work to be done outside of the regular classroom time, a considerable amount of classroom time is still used to give and explain the assignment, go over the assignment if it is reviewed in class or collecting and returning papers if the teacher reviews the assignment during non-class hours. One begins to wonder if homework is truly useful in improving mathematics achievement to a degree that warrants the use of so much classroom time. This can be especially true in middle school and high school when the time with the students in any given content area is so limited.

Many families report that homework causes much stress in their lives. Students today have many opportunities for participation in extra-curricular activities and families are pulled in many directions with outside commitments leaving students with little time to complete homework outside of the classroom time. Additionally, many parents of middle school and high school students report that they are not able to help their children with homework as the work is of a level that is past the ability or comfort level of the parent.
Teachers today are encouraged to be reflective in their work and question why they do the things they do in their classrooms and evaluate the effectiveness of various classroom practices. Schools are under much scrutiny and pressure to have students reach certain academic levels at certain times and teachers also feel the pressure of covering all the material to have their students prepared for the various standardized tests that students take in school. With all of this in mind, the mathematics teacher must evaluate the effectiveness of homework as a useful tool in mathematics education.

This research paper seeks to answer two questions for the middle school mathematics teacher. Is homework an effective tool to help increase achievement in middle school mathematics? How can parents support homework?

REVIEW OF THE LITERATURE

Homework

There has been much research on homework over the past decades, with mixed results. In fact, it has been suggested that one can find research to support any view of homework (Cooper, 1989).

Quantitative research of homework is complicated. Homework is influenced by a variety of factors making it very complex, perhaps more so than any other tool used by educators (Cooper, 1989). Homework can be affected by time spent on task, prior knowledge, motivation, parental support and influence and a host of other factors. Controlling for each of the potential influences is
difficult and creates many challenges for the educational researcher and the reviewers of the research.

Nonetheless, Cooper (1989) set out to determine the effectiveness of homework based on the research available at the time. What he found was an assortment of mixed results, but results which leaned heavily toward homework being an effective classroom tool. Cooper (1989) found that homework has many different effects, which he summarized in the chart below.

**Suggested Effects of Homework**

**Positive Effects**

- Immediate achievement and learning
- Better retention of factual knowledge
- Increased understanding
- Better critical thinking, concept formation, information processing
- Curriculum enrichment

**Long-term academic effects**

- Willingness to learn during leisure time
- Improved attitude toward school
- Better study habits and skills

**Non-academic effects**

- Greater self-direction
- Greater self-discipline
Better time organization

More inquisitiveness

More independent problem solving

Negative Effects

Satiation

Loss of interest in academic material

Physical and emotional fatigue

Denial of access to leisure-time and community activities

Parental interference

Pressure to complete assignments and perform well

Confusion of instructional techniques

Cheating

Copying from other students

Help beyond tutoring

Increased differences between high and low achievers (p. 86)

Other researchers have more recently concluded that higher homework completion rates result in higher grades and achievement scores and that time on task combined with completed homework results in improvement of skills (Epstein & Van Voorhis, 2001). Some potential reasons for this effect have been suggested. Perhaps low ability middle school students do their homework too quickly, less accurately or not at all, resulting in lower homework completion
rates and less time on task, which would prohibit them from getting the full positive benefit from the assignment and would certainly do nothing to improve their grades or achievement scores (Epstein & Van Voorhis, 2001). It is also possible that teachers assign less homework to lower ability students and have lower expectations for those same students (Epstein & Van Voorhis, 2001). Such a practice would reduce the opportunity for lower ability students to get the same positive effect from homework that other higher ability students might receive.

Looking at the same issue from another direction, it has been suggested that higher ability students get more homework so spend more time on task which results in higher grades and test scores (De Jong, Westerhof and Creemers, 2000).

Separating students by ability level is considered to be a form of tracking and is frowned upon by many (De Jong, et al., 2000). The prevalence of this practice in the United States is a contributing factor to the complexity of studying the effects of homework. Separating students by ability makes it harder for researchers to measure the effect of homework on a general population. Research has shown that the students most likely to complete homework are high achievers (Xu & Corno, 2003). So we have set up a type of chicken versus egg situation. Did completing homework cause the students to be high achievers or did they complete homework because they were high achievers?

As parental involvement with homework has been suggested to affect the completion of homework (Epstein & Van Voorhis, 2001), it bears consideration
on the chicken versus egg issue as well. In a study by Pezdek, Berry and Renno (2002), it was noted that parents spend more time helping students who were not doing well in mathematics. This same study found that parent involvement did not have a significant positive result on achievement in mathematics. Did parents become involved because their child was not doing well in the first place or did their involvement prohibit the child from achieving?

What has been determined in studies is that the effectiveness of homework varies by grade level. In his review of research, Cooper (1989) found that homework was more effective in junior high school than in-class study. This contrasts with the findings in elementary school where in-class study was more effective than homework (Cooper, 1989). Considered by many to be an expert in the area of homework, Cooper (1989) again concluded that

the evidence is clear. Homework has substantial positive effects on the achievement of high school students. Junior high students also benefit from homework but only about half as much. For elementary students the effect of homework on achievement is trivial, if it exists at all (p. 89).

It is unclear if these findings would change in a middle school as compared to a junior high. Based on the fact that middle schools usually serve the same age range of students that were previously served by a junior high school, one can make a case that homework effectiveness would be similar.
In a review of homework studies specifically related to mathematics, Austin (as referenced in Callahan, Rademacher & Hildreth, 1998) determined that homework can significantly improve academic achievement in mathematics. Interestingly, high mathematics achievement has been found to be a significant predictor of whether a student will attend college and complete a bachelor’s degree (Adelman as referenced in Catsambis & Beveridge, 2001). Pezdek, Berry and Renno (2002) found that there is a “modest but significant” (p. 774) relationship between the number of hours spent on mathematics homework and mathematics achievement.

What does all of this mean for the middle school mathematics classroom? It appears from the research literature available that a case can be made that homework in the middle school mathematics classroom does have some positive influence on achievement. Exactly how much positive influence homework has is difficult to measure. Achievement is measured in different ways in the various studies. Some use grades as a measure of achievement, some use standardized test scores as a measure of achievement and some use a combination of both. Additionally, as has been previously pointed out, homework is influenced by a variety of factors making it difficult to isolate all the variables affecting homework to get a true measure of the effect of any given situation. As such, it would seem prudent for the reflective middle school mathematics teacher to carefully consider how homework is to be used in the classroom. Cooper’s
(1989) chart on the effects of homework provides an excellent resource of issues for a teacher to consider in evaluating homework practices for the middle school mathematics classroom.

Homework is considered by some to be a “universal aspect of public schools” (Callahan, Rademacher & Hildreth, p. 10). Indeed, one study found that most mathematics teachers assign homework with every lesson but that the amount assigned varied greatly (De Jong, et al., 2000). While the reasons for assigning homework can include practice, preparation and communication with home (Epstein & Van Voorhis, 2001), the reality is that without homework, most mathematics teachers find that they cannot cover the intended curriculum (De Jong, et al., 2000).

There is a Chinese Proverb that states “I hear, and I forget. I see, and I remember. I do, and I understand.” Taking this to heart, teachers, at all levels of the educational spectrum, believe that for a student to take ownership of an issue or idea, the student must have an opportunity to work with it and make it their own. The mathematics classroom is no exception. Students are bombarded daily with new material, or new applications of old material. It is not uncommon for teachers to feel the need to allow students time to work with the material to master it and take ownership. The Ohio Graduation Test, which students will need to pass to graduate from high school in the very near future, contains some mathematics problems that are estimated to take 20 minutes to solve. Based on
the educational research supporting the positive link between homework effectiveness and student achievement and the need to cover material and give students practice time within the constraints of a normal middle school class period of approximately 40 minutes, a middle school mathematics teacher can feel comfortable giving reasonable and appropriate assignments for students to complete as homework.

The question for the middle school mathematics teacher then becomes, what can be done to maximize the positive effect of homework? Sullivan and Sequeira (1996) suggest that homework should be “meaningful, relevant, involving, creative, and of quality” (p. 1). Feldman (2004) suggests the following things to consider when designing and assigning homework: assign homework regularly and consistently, communicate your homework policy to parents and students, be flexible, make homework count (otherwise it will not get finished), make homework interesting, use an appropriate level of difficulty, give feedback to students, involve parents and never use homework as punishment.

Following his review of homework research studies, Cooper (1989) devised several recommendations regarding homework. Regarding the time spent on homework, Cooper suggests that in grades 7 through 9, students should have three to five assignments per week, each lasting 45 to 75 minutes. In another article, Cooper (2001) says that for junior high students, positive effects result for homework lasting up to 1 to 2 hours per night. Beyond that time period, positive
Homework

benefits of homework disappear. Cooper also makes reference to the 10 minute homework rule. The original source of this rule is unknown but the rule states that students can be expected to do 10 minutes of daily homework for every year in school. Thus, a student in seventh grade would be expected to do 10 minutes x 7 years or 70 minutes of homework a night. This rule of thumb is consistent with Cooper’s findings and he supports this rule of thumb (Cooper, 2001). Since students in these grades see many different teachers during the school day, it is imperative that teachers work together to see that their cumulative homework assignments do not exceed a reasonable time per night.

Students with various learning disabilities or other academic challenges may commonly spend twice as long as general education students on the same assignment (Jenson & Sheridan, 1994). This is certainly a significant issue that teachers will want to consider when assigning homework, differentiating instruction and reviewing IEP goals and requirements. Teachers need to design homework in a way that encourages low ability students to take the time they need to complete the assignment and give everyone an opportunity to benefit from the assignment (Epstein & Van Voorhis, 2001).

Students need to be personally involved in the homework assignment (Sullivan & Sequeira, 1996). The personal involvement helps students increase their skill retention and master knowledge (Sullivan & Sequeira, 1996). This implies that students must be actively engaged during the class time so that
students have the maximum benefit from the lesson which the student can then
take home and transfer to their homework at their own pace and interest level,
giving all students a more reasonable opportunity to be successful in the
completion of the assignment. This also implies that teachers need to create
assignments extending classroom work in a way that allows students to practice
and apply skills to real-life situations in a meaningful way (Sullivan & Sequeira,
1996).

Teachers should emphasize the quality of the assignment (Sullivan &
Sequeira, 1996). Homework is not to be busywork but must be meaningful and
students must understand that the quality of their work is important.

Because teachers want students to do quality work on their homework,
teachers need to give them feedback regarding their homework. Homework needs
to be checked, commented on and returned to the students in a timely manner
(Sullivan & Sequeira, 1996). Some teachers prefer to go over the homework in
class with the students checking their own work. This has been supported by
research which demonstrates that classes where students check their own work
have higher achievement (De Jong, et al., 2000).

Given the research findings, it is clear that teachers must be very
deliberate in their homework planning to insure the maximum positive
opportunity for all students. If assignments are not effective, little or no positive
influence on achievement will be noted.
Parents

Parent involvement in education has a positive effect on homework completion (Epstein & Van Voorhis, 2001). Homework completion leads to higher academic achievement (Epstein & Van Voorhis, 2001). It is the responsibility of the teacher and the parent to motivate the student to be actively involved in school (Stiller & Ryan, 1992). Teachers set the stage by what goes on in their classroom. They further set that stage by providing meaningful homework for their students to practice and apply what they have begun in class. Teachers also need to provide opportunities for parents and their children to work together on mathematics (Strutchens & Perkins, 1997).

Parents can support the homework process. Parental involvement has been demonstrated to have a positive effect on student achievement but the exact amount of the effect is inconsistent (Fan & Chen, 2001). There are many types of parental involvement in schools. Epstein (as referenced by Fan & Chen, 2001) has noted “parent involvement in learning opportunities at home” (p. 2) as one of them. The question then becomes, how can parents best support their middle school children in regard to homework and education?

Grolnick and Ryan (as referenced in Cooper, Lindsay & Nye, 2000), suggest three aspects of parental involvement that affect students. The first is autonomy support. This has to do with how parents encourage and help their children to be independent problem solvers. The second is called direct parent
involvement. This has to do with parents being interested and involved in the life of their child. The third aspect of parental involvement is called provision of structure. This has to do with parents providing rules and consequences for behavior.

The effect of each of these types of parental involvement on student achievement varies but the results of research clearly point out that autonomy support has been found to be the more effective than the other two types of involvement (Cooper, Lindsay & Nye, 2000). Higher homework assignment completion rates are associated with more autonomy support (Cooper, Lindsay & Nye, 2000). In a study by Trivette and Anderson (1995), four types of parental involvement were studied -- parental aspirations for their children, parent-child communication about school, home structure and parental involvement in school related activities. Of these four types of parental involvement, parental aspirations, a form of autonomy support, had the strongest effect on the achievement of children.

Parents can encourage higher aspirations for their children in several ways. Researchers have established a link between high aspirations of parents and past student performance (Trivette & Anderson, 1995). The same research showed that parents with high aspirations for their children had greater school communication with their children. Not all students have had past mathematics performance that would automatically lead parents to have high aspirations.
Parents can, however, work to turn that around. When parents have appropriate and reasonable expectations for their children and communicate those expectations to their children in a positive and encouraging manner, this involvement will help the children to have a feeling of competence which will then result in positive outcomes (Hoover-Dempsey, Battiato, Walker, Reed, DeJong, Jones, 2001).

Attitude is everything. If parents maintain a positive attitude about homework, that attitude will be passed to the children who will also maintain a positive attitude (Hoover-Dempsey, et al, 2001, Hartog & Brosnan, 1994). It has been found that a student’s attitude about mathematics is the most important factor in mathematics participation, especially in later grades (Ma, 1999). As mentioned previously, student participation in mathematics is the best predictor of whether a student will attend college and complete a bachelor’s degree (Adelman as referenced in Catsambis & Beveridge, 2001). With that in mind, maintaining a positive attitude about mathematics and mathematics homework has far reaching consequences for parents and students.

Sutton (n.d.) has suggested that one of the best things parents can do for their children in relation to mathematics is to help the children understand that it is normal to struggle with mathematics. At some point, nearly everyone finds mathematics to be challenging. It is a normal part of learning the content. Parents who can accept this struggle and help their children accept this struggle
will be much better able to maintain a positive attitude regarding mathematics (Sutton, n.d.). Parents need to recognize that some assignments or individual problems may take longer than others due to the type of problem rather than a lack of knowledge or understanding on the part of the student (Bay-Williams & Meyer, 2003). Students also need to understand this. We live in an instant gratification society. We want answers now and middle school students are no exception. When doing homework, students need to recognize that the type of problem frequently encountered at this level requires some time to complete and will not likely be solved instantly. Parents need to support this thought process.

When a student does not understand a homework problem, the student may ask the parent for help or the parent may volunteer to help. While it is certainly permissible for the parent to assist their child in understanding a difficult homework problem, there are some specific things that parents can and should do first. Keeping in mind the goal of having the student be an independent problem solver, the parents can ask the student questions about the problem (Finn, 1998). What is the problem? How is it set up? What are you trying to find? Why is the problem set up in this manner? Through the process of discussing the problem with the parent, the child may often discover the solution on their own, thereby being successful with minimal parental assistance. This process will often work even if the parent is not familiar with the specific content that the student is studying (Finn, 1998). A wonderful side effect is that the student becomes the
teacher and the parent learns mathematics, or at the very least gets a refresher course.

A study of at-risk students and homework performance found a “greater-than-expected” (p. 9) rate of mathematics improvement when parents were able to help students implement self management strategies and parents provided positive reinforcement to the students (Callahan, Rademacher & Hildreth, 1998). This lends further support to parents striving to achieve autonomy support.

Parents should discuss mathematics with their child. Sui-Chu and Willms (1996) determined that the most important factor for parents in middle school mathematics achievement is home discussion. Through this home discussion, parents convey their high aspirations for the children, their support and encouragement in the mathematics struggle of their children and the importance of mathematics in daily life. In a study of race and income related to parent involvement, Desimone (2001) found that student discussion with parents was the best parent involvement predictor of student achievement. This was found to be true across all races, except Asian, and for all children, although it was less significant for disadvantaged children (Desimone, 2001). The importance of parents being involved through academic discussion with their children cannot be overemphasized.

In a study of parental influence and student achievement in seventh grade mathematics, Wang and Wildman (1996) studied 30 variables representing
varying types of parental involvement. The most significant parent variables associated with positive student achievement were (in order): parents vote in most elections, student believes parent is confident in student’s ability, and parents expect student to earn a college degree. The most significant parent variables associated with negative student achievement were (in order): parents reward good grades, parents help student with homework and parents read a lot of books. 

The relation between parental voting practices and book reading may be surprising to some. Wang and Wildman (1996) suggest that it is possible that parental voting practices influence students’ skills in logic and reasoning which are important mathematics skills and are also skills which are not normally attained through regular book reading.

As a result of their study, Wang and Wildman (1996), devised a list of four parental guidelines to help improve mathematics achievement in seventh grade. Parents should “express confidence in the students’ abilities, encourage students to do their homework independently, promote students’ intrinsic interest in mathematics, whereby learning mathematics becomes its own reward, enhance students’ independent logic reasoning through extracurricular activities” (p. 3). All of these suggestions underscore the importance of autonomy support.

Direct involvement is the second form of parental involvement as outlined by Cooper, Lindsay and Nye (2000). This form of parental involvement deals with parents being interested in and directly involved in the life of their children--
a hands-on approach to parenting. With regard to homework, this type of parental involvement is demonstrated by monitoring the homework of their children, quizzing the children on their facts and modeling how parents use mathematics in their daily lives (Bay-Williams & Meyer, 2003).

It has been suggested that it is possible that when a student is doing well, parental involvement takes the form of autonomy support and when a student is doing poorly, parental involvement takes the form of direct involvement (Cooper, Lindsay & Nye, 2000). This leads to a further chicken versus egg debate about the effectiveness of direct support as compared to autonomy support.

A parent helping their child to complete homework does happen. In a study of homework in the home, Cooper, Lindsay and Nye (2000) found that most parents reported helping their children “some of the time.” (p. 475). For at-risk middle school students, direct parental involvement was found to increase student achievement (Callahan, et al., 1998), although Xu and Corno (2003) found that parental (or family) help with homework had no significant effect on student achievement compared with no help for the general student population.

Direct parental involvement in homework allows children to observe modeling by parents, receive feedback from parents and participate in content related activities (Hoover-Dempsey, et al., 2001). While it can be argued that helping children with homework does show interest and may stimulate some discussion between parents and students, the achievement results are arguably
Homework

limited. Direct assistance is more helpful for at-risk students than for the general education population. Parents should exercise caution in providing too much direct homework help for their children. Children should be encouraged to do their homework independently to the degree possible and parents should seek to support their children in the homework efforts in a more autonomous manner. Student achievement is often the goal parents have when they become involved in their children’s homework. This should not be the case. A better goal for parents would be to improve student attitudes toward homework and student behaviors (Hoover-Dempsey, et al, 2001). This points parents back toward autonomy support types of involvement.

Provision of structure is the final form of parental involvement discussed by Cooper Lindsay and Nye (2000). This form of parental involvement involves parents providing consistent rules and consequences for their children. As it relates to homework, parents can certainly have household rules about when and where and under what circumstances homework is completed. All parents know that they should monitor the homework completion of their children but parents of middle school students do not monitor homework as much as parents of elementary school parents (Epstein & Van Voorhis, 2001). This type of parental involvement does have a positive effect on students but less so than autonomy support (Fan & Chen, 2001). It has been suggested that this is perhaps because the students who are being closely supervised by parents are students who were
not doing well in the first place (Fan & Chen, 2001). This furthers the chicken versus egg debate. Which came first, the parental involvement or the student achievement?

Being typically very social, middle school students often will try to do homework with a friend. Yet, research shows that students are much more attentive to their homework when they are with a parent as opposed to a friend (Xu and Corno, 2003).

Xu and Corno (2003) did a study of middle school students and their homework management skills. They found that middle school students did a much better job of time management, focusing attention and monitoring their motivation than they did at arranging their work stations or controlling their emotions. These findings then provide a window into opportunities for parents to be involved by helping their middle school children manage their work space and control their emotions. Indeed, Xu and Corno (2003) found that students who did receive family help were much more likely to make more effort to manage work space and control emotions. This means that parents can make sure students are working on homework in an appropriate place that is free from unnecessary distractions and that students’ emotional lives are being appropriately addressed. The students themselves have suggested that parents can monitor the telephone and door during study time; turn off appliances and control the volume of the television, radio and stereo; remove siblings and pets; and request that other
family members keep yelling and crying to a minimum during the study period (Xu & Corno, 2003).

Just as parents do more monitoring of homework in earlier school years, parents also work harder to eliminate distractions during homework time during those years (Cooper, Lindsay & Nye, 2000). As children get older, parents do less monitoring of homework and seem to be less involved in making sure that their children are working distraction free. Parents who are home when their children arrive home from school have been found to be more successful at eliminating distractions (Cooper, Lindsay and Nye, 2000) which provides an extra challenge for families where all the adults are working when children arrive after school.

For the middle school mathematics teacher, it is important to have regular communication with the home. Homework has been described as the connector between home and school (Epstein & Van Voorhis, 2001). Epstein and Van Voorhis (2001) suggest that parents do want to help their children. Teachers then need to teach parents how to help appropriately. Newsletters have been the traditional and effective way for mathematics teachers to communicate with parents (Peressini, 1998). Positive results have also been associated with back-to-school nights and parent-child activities to be completed at home (Peressini, 1998). Billig (2002) suggests that parental involvement decreases all through the school years, particularly as students enter the middle school years and that
parents want and need guidance from the school as to how to help their children. With this in mind, it is especially important for middle school mathematics teachers to reach out to parents, providing useful information about the mathematics curriculum and suggestions about how parents can help their children be successful mathematics students.

How a parent chooses to help their child with homework will depend on several things: child rearing values and learning assumptions, parental understanding of the purpose and goal of the homework, knowledge of strategies to support student learning, and responses to specific information from teachers or children about homework (Hoover-Dempsey, et al., 2001). It is clear from the reasons listed that teachers play an important role in how parents decide to help their children with homework, and ultimately with the success of the homework.

CONCLUSION

The study of homework and parents in the middle school classroom is not an easy one. While there is a large collection of research on the subject, each piece must be carefully reviewed for the context of the particular study. Homework and parenting both involve a complex assortment of variables, making clear quantitative research on the subject difficult at best. Much of the literature reviewed for this paper failed to establish a clear causal relationship between homework and specific types of parental involvement and academic achievement in the middle school mathematics classroom. The research frequently pointed out
the chicken versus egg type of debate about many of the issues studied here. Nonetheless, absent any future specific causal relationship information, the middle school mathematics teacher can feel comfortable giving homework to students and directing parents to participate in an appropriate role in the homework process. It is imperative that a teacher recognize that the success or failure of any homework program will depend largely on how the program is implemented and communicated to parents and students. Middle school mathematics teachers must be very deliberate in their homework process to achieve the maximum benefit from homework. Keeping the mathematics theme in mind, the results can be summed up in the following equation.

\[
\text{Student} + \text{Teacher} + \text{Parents} = \text{Increased Homework Time and Effective Involvement Completion}
\]

\[
\text{Care to Assignments} \quad \text{Focusing on and Higher}
\]

\[
\text{Complete With Reasonable Autonomy Mathematics}
\]

\[
\text{Opportunity for Support with Achievement}
\]

\[
\text{All Students to Appropriate Amounts of Direct Involvement}
\]

\[
\text{Be Successful Amounts of Direct Involvement And Structure}
\]
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