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ABSTRACT

This quasi-experimental study investigated the effects of teachers' use of interactive and non-interactive science homework assignments on family involvement in student homework, homework completion and accuracy, student science achievement, and student and parent attitudes about science homework. Two hundred and fifty-three students from ten classes of sixth and eighth grade students participated in this study that lasted eighteen weeks during the school year. Six classes of students completed Teachers Involve Parents in Schoolwork (TIPS) interactive assignments, and four classes completed non-interactive assignments (ATIPS). TIPS students received instructions to involve a parent or other family partner in certain sections of the homework assignment while ATIPS students received the same assignment with no instruction for family involvement. Results indicated that TIPS students more often involved parents in their science homework assignments than did ATIPS students; however, TIPS science students reported no more parental or family involvement in homework than ATIPS students where teachers did not assign interactive homework. The results of this study indicate the benefits of well-designed interactive homework for students in terms of levels of family involvement in homework, science attitudes, and science achievement. Appended are: Sample 8th Grade Geology TIPS Activity parent and student handouts. Contains 36 references, 5 tables, and 2 figures. (SAH)

Teachers' Use of Interactive Homework and Its Effects on Family Involvement and Science Achievement of Middle Grade Students

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Abstract

This quasi-experimental study investigated the effects of teachers' use of interactive and non-interactive science homework assignments on family involvement in student homework, homework completion and accuracy, student science achievement, and student and parent attitudes about science homework. Two hundred and fifty-three students from 10 classes of sixth and eighth grade students participated in the study that lasted 18 weeks of the school year. Six classes of students completed TIPS (Teachers Involve Parents in Schoolwork) interactive assignments, and four classes completed non-interactive assignments. TIPS students received instructions to involve a parent or other family partner in certain sections of the homework assignment while ATIPS students received the same assignment with no instruction for family involvement.

Results indicated that TIPS students more often involved parents in their science homework assignments than did ATIPS students. However, TIPS science students reported no more parental or family involvement in homework than ATIPS students in subjects where teachers did not assign interactive homework. TIPS students did not differ from ATIPS students in accuracy or the percent of homework returned. Students who rated the homework more positively and who regularly involved their families returned more homework assignments than students who did not do so. In terms of science achievement, TIPS students did earn significantly higher science report card grades than ATIPS students after controlling for background variables, teacher effects, and percent of homework returned. The results of the study indicate the benefits of well-designed interactive homework for students in terms of levels of family involvement in homework, science attitudes, and science achievement.

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Teachers' Use of Interactive Homework and Its Effects on Family Involvement and Science Achievement of Middle Grade Students

Homework is an everyday part of school life. Studies show that middle and high school students who spend more time on homework and complete their assignments tend to earn higher grades or achievement scores (Cooper, 1989; Cooper, Lindsay, Nye, & Greathouse, 1997; Epstein, Simon, & Salinas, 1997; Keith, 1982; Keith et al., 1993; Kelley & Kahle, 1995; Muhlenbruck, Cooper, Nye, & Lindsay, 2000; Paschal, Weinstein, & Walberg, 1984; Van Voorhis, 2000). Despite the knowledge of the link between homework completion and achievement in secondary education, teachers, parents, and students voice legitimate concerns over current homework practice. For example, many students complain that they are assigned too much homework or "busy" work. Parents report that they want to help their children with homework, but feel unprepared to do so and need more guidance from the school. Teachers say that many students do not complete homework and that they need more instruction and encouragement in developing high quality homework assignments

Though some writers suggest the possibility of ending the practice of homework (Kralovec & Buell, 2000), the fact remains that most U.S. schools and school districts have guidelines requiring students to complete homework. Therefore, more research and information is needed to remedy some of the homework problems expressed by students, parents, and teachers. In addressing possible solutions to difficulties in homework, it is helpful to review various questions about the process including who, what, when, where, why, and how much.

What Is Homework? Where Is It Completed?

Homework may be defined as work that teachers assign to students to be completed at home or during non-school hours (Cooper, 1989). Though homework is completed by students at

different times, research does suggest that homework is most effective in promoting secondary students' achievement when it is completed *at home* rather than *in school* (Keith, 1998).

Who Is Involved?

Teachers are responsible for designing and assigning homework. Students are responsible for completing homework, and parents, other family partners, and peers may be encouraged to be part of the process depending on the type of homework assignment (Corno, 2000). Teachers, therefore, play key roles in designing homework and in giving students instructions to complete the assignment and whether and how to involve family or other learning partners (Epstein, in press; Epstein & Van Voorhis, in press).

When is Homework Due?

Most homework is assigned one day and due back the next. Students are given more time to complete long-term projects or reports that may require research or work with others. Again, it is the teacher's responsibility to determine reasonable timetables for assignments depending on the purpose(s) of the homework assignment.

Why Is Homework Assigned?

Teachers and researchers have identified 10 general purposes for homework that help teachers clarify their goals for each assignment: *practice, preparation, participation, personal development, peer interactions, parent-child relations, parent-teacher communications, policy, public relations, and punishment* (not a valid purpose) (Epstein, 1988, in press; Epstein & Van Voorhis, in press). One homework assignment may address more than one purpose, but teachers should identify the goals of each assignment so that the purpose(s) are clear to students.

How Much Homework Should Students Complete?

Researchers have investigated the relationship between time on homework and achievement (Cooper, 1989; Keith, 1982; Keith & Cool, 1992; Paschal et al., 1984; Walberg, Fraser, & Welch, 1986). Age of student moderates these correlational relationships (Cooper, 1989). In the elementary grades, many studies show that increasing time spent on homework correlates with lower school grades and achievement, a negative relationship. In contrast, by the middle grades and high school, this relationship becomes positive such that more time spent on homework relates to higher grades and achievement. In fact, Keith's (1982) results indicate that a low-ability high school student completing one to three hours of homework weekly could theoretically achieve grades commensurate with an average student who fails to complete homework (p. 251).

However, these correlational relationships fail to tell us what causes the relationship between time on homework and achievement to be negative in the elementary grades and to be positive in the high school grades. The explanations offered for these patterns relate to the different types of assignments assigned to elementary and secondary students and the characteristics of students completing or not completing the assignments (Epstein & Van Voorhis, in press; Muhlenbruck et al., 2000).

TIPS Interactive Homework

Although a lot of attention has been given to how many minutes or hours of homework students should have, researchers and educators are beginning to focus on the deeper questions of the homework process including the content and design of assignments. Epstein and her colleagues have conducted research on how to improve the quality of homework assignments and to focus on teachers' roles in the process (Epstein & Van Voorhis, in press).

Key findings from Epstein's research and work with educators led to the development of an interactive homework process called Teachers Involve Parents in Schoolwork (TIPS) (Epstein, Salinas, & Jackson, 1995; Epstein, Van Voorhis, & Salinas, 2000). One important finding was the fact that teachers' efforts to involve parents in particular learning activities at home related to achievement gains in those subjects. Epstein (1991) found that teachers' efforts to involve parents in learning activities at home (namely reading activities) contributed independently to positive changes in reading achievement of elementary students from fall to spring, even after teacher quality, students' initial achievement, parents' education level, and quality of students' homework was included.

Other research findings highlight the desire of parents to better informed on how to support children's learning at home. Studies of elementary parents indicated that parents desire more information from the school to help their children at home (Epstein, 1984); parents report having time on weekends to assist their children with learning activities, and parents at both elementary and middle levels report that they could help their children more if their teacher guided them in how to help (Dauber & Epstein, 1993). In summary, these research studies emphasize the need for teachers to take the lead in providing information to parents so that parents may be more effective partners in the learning process.

The TIPS Interactive Homework process is designed for students in the elementary, middle, and high school grades. The process recognizes the shared responsibilities of schools and families in the education of children (Eccles & Harold, 1996; Epstein, 1987, 1995). Epstein's theory of overlapping spheres of influence refers to the dynamic and developmental relationships between schools and families that can be pushed together or pulled apart by practices and interpersonal forces. This model of overlapping spheres of influence does not

presuppose that all responsibilities of families and schools overlap, but it does assume that there are some shared goals for students between the two institutions (Epstein, 1987, 1995).

TIPS Interactive Homework assignments differ from traditional homework in that they guide students to conduct interactions with family partners (parents, guardians, other older relatives, neighbors, etc.). TIPS activities are assigned no more than weekly or twice a month, and students are given several days to complete the work. Certain sections of the activity include written instructions to prompt students to involve family partners in conversations or experiments. Parents provide feedback to teachers about how effective and enjoyable the activity was in the home-to-school communication section (Epstein, Salinas, & Jackson, 1995).

Research on TIPS Interactive Homework

Two scientific investigations of TIPS math and language arts have been conducted. One study of TIPS writing with sixth and eighth grade students in an inner city public middle school indicated that the number of TIPS assignments completed positively related to students' language arts grades (Epstein, Simon, & Salinas, 1997). Also, parent participation on TIPS assignments positively influenced the overall quality of student's writing skills.

Balli conducted an experimental, non-developmental investigation of sixth grade students' use of math homework (1995; Balli, Demo, & Wedman, 1998). One class used the TIPS assignments as designed with prompts for involvement for both student and family; another class received only student prompts for family involvement, and the third class received the same assignment content without student or family prompts for family involvement. Parents reported liking the TIPS design and were most involved when students were assigned TIPS homework. Unlike the writing study, there were no significant differences in math achievement by group, in

part because only one teacher's classes were involved, and all three classes made progress in math.

The present study of TIPS Science (Van Voorhis, 2000) extended homework research in five important ways. This study 1) implemented a quasi-experimental design assigning students to a non-interactive (ATIPS) homework condition or to an interactive (TIPS) condition; 2) looked at the effects developmentally (sixth and eighth grade students); 3) examined results for students at different ability levels and on different teachers' classrooms; 4) collected various science achievement, family involvement, homework completion, and science attitude measures, and 5) examined a new homework subject area, science. Few studies of homework include such extensive measures from several teachers and hundreds of students and parents.

Methods

Sample

The study was conducted with educators at Pikesville Middle School (grades 6-8) in Baltimore County, Maryland. Two sixth and two eighth grade teachers conducted the homework intervention over the course of the first two marking periods (18 weeks) of the 1999-2000 school year. A subsample of these teachers' classes was selected for the study, including three classes from each sixth grade teacher and two classes from each eighth grade teacher, for a total of 253 students, as shown in Table 1. Fifty-three percent of the students were white, 36% were African-American, and the other 11% were multi-racial, Asian American, Hispanic, and Russian students. Students were in low, average, and honors classes in sixth grade, and average and honors classes in eighth grade. Six classes were assigned TIPS homework, and four classes were assigned ATIPS assignments.

Due to an experimental error, both honors-ability classes were assigned TIPS and both average-ability classes were assigned ATIPS. Because it was not possible to change a TIPS to

an ATIPS class, the author collected data from two additional low-ability classes assigned TIPS. Ideally, one average and one honors class would have been assigned to each condition, as was the case in the eighth grade sample of students.

Materials

Interactive assignments. During the summer of 1999, the author worked with sixth and eighth grade teachers to develop TIPS science assignments for the first two marking periods of the science curriculum. Teachers chose topics for weekly assignments based on curriculum objectives, and designed two test questions for each assignment.

All TIPS science activities include eight important components (Epstein et al., 1995). The *letter to parent, guardian, or family partner* briefly explains in one sentence the topic and skill of the assignment. The student writes in the due date and signs the letter. The *objective(s)* explain the learning goal(s) of the activity. *Materials* are common, inexpensive, and easily available at home, or the school provides the materials. The *procedure* guides the student, step by step, in a hands-on activity that requires the student to think and act like a scientist, and to interact with a family partner. Findings are reported in the space called *lab report or data chart. Conclusions/Discussions* guide the student to discuss results and real-world applications of science with a family partner. Two-way forms of communication (Epstein, 1995) are encouraged in the home-to-school communication section that invites the family partner to send an observation, comment, or question to the teacher about the skill demonstrated and the homework experience. Finally, a *parent/guardian signature* is requested on each activity. See Appendix A for a sample TIPS activity used in grade 8.

Each TIPS activity was linked to the curriculum in a meaningful way, interactive, the student's responsibility, easy to read and understand, attractive, and designed for two sides of

one page. Teachers also assigned point values to each homework question in the design phase of the assignments and typed these point values next to each question. Each activity totaled 10 points, but no points were assigned for the home-to-school communication section.

Non-interactive assignments. From the TIPS activities, the author produced a set of "altered," non-interactive, activities for the study. The ATIPS activities included the same homework content as the TIPS assignments and same distribution of points, but they included no prompts for the student or family regarding involvement. There were no letters to the parent, home-to-school communications, or questions encouraging students to involve family partners in their experiments or discussions. See Appendix B for a sample ATIPS activity.

Procedure

Each participating student's family received a letter at the beginning of the school year describing either the interactive or non-interactive homework assignments. Both letters included information on the weekly use of the "green sheets." Only the interactive (TIPS) letter stressed the importance of students involving family partners in sections of the assignment.

Each teacher assigned a TIPS or ATIPS activity weekly over the course of the study, graded the activities weekly on a 10-point scale, and included homework-related questions on student examinations. At the end of the second marking period, teachers asked students to complete a brief, in-class survey of their perceptions of family involvement in their TIPS or ATIPS science homework assignments, homework in other subjects, and general opinions about homework, school, and science. Parents also received a survey of their opinions of the science homework.

Data

Data for this study came from 4 sources: prior science grades, homework assignments, science exams, and surveys. The author recorded data weekly from the homework assignments

(TIPS and ATIPS), including whether or not the assignment was turned in, how many points the student earned on each assignment (maximum number of points for each assignment was 10), and whether all questions were answered. Teachers also provided the author with previous science report card grades. The survey included questions for students and parents about family involvement in science homework and other subjects, time on homework, opinions of science homework, and attitudes about science and school.

Research Questions and Results

This study addressed five main research questions. The first two questions related to the effect of science homework condition (TIPS and ATIPS) on family involvement in science homework and homework in other subject areas. Other research questions asked about the effects of interactive and non-interactive homework on homework completion, homework accuracy, and science achievement. Finally, student and parent attitudes about the science homework assignments were assessed as part of the survey analyses.

Family Involvement

Question 1: What was the relationship between homework condition (TIPS and ATIPS) and student reports of family involvement with science homework?

It was hypothesized that students assigned TIPS would report higher levels of family involvement in science homework as they had instructions to do so. Two hundred and twenty-six students in the sample (89%) completed the survey questions about family involvement in homework. The white bars in Figure 1 represent ATIPS student reports ($n = 98$), and the black bars represent students in the TIPS condition ($n = 128$). Over 80% of students in the ATIPS condition said their families were never, rarely, or sometimes involved in the science homework

assignments over the 18-week study period. In contrast, 80% of TIPS students said their families were sometimes, frequently or always involved in science homework assignments.

Also of interest is with whom students reported working on science homework. Seventy-four percent (74%) of students reported working with their mothers on at least one of the science assignments (167/226). Forty-seven percent (47%) of students who completed the survey said their fathers were involved in at least one assignment; 18% of students reported help from a sister, and 16% said a brother helped at least once. Twenty-seven percent of students said they received homework help from a relative other than immediate family or a friend. These relatives and friends included cousins, grandparents, neighbors, aunts, uncles, and others. Students also described who helped with science homework most frequently.

Parent reports of involvement followed the same pattern as the student reports with most TIPS parents marking sometimes, frequently, or always involved, while most ATIPS parents marked never, rarely, or sometimes involved in science homework. A positive and significant correlation ($r = .669$, $p < .001$, $n = 177$) exists between parent and student reports of family involvement in science homework. Because the student survey return rate (89%) exceeded the parent return rate (71%), and the patterns of student and parent were similar, student reports of family involvement served as the dependent measure for family involvement in science homework.

Ordinary least squares (OLS) regression analyses calculated the effects of various background measures and homework condition on family involvement in science homework. Table 2 displays the results of the regression analyses.

To control for variations in the TIPS and ATIPS groups, previous science achievement, mother education level, class ability grouping, race, gender, and grade served as the background

control variables. The first model includes those variables and explains only 6% of the variance in family involvement levels in science homework. Honors students reported significantly higher family involvement levels in model 1 than did average students, and sixth graders reported significantly higher levels of involvement than did eighth graders. Sixth grade students reported a mean level of involvement of 2.37 on a 0-4 scale, while eighth grade students reported a mean level of 1.73.

Model 2 adds the effect of homework condition to the previous model and accounts for 19% of the variance in student reported levels of family involvement in science homework. Condition is the most predictive variable in the model such that TIPS students reported significantly higher levels of family involvement in science homework than did those in ATIPS classes ($\beta = .451$; $p < .001$). Again, sixth grade students reported more involvement of families in science homework than did eighth grade students, but classroom ability grouping failed to explain a significant portion of the variance when condition was added to the model. Previous achievement failed to predict variation in levels of family involvement.

Question 2: What was the relationship between science homework condition (TIPS and ATIPS) and student reports of family involvement in science and in other subjects not using TIPS assignments (i.e., math and language arts)?

One might wonder whether students in the TIPS condition had families who were already more involved in student homework than the families of ATIPS students, or if involvement in science homework generalized to other subject areas. The second research question examined levels of family involvement of the TIPS/ATIPS science grouping across subjects where TIPS/ATIPS assignments were not used.

Figure 2 displays the family involvement means by school subject for the TIPS and ATIPS science homework conditions. According to the graph, the mean for TIPS family involvement

levels in science (M = 2.55) exceeds the ATIPS mean (M = 1.43). The math and language arts family involvement levels do not dramatically differ by science condition. OLS regression models like the one for science (Table 2) were run for math and language arts. None of the variables in the model significantly predicted variation in family involvement levels in math or language arts homework. Therefore, one cannot conclude that the higher levels of family involvement in science were due to the fact that the TIPS families were more involved in homework generally, regardless of prompts from teachers.

Homework Completion and Accuracy

Question 3: Were there differences in the homework accuracy and return rates of students in the TIPS and ATIPS science conditions?

The third research question involved the investigation of differences in the homework accuracy and return rates of students in the TIPS and ATIPS conditions. Because the homework groups differed in terms of classroom ability grouping and previous science achievement, it was necessary to control for these differences to assess the true effects of the TIPS intervention on homework completion and accuracy. The models for homework completion and accuracy revealed similar patterns of results, but only the accuracy OLS model is presented here.

Table 3 displays four regression models for average accuracy of 18 assignments. Model 1 includes background variables and teacher effects and accounts for 33% of the variation in homework accuracy. Controlling for differences in student's previous science grades, classroom ability grouping, parent education levels, race, gender, and grade level, results revealed no significant differences in homework accuracy or homework return rates of TIPS and ATIPS students.

There were, however, teacher differences. Teacher B's students earned significantly fewer average homework points than Teacher A. Level of family involvement was a significant

predictor of students turning in and completing more accurate assignments, and students who more regularly involved family partners in the science homework assignments earned more points and turned in more assignments than students who involved family partners less regularly. Also worthy of note is the fact that students who reported liking the homework assignments returned and completed more accurate homework assignments.

Science Report Card Grades

Question 4: What were the predictors of higher report card grades in science?

The fourth research question examined the predictors of higher report card grades in science. Model 1 in Table 4 accounts for 51% of the variation in report card grades. Higher previous science achievement related to higher report card grades in science. Students with mothers having high school or some college education had lower report card grades than students with mothers having a college degree. Race of student predicted a significant portion of the variance with black students earning lower report card grades than white students in the study. Male students earned significantly higher report card grades than females, and grades differed by teacher. Student reported levels of family involvement in science failed to predict a significant portion of the variation in report card grades for the entire sample.

Another important science achievement research question asked how the percent of assignments returned related to science achievement. Model 2 demonstrates that students who completed more of the science homework assignments earned higher report card grades (β = .461, $p < .001$). This finding supports the fact that both the ATIPS and TIPS assignments had clear purposes and objectives and both represented high quality homework assignments that, when completed, should relate to higher report card grades. Studies of middle school homework

completion and achievement confirm this result and demonstrate the positive relation between the two (Cooper et al., 1998; Keith et al., 1993).

After controlling for the background variables and percent of homework assignment returned, students in TIPS classes still earned higher report card grades than students in ATIPS. This finding is significant because it suggests the importance of not only completing homework, but also completing specifically the TIPS interactive homework.

Student and Family Opinions of Homework

Question 5: What were student and family member's attitudes about homework?

All students in the study reported high educational expectations: 98% of students completing the survey said they wanted to complete high school, and 90% said they wanted to go on to college. Students and families reported the time students spent on the science assignments. Eighty-nine percent of the parents surveyed in both conditions reported that their children spent 45 minutes or less on each science homework assignment. Student estimates were lower with over 80% of students in both groups reporting that they spent 30 minutes or less on each science homework assignment.

Opinions of the TIPS/ATIPS assignments. Table 5 highlights some of the opinion findings from the matched group of parent and students (N=177, 70% of full sample) who returned surveys. Both the ATIPS and TIPS assignments were printed on green paper each week and teachers referred to homework assignments in both groups as "green sheets." Therefore, rather than referring to the homework assignments as ATIPS and TIPS assignments, the generic "green sheet" label was used on the surveys. The table reports the percentage of students or parents who checked either "agree a little" or "agree a lot" with the statement. The remaining percentage either disagreed "a little" or "a lot" with the statements shown.

Students and parents were very positive about the TIPS and ATIPS assignments. Over 75% of students in both groups reported that the green sheets were a good idea and wanted it to continue in the future. Certain questions referred to the *parent-child interactions* specific to TIPS assignments. Worthy of note is the fact that TIPS students and parents reported agreeing with these statements more frequently than did ATIPS students and parents. Sixteen percent more TIPS students than ATIPS students reported that their family partners liked working on the green sheets. Also, 13% more TIPS than ATIPS students agreed that they were able to talk about science work with a family partner. More TIPS than ATIPS parents also reported that their children worked as hard as they could in science.

Some students and parents in both groups asked that they receive more information from the school about the assignments. Varied communications home to help explain the TIPS process are needed.

Overall, the TIPS process and newly designed homework assignments for all students (TIPS and ATIPS) were well received. Homework requires work and time on the part of students and families. No one solution will address all challenges homework poses to students and their families. The results of this TIPS science homework intervention are promising, but future study is needed to confirm and build upon these findings.

Discussion

Researchers and educators have paid insufficient attention to the role of homework in education. Even less attention is devoted to homework design that encourages family interaction. Many teachers report that there are no formal structures to assist them with homework procedures, and very little information on the topic is provided in teacher education programs (Jenson, Sheridan, Olympia, & Andrews, 1994; Murphy & Decker, 1990;

Royochoudhury & Kahle, 1999; Zentall & Goldstein, 1999). This discussion highlights the major findings and limitations of this study, and summarizes strategies for brightening the future of homework.

Major Findings

TIPS encouraged more family involvement. The TIPS intervention was successful in promoting higher levels of family involvement in science homework than the ATIPS condition. As noted by one TIPS student: "I think these sheets (TIPS assignments) were a very good idea because they help my family partner know what I'm doing."

This result supports findings from Balli's (1995) experimental study of middle grade students using TIPS math. The higher level of family involvement in science, however, did not carry over to other subject areas such as language arts and math (subjects not utilizing the TIPS design). Thus, this alerts researchers and educators to the importance of implementing subject-specific involvement strategies to increase subject-specific results (Epstein, 1991).

The TIPS design provided students with activities to involve family partners and instructions for guiding interactions so that parents do not need to figure how they may be involved in their children's homework in appropriate ways. Several parents commented on the survey about their appreciation of the TIPS assignments: "They (TIPS) are a great way for us to work together and keep informed of what is going on at school."

Family involvement related to homework completion. The results failed to demonstrate significant differences by condition in homework completion or accuracy. This may have occurred because both groups' assignments contained high quality, identical content and questions, except for guided family involvement. All students had incentives for completing the

assignments, and condition (TIPS vs. ATIPS) did not explain whether students completed their homework assignments.

Although there were no differences in homework return rates between TIPS and ATIPS students, more regular family involvement and more positive student opinions of science homework did relate to more average points earned per homework assignment. These findings point to important interrelations among student science attitudes, homework completion, and family involvement.

TIPS students earned higher report card grades than ATIPS students. After controlling for student background characteristics including prior report card grade in science, teacher effects, and percent of homework completed, TIPS students earned significantly higher science report card grades than ATIPS students. This finding suggests a positive relationship between the TIPS interactive homework and student success in school. It is also encouraging because the study period lasted only 18 weeks, and a significant achievement effect emerged by condition. Future research should examine the possibility of cumulative effects of such interventions over several grades in school.

Less clear are the specific aspects of TIPS that relate to higher achievement. Because there were no significant differences in homework return rates or accuracy of TIPS and ATIPS students, it is not possible to conclude that the science achievement difference by condition was due to TIPS students completing more or more accurate homework assignments. Also, the regression analyses do not suggest that the TIPS advantage is due to the higher levels of involvement of the TIPS students' families. Deeper investigations of the TIPS process at home and its effects on other variables like school attendance, student perceptions of their teachers and

science in general, and ratings of home interactions may elucidate the processes of TIPS that contributed to higher science grades.

Limitations

Need for standardized achievement scores. This study was limited as standardized achievement tests in science were not available at the end of the study period. These scores are important as they are not influenced by individual teacher bias. Having these scores would permit researchers to determine whether TIPS students also experienced achievement gains as measured by standardized tests.

Lack of teacher implementation measures. Another limitation relates to the lack of specific measures of teacher implementation, namely homework introduction and follow-up. Though the author instructed the teachers to keep introduction and follow-up of homework consistent in terms of *time* across condition, teachers varied in *how* that time was utilized. Introduction of the homework might include explaining the various questions and materials needed for the assignment, and for TIPS students only, pointing out the sections requiring family interaction. Follow-up includes grading and teacher comments, review of homework answers in class, and talking with students and families about the importance of family involvement if home-to-school communications were not completed. Future studies should address these issues of the homework process.

Lack of measures for the quality of homework interaction. Another area of future study represents more detailed investigation of the use of TIPS assignments in the home. The matched parent and student survey questions permitted exploratory analyses of the student/parent interaction in both conditions. Though parents and students reported liking the homework, no survey questions specifically addressed the content of or emotions about working together on

homework. Future studies of family interaction on homework assignments should examine the findings from the few studies that have addressed the circumstances in which adolescents do homework, who is involved, and how these factors relate to achievement (Leone & Richards, 1989; McDermott, Goldman, & Varenne, 1984; Patton, Stinard, & Routh, 1983).

Lack of homework adaptation by class ability grouping. An important note to both researchers and educators relates to adaptation of the homework assignments to match the ability levels of students. In this study, all students completed the same homework assignments for the purpose of keeping content of assignments constant for all students in both conditions. In practice, teachers should adapt homework assignments according to the ability levels of the students by either deleting some of the more challenging questions, providing more clues to an answer, or adding more challenging questions to promote critical thinking. Homework that is too challenging or too easy can frustrate or bore students rather than encourage learning and interest in a topic (Corno, 2000).

The Future of Homework

Numerous popular press books have been written to help parents survive the years of homework their children bring home. The titles indicate the frustration of both parents and students: 99 Ways to Get Your Kids to Do Their Homework (And Not Hate It), How to Do Homework Without Throwing Up, Ending the Homework Hassle : Understanding, Preventing, and Solving School Performance Problems, and Homework Without Tears : A Parent's Guide for Motivating Children to Do Homework and to Succeed in School .

Homework should never be assigned for the sake of homework. By identifying the purpose(s) of the assignment, teachers can then answer the who, what, when, where, why, and how much questions related to the homework process.

Results of this study show that well-designed TIPS homework assignments in science can help students practice skills, prepare for the next class, participate in learning activities, develop personal responsibility for homework, promote parent-child relations, develop parent-teacher communication, and fulfill policy directives from administrators. Survey reports from students indicated that students liked both the ATIPS and TIPS homework assignments, rated them better than standard homework, and suggested that they be used next year in school. Hundreds of prototype TIPS activities in various subjects for middle and elementary grade students are available to teachers to use and adapt to their classroom objectives (Center on School, Family, and Community Partnerships, Baltimore, MD). In fact, researchers at Johns Hopkins are currently conducting TIPS trainings and developing TIPS resources that are available to educators nationwide (ASCD, 2001; Epstein et al., 2000).

Though the results of the TIPS program in science are positive, teachers should not abandon other types of homework. Again, homework designs serve different purposes, and independent homework still holds a place on the educational agenda. Boredom and frustration can be avoided when teachers utilize a variety of homework designs with clearly defined and different purposes.

Much of school homework today is monotonous, pointless, discouraging to students, and disruptive of family time. Professional development time must be allocated for teachers to learn about the importance of homework, to share ideas about science, and to develop meaningful homework assignments that match the creativity found in their classrooms. TIPS homework is one tool for teachers to develop students' skills and to inform parents of what is going on in the classroom.

Now is the time to shift the emphasis from *homework time* to *homework quality and design.* As noted by one parent, " I think TIPS is great 3-way communication between teacher, parent,

and student." Homework is here to stay, but brightening the future of homework will require a concerted effort on the part of teachers to reevaluate its varied purposes and design, to emphasize its importance to students, and to communicate with parents about their roles in the process. There is no panacea for the current homework challenges, but TIPS represents one strategy for providing more parents the opportunity to be involved in their children's education.

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Table 1

Students in the Science Homework Study

	TIPS Interactive Homework		ATIPS Non- Interactive Homework	
	6th grade	8th grade	6th grade	8th grade
Low-ability students	36 (2 classes)			
Average-ability students		23 (1 class)	53 (2 classes)	22 (1 class)
Honors students	54 (2 classes)	33 (1 class)		32 (1 class)
Total students by grade and homework group	90 (36%) (4 classes)	56 (22%) (2 classes)	53 (21%) (2 classes)	54 (21%) (2 classes)
Total students by homework group	146 students (6 classes)		107 students (4 classes)	
Total	253 students (10 classes)			

Table 2

Predictors of Student Reported Levels of Family Involvement in Science Homework (N = 226)

Variable	Model 1 β	Model 1 t	Model 2 β	Model 2 t
Prior science achievement	.01	0.08	.02	0.29
Mother education level (reference- college graduate)				
High school	.09	1.14	.07	0.95
Some college	.03	0.32	-.02	-0.21
Graduate school	.01	0.16	.00	0.03
Class ability grouping (reference- Average)				
Low	.09	1.12	- .15	-1.68
Honors	.26	2.90**	.01	0.05
Race (reference- White)				
Black	- .00	- 0.02	- .03	-0.35
Other	.09	1.10	.05	0.68
Gender (Male = 1, Female = 0)	.01	0.08	.03	0.36
Grade (Grade 6 = 1, Grade 8 = 0)	.25	2.94**	.21	2.68**
Condition (TIPS = 1, ATIPS = 0)			.45	5.40**
R^2/Adjusted R^2	.11/.06		.24/.19	

Note. $\Delta R^2 = .129$ for Model 2 ($p < .01$). *$p < .05$. **$p < .01$.

Table 3

Predictors of Average Accuracy of 18 Science Homework Assignments (N = 233)

Variable	Model 1 β	Model 1 t	Model 2 β	Model 2 t	Model 3 β	Model 3 t	Model 4 β	Model 4 t
Prior science achievement	.32	4.03**	.33	4.14**	.33	4.24**	.33	4.34**
Mother education level (reference- College graduate)								
High school	-.13	–1.79	-.13	–1.84	-.15	–2.12*	-.12	–1.70
Some college	-.10	-1.36	-.11	-1.45	-.11	–1.47	-.11	–1.49
Graduate school	.01	0.14	.01	0.12	-.01	0.12	.02	0.34
Class ability grouping (reference- Average)								
Low	-.16	-2.27*	-.20	-2.36*	-.17	–2.05*	-.15	-1.89
Honors	-.03	-0.43	-.07	-0.79	-.08	– 0.88	-.08	-0.88
Race (reference- White)								
Black	-.18	-2.54*	-.19	-2.59*	-.19	–2.57*	-.18	–2.50*
Other	-.08	-1.15	-.08	-1.24	-.10	–1.46	-.10	-1.62
Gender (Male = 1, Female = 0)	-.09	-1.36	-.08	-1.31	-.09	–1.42	-.10	-1.57
Teacher (reference- Teacher A)								
Teacher B (6)	-.37	–4.74**	-.37	-4.76**	-.36	–4.80**	-.31	-4.17**
Teacher C (8)	-.15	-1.74	-.14	-1.57	-.08	–0.97	-.05	-0.59
Teacher D (8)	-.09	-1.10	-.09	-1.13	-.06	–0.76	.03	0.41
Condition (TIPS = 1, ATIPS = 0)			.06	.81	-.03	-0.31	.01	0.07
Student report of family involvement					.21	3.00**	.16	2.24*
Student opinion of science homework							.21	3.19**
R^2/Adjusted R^2	.38/.33		.38/.33		.41/.36		.45/.39	

Note. $\Delta R^2 = .003$ for Model 2 (p = .652, NS); $\Delta R2 = .033$ for Model 3 (p = .003); $\Delta R^2 = .035$ for Model 4 (p = .002); *p < .05. **p < .01.

Table 4

Predictors of Science Report Card Grades (N = 240)

Variable	Model 1		Model 2		Model 3	
	β	t	β	t	β	t
Prior science achievement	.39	5.72**	.25	4.19**	.26	4.39**
Mother education level (reference- College graduate)						
High school	-.13	-2.18*	-.07	-1.27	-.07	-1.33
Some college	-.17	-2.62**	-.13	-2.36*	-.15	-2.65**
Graduate school	-.03	- 0.45	-.03	-0.50	-.03	-0.57
Class ability grouping (reference- Average)						
Low	-.05	- 0.73	.03	0.47	-.05	-0.80
Honors	-.00	-0.01	.08	1.31	.00	0.06
Race (reference- white)						
Black	-.22	-3.54**	-.18	-3.22**	-.18	-3.40**
Other	-.11	-1.90	-.07	-1.43	-.08	-1.64
Gender (male=1)	-.09	1.65	.13	2.69**	.14	2.89**
Teacher (reference- Teacher A)						
Teacher B (6)	.12	1.85	.37	5.65**	.37	5.75**
Teacher D (8)	-.36	-5.31**	-.29	-4.95**	-.30	-5.18**
Teacher C (8)	-.12	-1.58	-.04	-0.56	-.02	-0.34
Student report of family involvement	.07	1.15	-.01	-0.17	-.06	-1.04
Percent of homework returned			.45	7.75**	.46	8.02**
Condition (TIPS=1)					.15	2.41*
R^2/Adjusted R^2	.54/.51		.67/.64		.68/.65	

Note. $\Delta R^2 = .12$ Model 2 ($p = .00$); $\Delta R^2 = .01$ Model 3 ($p = .02$); *p < .05. **p < .01.

Table 5

Student and Parent Opinions of the Science Homework Assignments

	TIPS Students (n=100)	ATIPS Students (n=77)	TIPS Parents (n=100)	ATIPS Parents (n=77)
Homework Design (All Green Sheets)				
The green sheets are a good idea.	78%	89%	90%	88%
Green sheets are better than regular homework.	77%	80%	-----	-------
Students should use the green sheets next year.	72%	83%	85%	83%
Parent needs more information from the school about the green sheets.	31%	26%	29%	38%
Parent-Child Interactions (TIPS Feature)				
Green sheets help parent see what student is learning in science.	91%	88%	94%	89%
Family partner liked working on the green sheets with student.	76%	60%	88%	81%
Student is able to talk about science work with a family partner.	90%	77%	92%	93%
Student Effort				
The student works as hard as s/he can in science.	92%	88%	83%	73%

Figure 1. Level of family involvement by homework group (N=226).

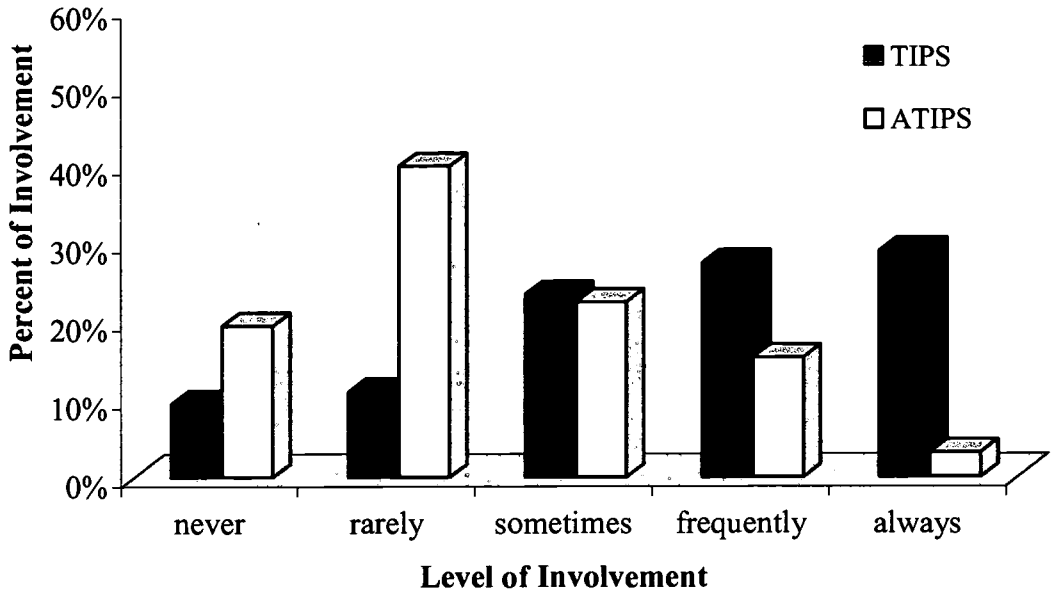
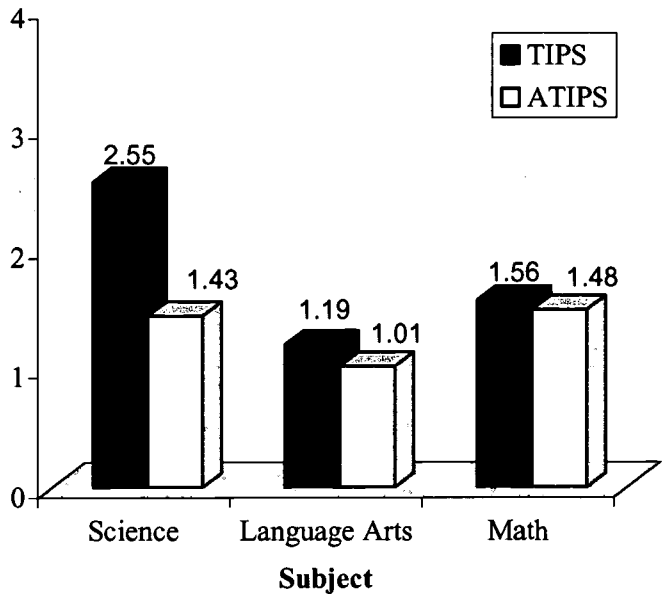


Figure 2. Student reported levels of family involvement in science, math, and language arts (N = 226) by science homework condition (TIPS and ATIPS)



Appendix A. Sample 8th Grade Geology TIPS Activity

Name:_____ Class:_____ Date:_____

Journey Through the Earth's Layers

Dear Parent or Guardian,

We are learning about the internal structure of the earth. This activity will help build science skills in observing, comparing, and evaluating a model. I hope you enjoy this activity with me. This assignment is due _____.

Sincerely,

_____

OBJECTIVE: To identify the four layers of the Earth.

MATERIALS: 1 food item that has layers such as a hard boiled egg, chocolate covered peanut, avocado, apple, or another item that has layers.

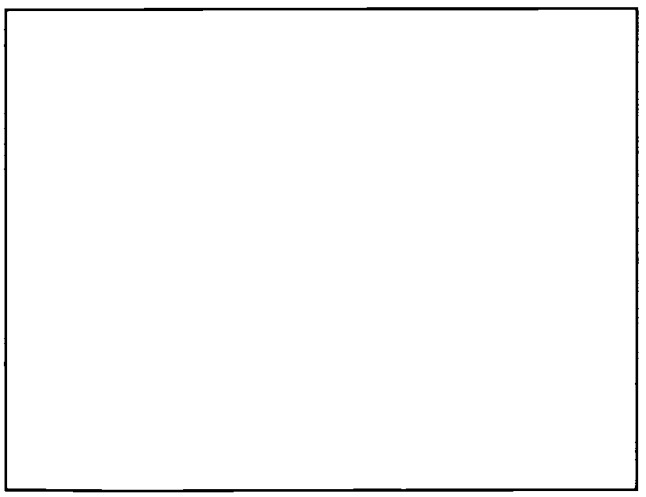
knife to cut the food item in half (STOP: Do not use the knife without your partner.)

PROCEDURE:

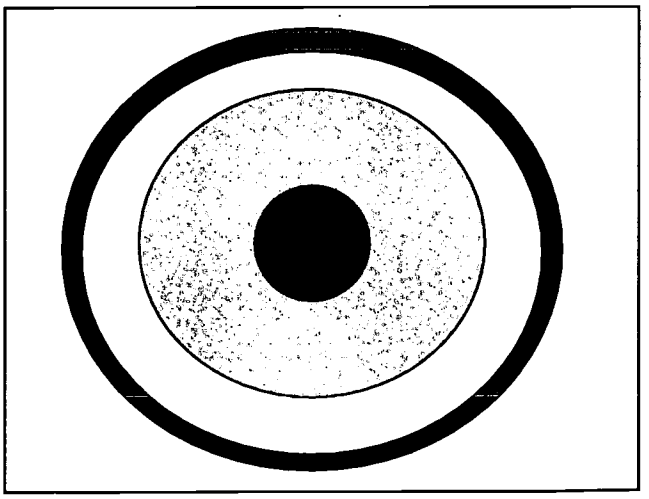
1. Read and explain the following definitions to your family partner.
   Who is your family partner?_____

crust:	thin, outermost layer of earth
mantle:	layer of earth between the crust and outer core
outer core:	liquid layer of earth surrounding the inner core
inner core:	solid, innermost layer of earth

2. With your family partner, carefully cut your food item in half. Draw and label a cross section of your item in **Box A**. Your labels for the food item might include some of the following terms: shell, skin, pit, chocolate covering, yolk, etc. Next, label the diagram of the cross section of the earth in **Box B** with the vocabulary terms from above. **(3 points)**



BOX A



BOX B

DATA CHART

Show your family partner the labels and drawings you worked on in Step 2. Discuss with your partner the similarities and differences between the diagrams in Boxes A and B. You should record the ideas from your discussion in the data chart below. **(2 points)**

Question	My ideas	My family partner's ideas
Similarity of diagram A and B		
Difference of diagram A and B		

CONCLUSIONS:

Write your answers in complete sentences.

1. Why are models/diagrams useful for studying the layers of the earth? **(1 point)**

   _____

2. What is one disadvantage of using a model or diagram to understand the layers of the earth? **(1 point)**

   _____

FAMILY DISCUSSION: (3 points)

The author Jules Verne wrote a book entitled "Journey to the Center of the Earth" about a young man's trip into the earth. Discuss with your family partner whether or not each of you would like to travel to the center of the earth? You record both responses below in complete sentences.

My answer:_____

_____

My family partner's answer:_____

_____

What would you expect the center of the earth to be like?_____

_____

HOME-TO-SCHOOL COMMUNICATION:

Dear Parent or Guardian,

Please give me your reactions to your child's work on this activity.

Write YES or NO for each statement.

_____1. My child understood the homework and was able to discuss it.

_____2. My child and I enjoyed the activity.

_____3. This assignment helped me know what my child is learning in science.

Any other comments: _____

Parent/Guardian Signature:_____

Teachers Involve Parents in Schoolwork (TIPS). (1999). L. Blind, N. Dewberry-Moore, F. Van Voorhis, & J. Epstein. Baltimore, MD: Center on School, Family, and ity Partnerships, Johns Hopkins University.

Appendix B. Sample 8th Grade Geology ATIPS Activity

Name:_____ Class:_____ Date:_____

Journey Through the Earth's Layers

This assignment is due _____.

OBJECTIVE: To identify the four layers of the Earth.

MATERIALS: 1 food item that has layers such as a hard boiled egg, chocolate covered peanut, avocado, apple, or another item that has layers.

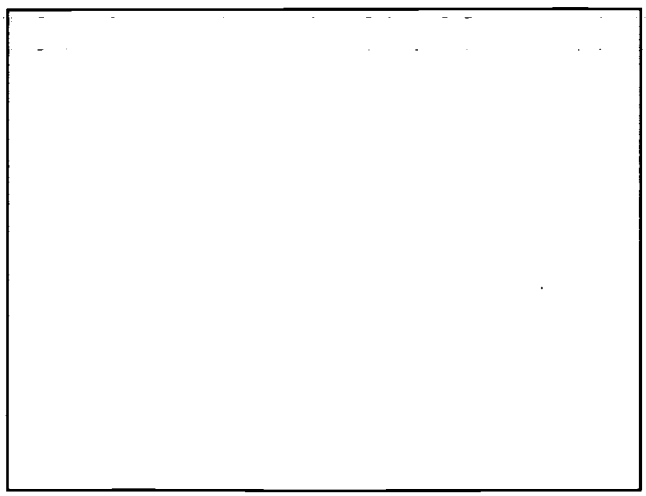
knife to cut the food item in half (**STOP: Be VERY careful when you cut your food item.**)

PROCEDURE:

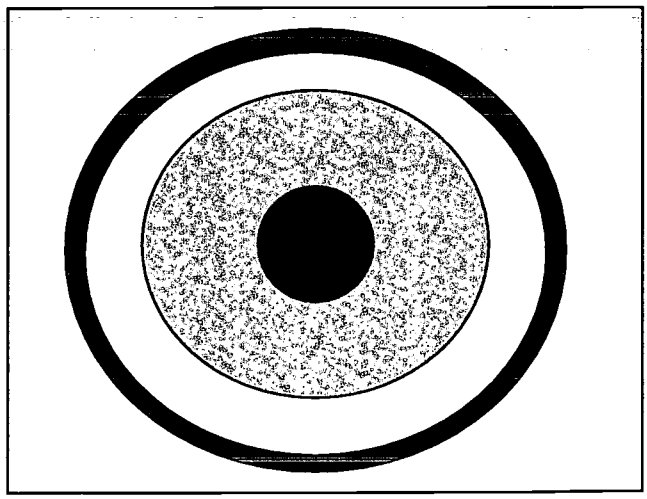
1. Read the following definitions.

crust:	thin, outermost layer of earth
mantle:	layer of earth between the crust and outer core
outer core:	liquid layer of earth surrounding the inner core
inner core:	solid, innermost layer of earth

2. Carefully cut your food item in half. Draw and label a cross section of your item in **Box A**. Your labels for the food item might include some of the following terms: shell, skin, pit, chocolate covering, yolk, etc. Next, label the diagram of the cross section of the earth in **Box B** with the vocabulary terms from above. **(3 points)**



BOX A



BOX B

DATA CHART

Look at the labels and drawings you worked on in Step 2. Think about the similarities and differences between the diagrams in Boxes A and B. You should record the ideas from your discussion in the data chart below. **(2 points)**

Question	My ideas
Similarity of diagram A and B	
Difference of diagram A and B	

CONCLUSIONS:

Write your answers in complete sentences.

1. Why are models/diagrams useful for studying the layers of the earth? **(1 point)**

_____

2. What is one disadvantage of using a model or diagram to understand the layers of the earth? **(1 point)**

_____

3. The author Jules Verne wrote a book entitled "Journey to the Center of the Earth" about a young man's trip into the earth. Think about whether or not you would like to travel to the center of the earth? Record your answers below in complete sentences. **(3 points)**

My answer:_____

_____

What would you expect the center of the earth to be like?_____

_____

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