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**Increasing parent engagement in student learning
using an Intelligent Tutoring System**

by

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Abstract

In this paper we present the results of a study that demonstrates the ability of an Intelligent Tutoring System (ITS) to increase parental engagement in student learning. We developed a parent notification feature for the web-based ASSISTment ITS that allows parents to log into their own accounts and access detailed data about their students' performance. We then invited parents from a local middle school to create accounts and answer a survey assessing how engaged they felt they were in their students' education. We ran a 60 day study during which we sent messages home to parents regarding what their students were studying in class and how they were performing. After having them take a post-survey, we found that parents felt significantly more engaged in their students' education. Additionally, the messages significantly increased how frequently parents logged in to check reports on their students' performance data using the ASSISTment system. Qualitative feedback from both parents and teachers was extremely positive.

1. Introduction

Our intuition and experience tells us that parents play an extremely important role in a student's education. A parent's support is critical to keeping a child on the right track and instilling in them the importance of doing well in school. This intuition is supported by a vast body of research, meta-analyzed in [5], showing that parent involvement leads to improvement in student achievement in a multitude of different areas. A more recent meta-analysis [6] finds less of a consensus but still shows a strong correlation between some forms of engagement and student well-being. Even if it were not the case that student performance improved, few would argue that parental support in a child's education is not in and of itself a desirable goal worthy of study. For example, a key meta-analysis of studies on homework in general [4] found that it had overall positive results on student learning. Homework completion is one area that parent notification has enormous potential to improve, as parents can support their children by making sure they complete their homework and in a timely fashion.

This support is contingent, however, upon access to information related to the student's performance, what topics are being covered in class, whether or not they are completing their schoolwork, and how they are behaving in class. Unfortunately, students are rarely forthcoming with this information. Oftentimes the only feedback parents receive is a report card once every semester, which is rarely sufficient to successfully monitor and guide a student's progress. E-mails and phone calls from teachers can provide more frequent data but are extremely time consuming for the teacher. Additionally, these reports generally lack the detailed data necessary to contextualize the feedback.

Intelligent Tutoring Systems (ITS's) offer a promising solution to this problem. The purpose of an ITS is to provide in software the services of a private tutor at least as well if not better than a human. Among many reasons, this is desirable because software is much more cost effective and scalable than hiring an army of human tutors for every student. ITS's typically have students solve problems and provide direct feedback on their performance, as well as assistance if required. Often cognitive models of each student are built using the extensive learning data collected by the system in order to provide individualized instruction. Unlike teachers using pencil and paper assignments, ITS's are able to electronically record significant amounts of detailed data related to student performance and make that data available in meaningful ways, all automatically. This has the obvious potential to increase parent engagement in student learning

by simply making this data accessible to parents, and with minimal effort. ITS's can also provide teachers with the facilities to easily send contextualized messages home that reference this data, significantly reducing the time required to communicate directly with parents. Sending such messages through an ITS rather than email or phone also allows the teacher to tightly control the nature of the communication, making the investment in such communication less daunting.

We looked at several of the most popular ITS's in existence today, including Carnegie Learning's Cognitive Tutor [3], the Andes physics tutor [11], and the IMMEX system [10]. While all of these software systems collect and analyze considerable amounts of data on student learning, none of them provide comprehensive facilities for parents to access this data. Similarly, there is an abundance of software packages for schools meant to keep parents and teachers informed of student progress, such as Pearson's PowerSchool [9]. However, these programs are not ITS's. While they do provide access to data, monitor trends, and alert parents and teachers when these trends indicate a problem, the data used must be entered by the teacher manually. Furthermore, this data consists primarily of what one might find in gradebooks—averages on important assignments and tests. It would be next to impossible for a teacher to manually enter the fine-grained, problem-level data from all assignments and homework that ITS's automatically provide.

In addition to those mentioned above, there is another large class of electronic assessment tools that seek to mimic the traditional offline assessment model using software. Some of them, including the popular Study Island [1], attempt to combine the fine-grained data collection inherent in electronic assessments with the parent notification facilities found in student management systems. However, these systems are not classified as Intelligent Tutoring Systems—they are not “intelligent,” meaning they do not attempt to reproduce the assistance of a human tutor by building cognitive models of student learning and responding with individualized instruction. They simply replicate the assessment, not the tutor. On the opposite side of that spectrum, there is at least one system [8] we are aware of that attempts replicate the services of a tutor, but for the parent rather than the student. While certainly an interesting and viable approach, our goal is to increase parent engagement by taking advantage of the automatic fine-grained data collection provided by *student* Intelligent Tutoring Systems.

We put this hypothesis to the test by developing a parent notification feature for the ASSISTment ITS and running a study to measure its effectiveness at increasing parent engagement. The ASSISTment system (www.assistment.org) is a free, web-based ITS developed at WPI and used by thousands of students in the greater Worcester area. It provides a virtual classroom environment where students sign up for accounts and enroll in classes created by their real-life teachers, who also have their own accounts. Teachers can then assign problem sets and monitor their students' progress using the system's extensive reporting functionality. These reports display the considerable amount of fine-grained data collected by the system in meaningful ways in order to inform teachers and students how they need to adjust their teaching and learning, respectively. While using the system, students are being assessed while they are learning, saving considerable time as described in [7]. The ASSISTment project uses this assessment data to perform research on student learning, such as detecting when and why students game the system as described in [2].

This past summer we implemented a parent notification component for the ASSISTment ITS. This feature added a parent role to the system, allowing parents to sign up for accounts on the website. In order to do this, however, a teacher would have to enable the feature for a particular class. Students would then be prompted to enter their parents' email addresses into the

system, and these addresses would show up in the teacher's digital roster. From there, the teacher could invite parents to sign up for accounts, causing the system to send out an email to the address specified by the student with a link to a special sign-up page.

The parent accounts are automatically linked to their students' accounts, allowing parents to log in at any time and from any web-ready device and check-in on their students' performance. The system exposes several important pieces of functionality that provide parents with meaningful data about their students' progress. When parents first log in, they are presented with the Summary view, which displays upcoming, completed, and past-due assignments within a customizable window of time. Also shown on this page are any new messages sent by the student's teacher and a list of daily reports. These reports contain a detailed breakdown of every problem that the student worked on in a given day, including what answer the student gave and what the correct answer actually was if the student got the problem wrong. These reports give parents a temporal sense of their students' activity and allow them to enforce good time management, an area where parent involvement is particularly beneficial.

at Oak Middle School

Assignments Due/Completed (within 7 days - see all [here](#)):

223 - Median		Due: 16 Mar, 2010, 09:10 AM
225 - Range		Due: 18 Mar, 2010, 09:11 AM
41 - GGG Exit Card - Investigation #1 (completed)		100%
42 - GGG - Exit Card - Investigation #1 (completed - 4 DAYS LATE)		50%
44 - GGG Investigation 2.2 Book Mastery Homework (in progress)		Due: 08 Mar, 2010, 08:06 AM
45 - GGG Investigation 2.3 Book Mastery Homework Honors (completed - 4 DAYS LATE)		85%
18 - Solving Percent problems (mastered)		Mastered in 1 days

Messages (0 new - see all [here](#)):

No recent messages.

Daily Student Reports (see all [here](#)):

Icon Key: Viewed. Not viewed.

- Report for 14 Mar, 2010
- Report for 10 Mar, 2010
- Report for 08 Mar, 2010

Figure 1 - Summary View

Clicking on any of the assignments listed in the Summary view will bring parents to the Item Report for that assignment. The Item Report is the ASSISTment system's most commonly used report, and is accessible by both teachers and students as well. It provides clear and detailed information about a student's performance on a particular assignment. The report consists of a table with a row for each problem in the assignment, with the first column containing a link allowing parents to preview the problem themselves and review it with their students. The second column displays the student's response to the problem and whether or not it was correct. The last column shows how many hints the student requested for that problem. The bottom of the table displays the student's grade on the assignment and the class average. Parents can also click on a link to see a second by second breakdown of the student's activity on the assignment,

allowing them to detect if their student is getting distracted and wasting time. This report is updated in real time, allowing parents to monitor students as they do their homework, no matter their location.

The parent notification component also exposes new functionality to teachers in the form of a messaging system. This feature allows teachers to easily send messages to the parents of their students through the ASSISTment system, as well as see who viewed them. These messages can be sent to the whole class or to individual students or groups of students. Parents are notified by email when they receive a message. The notification email does not contain the message itself; instead, it contains a link to the parent’s inbox on ASSISTment that automatically logs them in. This was a conscious decision designed to encourage parents to utilize the rest of the ASSISTment system by forcing them to log in whenever they wanted to read a message from their student’s teacher. Teachers can send messages from a typical email-like interface or they can use the Item Report, allowing them to send contextualized messages tied to relevant data. The teacher’s Item Report differs slightly from the parent and student version in that it contains a row for each student in the class, with columns representing the individual problems in the assignment. An additional column is present when the teacher has parent notification enabled, containing a form to send either a generic or custom message to a particular student or the whole class regarding the particular assignment. When a parent receives this message, it will automatically contain a link to the Item Report of the assignment the message pertains to.

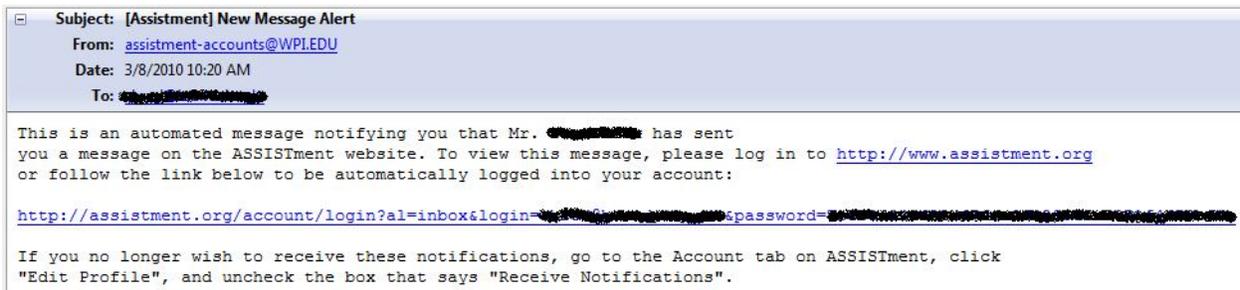


Figure 2 - Notification email

XXXX *	Select a comment	90%	6.5	(Ungraded Essay) noi because to find the volume you do L*W*H*1/2 but the hypotenuse is not either of them so it is not needed.	30
XXXX *	Select a comment XXXXX seemed to struggle applying the	63%	6.5	(Ungraded Essay) You do need to know the length of a for surface area, but not area.	60
	Send			(Ungraded Essay) no you do not need to find the	

Figure 2 - Teacher Item Report

One important point to note about the messaging feature is that parents cannot respond to teachers through ASSISTment. This restriction was specifically requested by teachers, and while it may seem counter-intuitive or even lazy, it serves an important purpose. Teachers are often hesitant to send messages home to parents because it invites further correspondence from the parent, adding even more of a burden to an already time-consuming process. This correspondence is often trivial and argumentative, making the decision to send a message home a daunting one and often discouraging teachers from communicating with parents. Thus, communication needs to be asymmetrical—there should be considerably more correspondence flowing from teacher to parent than the other way around. Email and phone cannot provide this asymmetry, but a custom messaging system built into an ITS can. The key is to make it much easier for teachers to send messages than for parents. The parent notification component of ASSISTment provides teachers with a means to send messages home much more efficiently, but does not provide those same facilities to parents. If parents need to communicate with their student's teacher, they can still use email or phone—however, this requires a bit more effort than just clicking a “Reply” button and thus maintains the asymmetry.

It should be noted that the development of the parent notification feature for the ASSISTment ITS was not a difficult task. Most of the important functionality, such as the Item Report, was already implemented and available to students and teachers. Adding this feature simply entailed making such functionality available to parents as well. The minimal effort required to implement this feature suggests that adding such functionality to other ITS's would be an equally favorable cost/benefit proposition.

2. Experiment

The parent notification feature was completed in the summer and pilot tested in the fall. Two of the authors of this paper are 8th grade math teachers at a local suburban middle school and use the ASSISTment system extensively in their classroom. Each teaches 4 periods of roughly 20 students, 2 honors and 2 non-honors. At the start of the semester, students signed up for accounts on ASSISTment and were instructed to provide their parents' email addresses. Invitations were sent out to parents to create accounts. Of 176 students, 127 (72%) of their parents signed up for accounts. However, participation was dismal. The ASSISTment database captures and stores the page requests of all users, allowing us to monitor parent activity during the fall semester. Parents rarely logged in after they signed-up to check on their students' performance. We were genuinely puzzled as to why parents were not taking advantage of this resource.

We hypothesized that because parents tend to be extremely busy, perhaps they needed some sort of reminder to prompt them to log in and check on their students. Sending out generic reminder emails, however, was not likely to be received well. The messaging feature of the parent notification component offered a promising alternative to spamming parents. A message home from a student's teacher provided the perfect excuse to remind parents to log in, especially since they were unlikely to ignore such a message. Thus, we designed an experiment to determine whether sending messages home via ASSISTment increased parent use of the system, and whether this increased use led to increased parent engagement in student learning.

We selected one honors and one non-honors class from each teacher to receive the experimental condition, totaling 86 students. Our selection of classes for the intervention was not completely random—one class contained a student whose parent was very confrontational about

his dislike for ASSISTment, and in order to avoid further problems we made sure his student's class was in the control. However, realistically this should not have affected the integrity of the experiment. A letter was sent out to the parents of these students informing them of the study and prompting them to sign up for a parent account on ASSISTment if they had not already done so. The letter simply mentioned that they would be receiving messages via the ASSISTment system—it did not confound the study by telling them its intent. These parents were also prompted to complete a pre-survey meant to gauge how involved they felt they were in their students' education. The survey contained questions asking how much parents felt they knew about what their child was studying, how well the school was keeping them informed of their child's performance, and how often they checked their student's homework and gave consequences if it was not satisfactory. We gave the students a similar survey intended to measure how much they perceived their parents to be involved in their education [see Appendix A].

We were very much aware of the risk that parents would overstate their engagement in their students' learning due to the embarrassment of being perceived as a bad parent. We were also wary of giving away the intent of our study based on the nature of the questions we asked. In order to prevent this, we were very careful about how we worded the survey. We inserted a preamble that described junior high school as a transitional period for students and parents, moving from the constant supervision of elementary school to teaching students independence and responsibility in high school. We described our intent as finding out where in this transition parents were at this stage in their students' education. This allowed parents to indicate a lack of involvement without feeling guilty, as they were simply trying to teach their student responsibility for their own education. The survey questions and answers were phrased using this same spectrum.

Out of the original 86 students in the experimental group, 63 (73%) of their parents signed up or already had accounts on ASSISTment. For 60 days during the Spring semester, the two authors that are also the teachers in this study sent messages home to parents through the parent notification feature of ASSISTment. In total, 46 messages were sent over that time period [see Appendix B]. Of these messages, 29 of them were sent to the parents of one student or a small group of students and contained feedback specific to those students. Not every student received such individualized feedback, as this would have placed an unacceptable burden on the teachers. Students were selected to receive such feedback based on need, and often these students' parents were sent more than one message in order to track progress, which we deemed far more important than attempting to hit each student only once. The remaining 17 messages were sent to every parent in a given class and contained general information related to what was going on in the classroom, such as class activities and upcoming exams. After the 60 day messaging period, we asked parents and students to complete a nearly identical post-survey in order to measure changes in their feelings of parental engagement.

3. Results

Of the 63 parents who signed up for accounts, 47 (75%) of them logged in to check their messages regularly during the study period. Keep in mind that notifications were sent out over email whenever a parent received a message on ASSISTment, and as we will show in the Discussion section this likely prompted them to log in. While 62 parents completed the pre-survey, despite our best efforts participation in the post-survey was unusually low, with only 27

parents responding. Of these, 8 had either not completed the pre-survey or did not log into ASSISTment during that period, even to check their messages, forcing us to discard their responses. This left us with a very small 19 person sample size (out of an original 186) with which to perform our analysis.

The majority of questions on the survey were scored on a scale of 1 to 5, usually representing “Strongly disagree” to “Strongly agree”, or some form of frequency (“Once a month”, “Once a week”, etc). We performed paired T-tests in order to determine if changes in the responses to any of these questions between the two surveys were significant. Perhaps due to our small sample size, we were only able to find a significant change in one of the questions, with $p \approx 0.05$ and an effect size of 0.35. While the other questions did not have significant p-values, they did indicate some informal trends in parent engagement. A question related to how well parents felt they were informed about their students’ performance increased, while oddly enough the frequency with which parents checked on their students’ homework and handed out consequences decreased.

Question	Pre-test Avg	Post-test Avg	Delta	Std Dev (Pre)	Std Dev (Post)	P-Value	Effect Size	% of Parents that changed
I feel I have a good understanding of what is going on in my student's math class (i.e. topics being covered, upcoming exams, etc).	3.58	3.9	0.32	0.9	0.88	0.055*	0.35	42% Increased, 21% Decreased, 37% Neither
I feel I have a good understanding of HOW my student is doing in math class.	4.06	4.22	0.17	0.8	0.65	0.421	0.21	33% Increased, 22% Decreased, 45% Neither
My child thinks I know how well he or she is performing in math class.	4.33	4.33	0	0.69	0.59	1	0	17% Increased, 17% Decreased, 66% Neither
I feel my school is *not* giving me enough information to adequately monitor my student's progress.	1.61	1.78	0.17	0.78	0.88	0.58	0.21	28% Increased, 28% Decreased, 44% Neither
In the past week, how frequently did you check up on your student's homework?	2.58	2.16	-0.42	1.22	0.9	0.21	0.35	16% Increased, 32% Decreased, 52% Neither
How often do you give consequences (rewards/punishments) for grades and homework completion?	2.42	2.16	-0.26	1.26	1.21	0.31	0.21	26% Increased, 47% Decreased, 27% Neither
How often have you interacted with ASSISTment in the last 30 days?	2.16	2.63	0.47	1.26	0.9	0.14	0.38	58% Increased, 26% Decreased, 16% Neither
How often have you initiated contact with your student's teacher in the last 30 days?	0.11	0.05	-0.05	0.32	0.23	0.58	0.17	5% Increased, 11% Decreased, 84% Neither

Figure 3 - Survey Results

Another not-quite-significant question involved how frequently parents interacted with ASSISTment during the study period. We were very skeptical of this result given that participation in the fall was dismal and these particular parents had logged in to view messages frequently in the spring. Of all the questions, this one should have been the easiest to show improvement on. We attributed this lack of statistical significance to noise resulting from our small sample size and decided to investigate the database for more concrete results. As we suspected, it was abundantly clear that parents interacted with ASSISTment much more frequently during the spring than in the fall. What we were really interested in, however, was whether or not parents were visiting the other parts of the site in addition to their message inbox. This would provide strong evidence that they were being reminded to check up on their students' performance in ASSISTment whenever they received a message, as hypothesized.

What is your name?	Days from creation of profile until beginning of study	Number of days during study	Number of unique days non-inbox page requests were made during pilot	Number of unique days non-inbox page requests were made during study	% chance on a given day parent would make non-inbox page request during pilot (unique days/days during pilot)	% chance on a given day parent would make non-inbox page request during study (unique days/days during study)
1	110	60	0	1	0.00%	1.67%
2	108	60	0	1	0.00%	1.67%
3		60	0	0		
4	109	60	3	3	2.75%	5.00%
5	108	60	2	2	1.85%	3.33%
6	109	60	0	2	0.00%	3.33%
7	103	60	2	11	1.94%	18.33%
8	108	60	2	0	1.85%	0.00%
9	63	60	1	1	1.59%	1.67%
10	84	60	1	2	1.19%	3.33%
11	100	60	1	0	1.00%	0.00%
12	101	60	0	2	0.00%	3.33%
13		60	0	0		
14	101	60	6	2	5.94%	3.33%
15	109	60	0	7	0.00%	11.67%
16	99	60	3	7	3.03%	11.67%
17	109	60	2	1	1.83%	1.67%
18	100	60	0	5	0.00%	8.33%
19	62	60	1	0	1.61%	0.00%
				Avg	1.45%	4.61%
				Std Dev	1.54%	5.05%
				Delta Avg/Stdev	3.16%	3.51%
				P-Value/Effect	0.023	2.05

Figure 4 - Database Results

We devised the following metric to measure whether or not parents were using ASSISTment's reporting functionality more frequently during the period they were receiving messages. We queried the database to determine how many unique days each of the 19 active parents made page requests to the non-messaging related portions of the ASSISTment site. We then normalized this by dividing by the number of days between when the parent created their account and until we sent the letter home about the study. One way to look at this measure is the probability that a parent would log into ASSISTment and use the reporting functionality on a given day in the fall. Two parents had not created accounts until the start of the study, so we were forced to discard them, leaving us with 17. We then took the same measure for the spring, during which parents were receiving messages. The probability that they would check in on their

students' performance on a given day increased significantly, from 1.5% to 4.6% with $p < 0.03$ and an effect size of 2.05.

The student version of the survey did not provide any significant results. We asked students three questions relating to how informed they thought their parents were about the student's education. These questions closely matched questions on the parent version of the survey, except they were from the student's perspective. Informal trends again indicate an increase in perceived engagement, but not at statistically reliable levels. Actual engagement, in the form of parents sitting down and working with their students on ASSISTment, even *decreased* slightly. It should be pointed out that if you compare the averages from the parent and student surveys, it appears parents believe they are more informed about what their students are doing in math class than students do, but students believe parents know more about *how* they are doing in class than their parents believe they do.

Question	Pre-test Avg	Post-test Avg	Delta	Std Dev (pre)	Std Dev (post)	P-Value	Effect Size	% of students that changed
I think my parents know what I'm doing in math class.	3.22	3.31	0.08	1.06	1.03	0.48	0.08	34% increased, 29% decreased, 37% neither
I think my parents know HOW I'm doing in math class.	4.25	4.34	0.09	0.84	0.78	0.33	0.11	28% increased, 21% decreased, 51% neither
My parents have sat down and helped me with my ASSISTment work this year.	36%	34%	-2%	N/A	N/A	N/A	N/A	7% increased, 9% decreased, 84% neither

Figure 5 - Student Survey Statistics

While the purpose of this study was to measure increases in parent engagement, we thought it diligent to take the next step and see whether or not the increased engagement we observed led to increased student performance. Due to the design of the experiment, we did not predict we would be able to detect any changes in student performance, though we hoped that if we zoomed in on only those students whose parents participated in the study or who had received individualized messages we might be able to observe something. Unfortunately, we were unable to detect any reliable results; we present our findings here for completeness. We analyzed two different measures of student "performance": homework completion rates and semester grade point averages for the fall and spring. We computed the average gains in each metric between the fall and spring semesters for both the experimental and control conditions and compared them. We used half of our students for each measure—that is, one of the authors uses the "due date" functionality of ASSISTment, making homework completion analysis feasible, while the other provided semester grades for her students.

Homework completion was measured in three ways: percentage of assignments completed by each student by the due date, percentage of assignments completed by the end of the semester, and average number of days late per assignment. Each of these measures has a different sensitivity to certain aspects of the intervention; for example, one of the authors would occasionally send out messages informing parents that their students had outstanding assignments. These assignments were not completed by the due date, but the message may have prompted students to finish them by the end of the semester under pressure from their parents. On the other hand, if a parent was frequently logging into the Summary view during the

intervention, they would be able to see when their student’s assignments were due and could put pressure on their student to complete them on time.

ALL	Exp Gain	Control Gain	Std. Dev. Exp/Con	P-Value	Effect Size
On-time Rate	-1.06%	2.13%	14%/20%	0.388	0.16
Semester Rate	5.09%	3.77%	22%/13%	0.731	0.10
Avg Days Late	-5.84	-4.44	9.49/5.96	0.414	0.23

Figure 6 - Homework completion rates

As the table indicates, none of the measures showed a reliable increase in homework completion rates (or decrease in average days late) versus the control; in fact, the experimental group actually decreased its on-time completion rate (though not significantly). The experimental group beat the control on the other metrics, but again not reliably. If we zoom in on only the non-honors students, however, the results look more promising. This is appropriate because the lower knowledge students offer the most room for growth in these areas. As can be seen from the table below, once we focus in on only these students, the differences between the control and experimental groups become clearer, though still not enough to be statistically reliable.

NON_HONORS	Exp Gain	Control Gain	Std. Dev. Exp/Con	P-Value	Effect Size
On-time Rate	4.38%	-0.55%	16%/24%	0.438	0.20
Semester Rate	9.33%	5.93%	30%/13%	0.634	0.26
Avg Days Late	-10.63	-6.78	11.27/6.62	0.177	0.58

Figure 7 - Non-honors homework completion rates

If we zoom in even further, looking at only those students whose parents actively read their messages, we find slightly different results. The table below shows that, if we take the homework completion rate averages of only those students whose parents received individualized messages, there is little difference compared to the non-honors averages. However, if we take the correlation between the gains in homework completion rates and the frequency with which parents logged into non-inbox parts of ASSISTment as outlined above, we find at least one strong, reliable value. Keep in mind though that this includes only those students whose parents logged in consistently to check messages.

	Average of students who received messages	P-value	Correlation with parent login freq	P-value
On-time Rate	-6.03%	0.351	0.78	0.012*
Semester Rate	10.74%	0.394	0.54	0.135
Days Late	-9.13	0.247	-0.33	0.385

Figure 8 - Homework completion rates of students with participating parents

We were even more skeptical of our ability to detect any changes in students’ grade point averages, as they can be thought of as another leap down the causal chain from homework completion, which is already a leap down the chain from parent engagement. At each leap, reliably detectable results are diminished without the support of a strong experiment designed to measure those metrics in particular. As expected, the difference in grade point averages between

the fall and spring semesters for both the control and experimental groups were not reliably different than 0, even when zoomed in on non-honors and message-receiving students only. Correlation between differences in GPA and increases in parent login frequency was very nearly 0 as well. In effect, our intervention appeared to have absolutely no detectable effect on student grades at all.

4. Discussion

Overall, most of the changes in survey responses were not statistically significant. As we will discuss in the Future Work section, we believe this is likely the result of a small sample size and a possible ceiling effect. The one question whose change was significant, however, was a very general and important one: “I feel I have a good understanding of what is going on in my student’s math class (i.e. topics being covered, upcoming exams, etc).” A likely explanation for this is that all parents received the messages talking about what was happening in class, while only a small subset of students received individualized feedback. This question maps directly to these more “global” messages, while the others are tied more to individual students. The number of parents who received individualized feedback about their students *and* checked their messages, filled out the pre-survey, and filled out the post-survey is extremely small—in order to get meaningful results on these other questions, we would likely need to send every parent several individualized messages, which was not feasible for this study.

Particularly interesting among these results is the fact that the frequency with which parents checked on their students’ homework and gave them consequences for poor performance decreased, though not quite significantly. This is perhaps the result of parents assuming that if they are not receiving messages about their student, then everything must be in order. As one parent put it, “no news is good news.” This is an important point to consider and warrants further study, as we now have to contend with the possibility that such a feature could actually *decrease* parent engagement due to a false sense of security given to parents by the system. Such a phenomenon would shift more responsibility from the parent to the teacher, which is the opposite of what we would like to see. Ideally, we would like to see the clerical burdens offloaded on the system, with some additional responsibilities shifted to the parent.

Our results from mining the database were far more conclusive than those from the survey. The data clearly shows that after parents started receiving messages from their students’ teacher, they visited the reporting sections of the site significantly more frequently. Combined with the results from the survey, this would seem to strongly indicate that our hypothesis was correct: that messages home from a teacher reminds parents to log into ASSISTment and check out their students’ progress, and that these messages and increased log-ins have caused parents to feel more engaged in their students’ learning.

The lack of results from the student survey was disappointing, but not unexpected. Like the grades and homework completion rates, student perception of parent engagement is a leap down the causal chain from actual parent engagement, and thus harder to detect. As in many of our results, however, the informal trends hinted at a positive result, suggesting that perhaps a stronger future study could uncover what we are looking for. The discrepancy between parental feelings of engagement and student perception is also interesting. Parents believed that they knew more about what their students were doing in class than their children believed they did, while students thought their parents knew more about *how* they were doing in class than parents believed they themselves did. The latter could be the result of simple paranoia, especially since

students are aware of how much information ASSISTment can provide. They are naturally less concerned about their parents knowing what is going on in class, while perhaps parents would like to think that they are more aware than they really are. Aside from the previous hypothesis, we do not have any explanation for this discrepancy.

Our analysis of homework completion rates again only provided us with informal trends, but they as well showed promise for a future study, especially among the low knowledge students. We were surprised to find that those students whose parents received individualized messages (usually about homework) did not differ from the group at large, though by the time we narrowed it down to those particular students our sample size was less than 5. The one reliable result, however, was very promising. Our data showed that there was a large, significant correlation (0.78, $p < 0.02$) between increases in on-time homework completion rates and increases in parent logins to ASSISTment (excluding the inbox). This supports the hypothesis that parents who logged in more frequently to the Summary page, which displays when students have assignments due/late, put more pressure on their students to complete their homework on time.

The qualitative feedback from the study was also positive. We the authors, as teachers, found the parent notification feature very useful and the experience of sending messages home via ASSISTment highly promising. The interface allowed us to send messages home much more efficiently and gave us the ability to contextualize those messages with real data. Most importantly, we did not have to worry about parents flooding us with responses—communication is still open at both ends, but one end has much higher bandwidth, making the prospect of sending a message home much less daunting and encouraging us to do so more often. We have continued to use this feature in our classrooms well after the study was completed.

Feedback from parents was also very positive [see Appendix C]. The last question on the post-survey instructed parents to write down any thoughts they had about the system or the study. Most were happy to receive messages from the teacher informing them of their students' progress. Many remarked that the messages did in fact remind them to log in and check up on their students' performance. There was no negative feedback; at worst, some parents did not gain any benefit from the messages or ASSISTment, stating that their students were very responsible and as long as they received good grades, their parents would let them be independent. In general, parents liked being more connected to their students' education and felt the parent notification feature was a positive step in that direction.

<p>"The program gives me the ability to observe the quality and quantity of nightly homework. I never have to worry about missing homework. Assistment is always available for past and future work."</p>	<p>"It is a nice feature and helps us to know better the types of activities being done in class so we can discuss them with our children. I think this program is a positive step toward connecting families with the curriculum."</p>
<p>"I really liked the notes sent by the teacher telling us what they did in class and what you might want to talk about with your child. It gives one more thing to try to connect with them at the dinner table. Thanks"</p>	<p>"It is a very good program. In the least, the notifications help you remember your child's school work and I can be an active participant. Usually I wouldn't get involved unless there was a problem, and then it would be too late. This helps me track progress and interact as necessary. I only read the messages. I will look at other areas of the site."</p>

Figure 9 - Sample Parent Comments

One anecdote from the study is worth mentioning here as it demonstrates the potential of the system that cannot be captured in quantitative data. Throughout the spring we sent 5 messages to one struggling student's parent in particular. While this was originally prompted out of genuine concern for the student's weak performance, it soon became obvious that this correspondence would make a great case study of the system's ability to connect with parents and effect positive change. The first two messages received by this student's parent were actually sent to the parents of several different students, warning them that their child was falling behind on homework completion. The next two were sent specifically to the one parent, informing her that her student had caught up with his work and had really improved in class. The final message was another warning that the student had become overconfident and was beginning to slip again. While we can't know for sure until we speak with this parent, we'd like to think that this student's turn-around was brought about by pressure put on the student by his parent as the result of these messages.

11 Jan, 2010 - Subject: Over due Assignments

Good morning, I am writing to inform you that your child has some outstanding assignments. Please encourage them to come in for extra help if they are having difficulty mastering the work. Thank you, Courtney Mulcahy

To: Multiple recipients

25 Jan, 2010 - Subject: Outstanding Assignments

Your child has several assignments that are outstanding at this point. Please encourage them to be responsible and take initiative to complete assignments that are overdue. Additionally, encourage them to come and see me for extra help if they need clarification so that they can get caught up. Thank you, Courtney Mulcahy

To: Multiple recipients

06 Feb, 2010 - Subject: *****

***** has really had a positive turn around with his work effort and production this week. He is current with his Mastery Learning assignments and is demonstrating much more responsibility. Please continue to encourage him. I am happy with his week at school.

To: *****

22 Feb, 2010 - Subject: *****'s Math Work

Good morning, I just wanted to let you know that I am sitting with ***** right now for extra help during math buddies and he is doing very well. He has a great understanding of the material for Pythagorean Theorem and has an excellent attitude about getting his work done. I have noticed a significant change in his attitude, behavior and effort. Please encourage him to keep up the great work! Thank you, Courtney

To: *****

10 Mar, 2010 - Subject: *****'s Math

Hi *****, I just wanted to let you know that ***** is slowly slipping behind in his work on Assistent. He was all caught up and very proud of himself but is beginning to build a list of overdue assignments. Please encourage him to stay up to date. I don't want him to get too proud and then take it easy. He claims that he didn't know that they were assigned, but I am trying to teach the students accountability and have them respond to the due dates in addition to assigning them for HW. He is not too far behind yet, so it should be relatively easy to catch up. I want him to continue with his good efforts. Thank you, Courtney

To: *****

5. Conclusion and Future Work

In this paper we have showed that Intelligent Tutoring Systems can be used to increase parent engagement in their students' education. We believe access to information about a student's performance to be one of the primary obstacles to increased parent involvement in student learning. Students are notoriously tight-lipped with such information, and messages and phone calls home place a large burden on teachers and are not contextualized with real data. ITS's have the unique potential to overcome this obstacle with their ability to collect large amounts of data and make this data easily available to parents. They also offer the facilities to enable teachers to efficiently send messages home that are backed up by this data. Furthermore, this communication can be controlled in order to ensure that more information is flowing from teacher to parent than parent to teacher, relieving more of the burden from teachers and encouraging them to send more feedback home.

Based on these observations we hypothesized that ITS's could increase parent engagement in student learning. To test this hypothesis, we developed a parent notification component for ASSISTment, an Intelligent Tutoring System used extensively in the classrooms of local teachers, including two of the authors. The new feature allowed parents to sign up for accounts and view detailed reports on their student's progress and performance. It also provided teachers with the ability to easily send contextualized messages home, but not the ability for parents to respond directly. We piloted this feature in the authors' classrooms in the fall, but participation was very low. Assuming that parents simply needed reminders to log in and check on their students, we designed a study for the spring where we sent home messages containing feedback on student performance and information about classroom activities to parents of both individual students as well as the entire class. We gave both a pre and post-survey designed to measure how involved parents were in their students' education before and after the study.

We found that parents felt significantly more informed about what was going on in their students' education after receiving messages from their teachers. Additionally, looking at database logs we found that these messages did in fact remind parents to visit other parts of the ASSISTment website to check in on their students' performance, which in turn likely contributed to their sense of engagement. Qualitative feedback was also positive, with teachers finding the system very convenient and parents commenting that they were glad to receive increased feedback and information about class from their teachers. One student's story gave us particularly promising insight into the ability of ITS's to positively affect struggling students by getting their parents involved.

We made one key assumption at the beginning of this study: that parent engagement in student learning is beneficial in some way and worthy of being increased. While we believe that parent involvement in a child's education is a positive end in and of itself, we also suspect such involvement would lead to increased student learning. As we discussed, many of our results hinted at this possibility informally. Demonstrating this will likely be the topic of any future research we perform; showing the ability to increase parent engagement is simply a necessary first step. Such future studies would similarly involve introducing an intervention known to increase parent engagement, but instead of just establishing increased engagement we would go further and measure whether or not metrics of student performance increased as well. This might include student test scores, homework completion rates, and some measure of behavior. In order to do this, however, increased engagement must be firmly established to the point where significant changes in such metrics would be feasibly measurable, which is what we sought to do in this study.

Any future work should seek to avoid some of the pitfalls we encountered during this study. Most unfortunate was the lack of participation by parents. This was particularly unexpected due to the fact that the school was located in an affluent community with almost ubiquitous access to computers and the internet, as well as a reputation for being very involved in their children's education. Whenever we do a demonstration of the parent notification feature of ASSISTment, parents are almost always excited, claiming they have been wanting their teachers to implement such a system. Yet, participation in the study, especially the post-survey, was extremely disappointing despite our persistent efforts. We are not yet sure why this is the case or how to remedy it. It does, however, result in a very small sample size, which can make obtaining statistically significant results difficult. Out of an original 86 parents, only 17 completed all parts of the study necessary to perform analysis.

In addition to the small sample size, we suspect our results fell victim to a bit of a ceiling effect. Apparently, our middle school is quite notable for keeping parents informed about their students' performance. The results from the pre-survey supported this, with parents indicating they felt relatively well engaged even before we introduced the intervention. On many of the questions, which were scored on a scale of 1-5, parents answered an average of approximately 4.0, leaving little room for improvement. Interestingly enough, the only question for which this was not the case, with an average of ~3.5, was the question we found reliably increased after the intervention. Future studies might benefit from taking place at a school with a higher need for parent-teacher communication.

Finally, we are well aware that we did multiple tests for statistical significance without using some sort of penalty to correct for it. Had we done so, we are confident that the few reliable results we found would likely become unreliable. We are not claiming this as justification for not using a penalty; we are simply pointing out the high possibility of that outcome. Our reason for not using such a correction is that this was mainly an exploratory study. Most of our important results consist of informal trends and qualitative feedback. A more robust evaluation is planned for sometime in the near future.

Acknowledgements

We would like to thank Oak Middle School in Shrewsbury, MA for their participation in this study. We would also like to thank the ASSISTment development team for their contributions to the construction of the parent notification feature. Funding for this research was provided primarily by the National Science Foundation's GK-12 program, of which the primary author is a fellow as part of the Partnership In Math and Science Education (PIMSE) grant. Additional sources of funding include the Department of Education, the Office of Naval Research, and the Spencer Foundation.

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Appendix A: Surveys

Oak Middle School Parent Involvement Post-Survey

For the past two months, your student's math teacher has been sending you messages through the ASSISTment system informing you about what is going on in class and perhaps how your student is doing individually. You may remember taking a similar survey at the beginning of this period—we apologize for the repetition, but in order for us to measure any positive or negative effects of introducing this new feature to ASSISTment, we need you to take a second survey so that we can detect any changes in your answers during this time period. We are also very interested in your thoughts on the parent messaging feature, and the last question on the survey will allow you to share them with us. Thank you for taking the time to participate; this research helps us improve ASSISTment and ultimately we hope it will help improve student learning.

* Required

What is your name? *

I feel I have a good understanding of what is going on in my student's math class (i.e. topics being covered, upcoming exams, etc).

We all know that when you ask your student what he or she did in school each day, the answer is often likely to be "Nothin." It can be hard for parents to feel they know what is going on in their student's class, and we understand that. That is why we are interested in this issue.

1 2 3 4 5

Strongly disagree Strongly agree

I feel I have a good understanding of HOW my student is doing in math class.

For example, how well he or she is performing, whether he or she is doing his or her assignments, and if he or she understands the material.

1 2 3 4 5

Strongly disagree Strongly agree

My child thinks I know how well he or she is performing in math class.

To clarify: we want to know what you believe about your child's perceptions, namely whether he or she thinks you are aware of how he or she is doing in math.

1 2 3 4 5

Strongly disagree Strongly agree

I feel my school is *not* giving me enough information to adequately monitor my student's progress.

1 2 3 4 5

Strongly disagree Strongly agree

In the past week, how frequently did you check up on your student's homework?

Do you ask them what their homework is, make sure they do it, and/or help them with it/check it afterwards? Or are you more of the opinion that they should be handling it themselves at this point?

- Never, it is their responsibility
- Once or twice, just to make sure
- 3-4 times, to keep them on track
- Almost every day

How often do you give consequences (rewards/punishments) for grades and homework completion?

1 2 3 4 5

Never Often

How often have you interacted with ASSISTment in the last 30 days?

This includes visiting the site either through your account or your student's, helping your student with his ASSISTment work, viewing his or her performance reports, etc.

- Never
- Less than once per month
- About once or twice per month
- About once per week
- Several times a week

How often have you initiated contact with your student's teacher in the last 30 days?

This includes via e-mail, phone, note, or scheduling a meeting.

- Never
- Once
- Twice
- 3-5 times
- 6 or more times

Have you used the Item Report feature of ASSISTment? This is the feature that allows you to view in detail how your student did on a particular assignment. The Parent account feature of ASSISTment allows you to view your student's Item Report.

- Yes
- No

We are extremely interested in how you feel about the parent notification feature of ASSISTment. Please take this opportunity to tell us what you liked about it as well as what you didn't like about it. We are also interested in what features and changes you would like to see (regarding parent involvement in ASSISTment). Did this feature cause you to log onto ASSISTment more often? Did you visit other parts of the site besides the message inbox? Do you feel it has increased your involvement in your student's education? Really any thoughts would be appreciated.

Parent Involvement Post-survey (student version)

Please answer as honestly as you can. Your parents are not going to see your answers to these questions, and your answers will not affect your grades or get you in trouble.

* Required

What is your name? *

I think my parents know what I'm doing in math class

As in, what you are studying, when your exams are, etc

1 2 3 4 5

Strongly disagree Strongly agree

I think my parents know HOW I'm doing in math class

As in, what you're getting for grades, whether you understand the material, and if you are doing your homework.

1 2 3 4 5

Strongly disagree Strongly agree

My parents have sat down and helped me with my ASSISTment work this year (say, since January)

- Yes
- No

Submit

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Appendix B: Parent Messages

Messages from Ms. O'Connor:

22 Feb, 2010 - Subject: Presentation on careers in Computer Science

Today in math class your son/daughter attended a presentation on careers in Computer Science, Engineering & Math. Zach, our WPI graduate student, put together a terrific interactive discussion describing his journey as a computer scientist. Tonight ask your child what they learned from the presentation. Zach made several connections to the course selection process at the high school - something that will begin this week & conclude two weeks from now. Your son/daughter will come home with the course selection booklet tonight. Be sure to check out the extensive list of math courses offered at the high school. The list is impressive for those students interested in engineering! Students also have the opportunity in later years to take advantage of classes in Web Design, Computer Programming, and Engineering. Don't forget to attend the discussion for parents on Thursday night @ SHS - it's a great time to ask any questions you have about the process! Christine O.

To: Multiple recipients

09 Feb, 2010 - Subject: Math Test

Your daughter/son scored extremely well on a recent quiz in math! I was very impressed with the attention to detail & their understanding of geometric solutions!

To: Multiple recipients

09 Feb, 2010 - Subject: Math Project

All students just completed a math lab involving the Pythagorean Theorem. Please check in with you child & ask how their group did with the activity. Ask if they can think of a real world example where the Pythagorean Theorem is used.

To: Multiple recipients

09 Feb, 2010 - Subject: Honors Math Mini Project

Your daughter/son did an outstanding job on a recent project involving the Pythagorean Theorem. Please check in with them & ask what the project involved.

To: Multiple recipients

09 Feb, 2010 - Subject: Math Placement Tests

Just a reminder....all students will be taking the math placement test for SHS on Tuesday 2/23. This will be used along with standard grades, MCAS scores, and teacher recommendation for placement. We will welcome Zach Broderick, a computer scientist & WPI graduate student, to our classroom on Monday 2/22. Zach will lead a discussion on careers in computer science - just in time as we begin to talk about options for classes at SHS.

To: Multiple recipients

28 Jan, 2010 - Subject: Extra math help

We started working with square roots this week & I am noticing that many students could use extra help - I am available next Monday 2/1 and Wednesday 2/3 morning @ 7:15. Please encourage your son/daughter to come if they need help. A big thank you to those of you who sent in jelly beans for our math lab planned for the end of next week. I hope to create a three dimensional model of the Pythagorean Theorem!

To: Multiple recipients

28 Jan, 2010 - Subject: Untitled

I will be moving the date of the LFP final assessment from Tuesday 2/2 to Thursday 2/4. All students are busy working on their assignments. I will be available for extra help Monday 2/1 & Wednesday 2/3 @ 7:15. Please encourage your son/daughter to see me if they have questions!
To: Multiple recipients

22 Jan, 2010 - Subject: Grading Math Essays

Today in math class we worked on grading ORQ's. Several exemplars (taken from last night's homework) were critiqued anonymously in real time using the Assistent program. Some of the things we look for in our mathematical writing include restating the question, attention to mathematical vocabulary, articulating methods to solve, and utilizing units of measure. Overall students have a strong understanding of what makes up a 4. We continue to work on understanding the differences between a 2 & 3.

To: Multiple recipients

22 Jan, 2010 - Subject: Today's math class...

Today your child's essay was used as part of a lesson on essay critiquing. You may want to check in with your child to see how the class critiqued their work. All work was done anonymously.

To: Multiple recipients

21 Jan, 2010 - Subject: Update from 8Red Math

Some students have not returned the final assessment for TWMM with a parent signature. Please check in with your son/daughter tonight - the last date for extra help is tomorrow morning (1/22) @ 7:15. Retake is scheduled for Monday 1/25 @ 7:15. All students are required to attend a help session & complete extra problems to earn the opportunity for a retake. Thanks!

To: Multiple recipients

21 Jan, 2010 - Subject: Update from 8Red Math

All students were assigned an ORQ for homework tonight. We will be critiquing them via Assistent tomorrow during class so it's important everyone completes the assignment tonight! We began our geometric proof of the Pythagorean Theorem using gum drops instead of jelly beans -everyone is trying to figure out the big question: What do you notice about the areas of the squares built off the sides of a right triangle? Stay tuned.....

To: Multiple recipients

15 Jan, 2010 - Subject: Looking for Pythagorus

Hi, We have finished our unit "Thinking with Mathematical Models" and are moving into "Looking for Pythagorus." In this unit we will create both algebraic & geometric proofs of the Pythagorean Theorem. The highlight of our investigations will involve an interactive activity with jelly beans. If you would like to help out by donating a bag of jelly beans please let me know! The final assessment on TWMM will be coming home for your review & signature on Tuesday 1/19. Over the weekend please check in with your son/daughter and ask how they did. We will be correcting the test so your son/daughter should share their corrections with you along with the test. Please check the date for extra help & the retake. Thanks for your support,
Christine O.

To: Multiple recipients

15 Jan, 2010 - Subject: Pythagorean Theorem

Hi, We are preparing for an interactive activity involving jelly beans next week. Over the weekend students will be taking 3 short quizzes on line - I will be looking at those scores to determine if we are ready to create a geometric proof of the Pythagorean Theorem. Please check in with your son/daughter over the weekend and ask what scores they earned on the online quizzes. They should be able to share their work with you either on paper or online through the Assistent program. I have scheduled the activity for Thursday 1/21 - if you would like to donate a bag of jelly beans please have your son/daughter bring them in by Thursday. Thanks, Christine O'Connor

To: Multiple recipients

Messages from Ms. Mulcahy:

12 Mar, 2010 - Subject: Math Conversation

We had a great discussion today in class about compound interest and different possibilities for investing money. This would be a great conversation to continue at home. Many of them were intrigued. Have a nice weekend!

To: Multiple recipients

12 Mar, 2010 - Subject: *****'s Math

Good morning, I just wanted to let you know that ***** is falling behind on his Assistent assignments. Many of them are not mastered and overdue. Please encourage him to get caught up over the weekend, so he doesn't fall too far behind. If he is having difficulty remind him to ask the computer for hints or come and see me for extra help next week. Thank you, Courtney

To: *****

12 Mar, 2010 - Subject: *****' Math

Good morning, I just wanted to let you know that ***** is falling behind on his Assistent assignments. Many of them are not mastered and overdue. Please encourage him to get caught up over the weekend, so he doesn't fall too far behind. If he is having difficulty remind him to ask the computer for hints or come and see me for extra help next week. Thank you, Courtney

To: *****

12 Mar, 2010 - Subject: *****'s Math

Good morning, I just wanted to let you know that ***** is falling behind on his Assistent assignments. Many of them are not mastered and overdue. Please encourage him to get caught up over the weekend, so he doesn't fall too far behind. If he is having difficulty remind him to ask the computer for hints or come and see me for extra help next week. Thank you, Courtney

To: *****

10 Mar, 2010 - Subject: Exponential Growth Unit

We began a new unit on exponential growth this week and the students seem to be intrigued by the concept of how quickly numbers can grow, especially when talking about money. Now I realize it is none of my business to discuss if a student receives an allowance, but "negotiating" one can be a real great discussion to review the concepts of exponential equations. Please have them explain to you why they would rather receive a penny a week doubled each week than a

million dollars. This conversation will reinforce what we are learning in class and it is always great to bridge that gap. Thanks!

To: Multiple recipients

10 Mar, 2010 - Subject: *****'s Math

***** continues to show excellent responsibility in math class. He completes his work punctually and thoroughly. He is always ahead of the game. Be proud of him and tell him to keep it up!

To: *****

10 Mar, 2010 - Subject: *****'s Math

***** continues to show excellent responsibility in math class. He completes his work punctually and thoroughly. He is always ahead of the game. Be proud of him and tell him to keep it up!

To: *****

10 Mar, 2010 - Subject: *****'s Math

***** approached me today about taking a retake on the Pythagorean Theorem unit test which is great to see her advocating for herself. She said she would review that material with her tutor. We began a new unit on Monday on exponential relationships. Although the unit is very new, I can see ***** is already challenged and it might not be a bad idea for her to review this topic with her tutor or come in to me for extra help before she becomes frustrated. Thank you for your continued support!

To: Multiple recipients

10 Mar, 2010 - Subject: *****'s Math

I wanted to let you know that we began a new unit on Monday on exponential relationships and ***** seems to have a firm grasp of the material already. I would like to see her share her ideas more in group discussions as her knowledge will be beneficial to her classmates. She sits extremely quietly and I would like to challenge her to become more involved.

To: *****

10 Mar, 2010 - Subject: *****'s Math

Hi ***** , I just wanted to let you know that ***** is slowly slipping behind in his work on Assistent. He was all caught up and very proud of himself but is beginning to build a list of overdue assignments. Please encourage him to stay up to date. I don't want him to get too proud and then take it easy. He claims that he didn't know that they were assigned, but I am trying to teach the students accountability and have them respond to the due dates in addition to assigning them for HW. He is not too far behind yet, so it should be relatively easy to catch up. I want him to continue with his good efforts. Thank you, Courtney

To: *****

26 Feb, 2010 - Subject: Presentation on Computer Science

Today in math class your son/daughter attended a presentation on careers in Computer Science, Engineering & Math. Zach, our WPI graduate student, put together a terrific interactive discussion describing his journey as a computer scientist. Tonight ask your child what they

learned from the presentation. Zach made several connections to the course selection process at the high school - something that began this week and will conclude March 10th. Your son/daughter brought home the course selection booklet, make sure you check out the extensive list of math courses offered at the high school. The list is impressive for those students interested in engineering! Students also have the opportunity in later years to take advantage of classes in Web Design, Computer Programming, and Engineering. Thank you for all of your continued support!

To: Multiple recipients

22 Feb, 2010 - Subject: *****'s Math Work

Good morning, I just wanted to let you know that I am sitting with ***** right now for extra help during math buddies and he is doing very well. He has a great understanding of the material for Pythagorean Theorem and has an excellent attitude about getting his work done. I have noticed a significant change in his attitude, behavior and effort. Please encourage him to keep up the great work! Thank you, Courtney

To: *****

06 Feb, 2010 - Subject: *****

***** has been doing a much better job staying current with her work. Thank you for encouraging her and helping her stay organized at home. I have noticed a big difference in her work completion this week.

To: *****

06 Feb, 2010 - Subject: 8 White Night Project

The boys have a great idea with their Inverse Variation video. The project really stresses how math truly is all around us. So much of teaching is trying to help students make connections with the "real world" and they did this very easily. This is very insightful and demonstrates a true comprehension of the material. Please encourage them to keep up the great work.

To: Multiple recipients

06 Feb, 2010 - Subject: *****

***** has really had a positive turn around with his work effort and production this week. He is current with his Mastery Learning assignments and is demonstrating much more responsibility. Please continue to encourage him. I am happy with his week at school.

To: *****

06 Feb, 2010 - Subject: 8 White Night Project

The girls have a great idea with their Pythagorean Theorem landscape. The project really stresses how math truly is all around us. So much of teaching is trying to help students make connections with the "real world" and they did this very easily. This is very insightful and demonstrates a true comprehension of the material. Please encourage them to keep up the great work. I am looking forward to seeing the finished product.

To: Multiple recipients

06 Feb, 2010 - Subject: *****

***** made an excellent PowerPoint presentation for his 8 White Night Presentation. I was very impressed with his PowerPoint skills. Ask him to see it if he hasn't shown it to you. Please continue to encourage him to keep up the great work!

To: *****

06 Feb, 2010 - Subject: 8 White Night Projects

The girls Sports Jeopardy project really came along nicely. I am excited to see the game in action on Wednesday night. They are very enthusiastic about it. They are a positive influence in class and have demonstrated excellent leadership this week. Please encourage them to keep up the great work!

To: Multiple recipients

06 Feb, 2010 - Subject: *****

I just wanted to let you know that ***** had a better week. She was more organized and responsible with her work. Thank you for continuing to encourage her.

To: *****

02 Feb, 2010 - Subject: 8 White Night Projects

Good morning, At this point your child should be well into their 8 White Night Project for math. Some of them have very creative ideas and seem to be enjoying working on the projects. Please remind them to keep the display focused on what they have learned and stress that the project must connect back to the standards. Some of them are getting distracted by the creativity and losing focus of displaying their mathematical knowledge. I am looking forward to seeing you on Wednesday, February 10th for our 8 White Night display. Thank you, Courtney Mulcahy

To: Multiple recipients

26 Jan, 2010 - Subject: Peer Critiques

Today in class we anonymously critiqued classmates responses to an old MCAS Open Response Question that was assigned for HW last night. Your child participated very actively in the assignment and justified the scores they gave their peers. The room was buzzing with great math conversation. Please discuss with them "What makes a good response?" and ask them to reflect on their own answers. Ask them how they will incorporate these ideas into their future responses.

Thank you, Courtney Mulcahy

To: Multiple recipients

26 Jan, 2010 - Subject: Today's Math Class

I wanted to let you know that your child's written response from an MCAS ORQ assigned last night for HW was selected to discuss their responses strengths/weaknesses. Discuss with your child how he/she felt to have their peers critique their answers and what they can do to strengthen their responses in the future. Thank you, Courtney Mulcahy

To: Multiple recipients

25 Jan, 2010 - Subject: Upcoming Assessment

At the end of the week, we will be taking our unit assessment for the Pythagorean Theorem. The test will be given in two parts. Part 1 will consist of math computations and calculations. Part 2 is a written essay describing "why" and "how" the Pythagorean Theorem works. Many of the

students have a strong comprehension of the concept however have difficulty expressing their thoughts. Please encourage them to explain it to you "clearly" and "concisely" as this will help them prepare for their written essay. They more comfortable they feel talking about the topic, the more comfortable they will feel writing about it. Thank you for your continued support and encouragement. Courtney Mulcahy
To: Multiple recipients

25 Jan, 2010 - Subject: Assessment

Your child is bringing home an assessment from our "Thinking With Mathematical Models" unit. Please ask them to see the test and discuss some of the topics including inverse variation and line of best fit for linear models. We will be returning to these topics after our unit on Pythagorean Theorem so it is vital that they understand these concepts. Retakes are available if desired. Thank you, Courtney Mulcahy
To: Multiple recipients

25 Jan, 2010 - Subject: Outstanding Assignments

Your child has several assignments that are outstanding at this point. Please encourage them to be responsible and take initiative to complete assignments that are overdue. Additionally, encourage them to come and see me for extra help if they need clarification so that they can get caught up. Thank you, Courtney Mulcahy
To: Multiple recipients

21 Jan, 2010 - Subject: *****'s Math

Good morning, I am writing to let you know that ***** is doing a really great job in math. Earlier in the unit she expressed frustration, however her comprehension and confidence have significantly improved. She was on fire today! Tell her to keep it up! Thank you, Courtney Mulcahy
To: *****

15 Jan, 2010 - Subject: *****

I just wanted to let you know that ***** has been doing an excellent job in class. He has been working hard, advocating for himself, and actively participating. Please encourage him to keep up the great work! I am very impressed with him! Thank you, Courtney Mulcahy
To: *****

15 Jan, 2010 - Subject: Extra Help

Please encourage ***** to come in and see me when he needs extra help on his Assignments. He has not yet mastered a few assignments and told me that he doesn't understand them. I offered help to him but he has not yet taken advantage of the opportunity. Please encourage him to come and see me when he needs clarification. Thank you! Courtney
To: *****

15 Jan, 2010 - Subject: Math Test Tuesday!

Good morning, I am sending this message to let you know that your child has a Thinking With Mathematical Model Unit Assessment on Tuesday, January 19th. Please encourage them to study over the long weekend. Thank you! Courtney Mulcahy

To: Multiple recipients

11 Jan, 2010 - Subject: Assistentment

***** has been doing a much better job keeping current with her assignments since we have returned from Winter Break. She seems to be more organized with her due dates on Assistentment. Continue to encourage her to keep up the good work. Thank you, Courtney Mulcahy

To: *****

See who has viewed this message

11 Jan, 2010 - Subject: *****'s Math

*****, I just wanted to let you know that ***** is really doing a nice job on his Assistentment work. He is really taking his work seriously and striving to do well. Tell him to keep up the great work! Courtney Mulcahy

To: *****

See who has viewed this message

11 Jan, 2010 - Subject: Assistentment

*****, I just wanted to let you know that Nikki is all caught up on her Assistentment work. Thank you for encouraging her to get everything up to date. Tell her to keep up the good work! Thank you, Courtney Mulcahy

To: *****

11 Jan, 2010 - Subject: Over due Assignments

Good morning, I am writing to inform you that your child has some outstanding assignments. Please encourage them to come in for extra help if they are having difficulty mastering the work. Thank you, Courtney Mulcahy

To: Multiple recipients

Appendix C: Parent Feedback

Post-survey comments

We are extremely interested in how you feel about the parent notification feature of ASSISTment. Please take this opportunity to tell us what you liked about it as well as what you didn't like about it. We are also interested in what features and changes you would like to see (regarding parent involvement in ASSISTment). Did this feature cause you to log onto ASSISTment more often? Did you visit other parts of the site besides the message inbox? Do you feel it has increased your involvement in your student's education? Really any thoughts would be appreciated.

Positive

I do like the notification by e-mail that I have received. I like being informed on what is going on in the classroom. I have not received any notice of how well (or poorly) my son is doing. I

just assume that no news is good news. Maybe an e-mail of once every other week or even once every 3/4 weeks of a status update of how good/bad a student is doing.

The Parent notification feature does seem to be an efficient way of communicating information about math class. The emails do remind me to log in and check on what is going on.

I like the ASSISTment program. While I don't always have the time to check, when I do, I feel as though I am given a clear explanation of what he has been doing so I can go and discuss it with him. He always is willing to talk about the work with me and it helps to feel connected in what he does. I wish all subjects had this!

I really liked the notes sent by the teacher telling us what they did in class and what you might want to talk about with your child. It gives one more thing to try to connect with them at the dinner table. Thanks

As a working mother, I find the message inbox to be very helpful. ***** is a very independent child when it comes to his school work. I don't feel a need to continuously check his work. If he were struggling with it or not as diligent about getting his work done, having this program would be more useful to me to monitor his progress.

The program gives me the ability to observe the quality and quantity of nightly homework. I never have to worry about missing homework. Assistment is always available for past and future work.

I think the assistment program is great. It allows my daughter to see how she is doing and I love getting periodic updates from the teacher. I allow my daughter to be responsible for her own work and don't usually check up on her, yet I want to know when there is an issue or if she is having difficulty. Children her age don't want to have their parents watching their every move, so it is great to have the feedback from the teacher.

It is a very good program. In the least, the notifications help you remember your child's school work and I can be an active participant. Usually I wouldn't get involved unless there was a problem, and then it would be too late. This helps me track progress and interact as necessary. I only read the messages. I will look at other areas of the site.

I appreciated getting updates through parent notification.

I liked the parent notification feature. That message was often what prompted me to log in. Yes it increased my involvement. I was often concerned when assignments were marked 8 days late. When I checked with my child he said he didn't know why either and that "he was all caught up". Not sure where the confusion lies on this one. I haven't had a chance to follow up with Mrs. Mulcahy. I like assistment, but I will always feel that a phone call or personal email is better. Mrs. Mulcahy did initiate contact with me and I felt that if my child was in fact falling behind that she would have informed me of such.

It is a nice feature and helps us to know better the types of activities being done in class so we can discuss them with our children. I think this program is a positive step toward connecting families with the curriculum.

The parent notification feature is very good, keeps parents informed about what's going on in the class. I did not visit other parts of the site after reading the email messages, but if there is a more visible button to click, or a reminder about where to go to see my child's homework progress, it will be helpful. Also, if there is a "reply" button to send replies to the teacher, it will improve communication.

I think overall it is a great tool. The ease of use and functionality could be improved slightly. Or perhaps more parental training maybe a month into the school year. We saw it at curriculum night and I think if we received better training on how to use the site perhaps more parents would utilize and benefit. I think the self help hints for the kids when doing problems is fantastic. It makes it easier for a parent to remember the concepts from years back and help our kids.

Neutral

I did not find that the parent notifications added any significant information. When I logged in to read a message, I did not visit any other parts of the site.

I don't usually check on *****. I have seen her at the computer doing her homework. She seems to always get her homework done so I don't really need to give her an incentive. I suppose if she wasn't doing her work I would use the assisment more.

I did look to see what the messages where. I did not visit other parts of the site. It did not increase my involvement. I usually ask my son if he has homework but it is up to him to get it done. He usually tells me what is up.

I really only checked the site when I received the email from the teacher & clicked on the link provided. I have a great dialogue with my daughter about her homework & she's very responsible about keeping up on her own. But otherwise I could definitely see a real benefit with a student who doesn't communicate about homework or who struggles with the assignments. This info would be very helpful for a parent.

It seems the system was down for a bit. I liked the teacher comments. not sure I understood the system when I went to the website, I could see what he got right or wrong but not the process.

Pre-survey comments

Do you have any comments regarding the questions asked in this survey? Do you want to share with us your opinion about the appropriate level of parent-teacher communication? Any other thoughts you would like to share are welcome.

Supportive of more communication

It should be made compulsory by school and class teacher to write the home work on planner and asked them to get signed by their parents and next day that should be cross checked by teacher to make sure that parents are getting aware what the teacher and students are doing in a class.

While feedback from the report card is great, it would help me immensely to be able to view the graded assignments and homework that my child does to better assess how he is doing and what help he may need to do better.

Neutral

Nothing at this time - Thank you

My daughter, *****, lives with me every other week, and likewise with her mother. She has never told me about ASSISTment, so I must conclude that she has told her mother. I will ask her to bring me up to speed next week. I do, however, ask her about all her homework on a daily basis.

Needing reminders due to busy schedule

Teachers have been very communicative with me, and that has been the single most effective way for me to become aware of how my son is doing in school. I had difficulty with the question about frequency of checking up on *****'s homework. I *ask* him about it daily, and believe it is my job to do so, but due to my work schedule and other responsibilities, I simply do not have time to sit down every day to review his homework thoroughly and correct it. He knows that if he needs help with something specific, I will make time to sit down with him. At 14 I believe that he is able to understand when he needs help and seek it out. If teachers feel that he needs extra help at any time, I will arrange to get him to school. I think there may be an unrealistic expectation about how much time working parents can put into homework. I think the OMS teachers are doing a great job of communicating with me and I appreciate it very much.

I like it! Thankfully, we have the technology in our home. And although, I rarely check it, My husband does and has helped Jacob on it from Germany. One Saturday for an hour and 1/2 his father tutored him while on Skype while having assistment up and running at the same time. It was great! I still appreciate emails from the teacher letting me know if he has fallen behind. Everyone's lives are busy. If I don't hear from the teacher. I assume that my child is pulling 3's and 4s. I'd like him to be in honors math next year, I feel he rises to the occasion of which he is challenged.

I like the concept of the Assistment math. I find my child more willing to ask for assistance than he would with traditional paper and pencil tasks. The forced repetition of content not mastered is excellent and exactly what my child requires. At one point this year, my son had neglected some assignments--I had not checked since he had not asked for any help or clarification. My assumption was incorrect and I found out that he actually neglected a large number. If possible earlier notification via email if x number of assignments are neglected would help. Or perhaps a quick email summary at the end of specific content sections would help. Although I am aware I can access this information myself, with three children and work it can slip one's mind. Thank you, I think the program is very worthwhile.

Criticism of ASSISTment or communication with teacher

I still very frequently have to help with Assistment problem interpretation (unclear or incorrect problems, etc), and system glitches. I can see how things are going via the current communications and homework, but I have little visibility into how well he actually likes the Math classwork, even though he always seems to do well. Other than that, the communication level is very good. More needs to be done to show how the math they are learning is relevant to the real world - that might improve the "Likes Math" rating. Clearer communication at the beginning of the year (and throughout, for that matter) as to how parents and the students should treat both difficulties with the homework and Assistment errors would also help.

I believe that ***** makes good use of assistment but I also think she is frustrated when she is not sure about how to solve the problems and she feels that she needs more reinforcement in class in regards to the problems given on assistment on a given day. I try to help her as a parent but do not always teach her the same way she is learning in school. Thank you!

My son has expressed some frustration with ASSISTment and the way it functions. There are many glitches that cause him to need to do more with the system, especially if an answer is not accepted although it was correct. He expresses his fears that his work and mastery may not be adequately captured and reported. He has notified Mrs. Mulcahy and believes that she reported the problem and the system has been corrected at this time. As a parent, I like the idea of ASSISTment and the way it helps students organize their thoughts and address math challenges, especially if they are initially unclear on the correct approach to a problem.

When my son first signed up for assistment I checked his progress. He felt I was spying or checking up on him so I stopped. My son regularly lets me know what he is studying in Math and how well he is doing on his own. The only problem with Assistment at this stage is that there are still bugs in the program. One instance my son asked me to solve a particular problem. I got the same answer as he but it was marked incorrect in ASSISTment. This has happened more than once. I think the ASSISTment program is a good one but it still needs work. I know my son has gotten very frustrated working on the program and would prefer to do the problem on paper.

We are concerned that today we found out that past assistments were never done. The teacher never sent us an e-mail for past assistment and our son at the time stated that it wasn't assigned. Tonight we cleaned up from the fall.

No commentary re: the survey questions. Limited contact from all teachers in all subjects at this point in his educational career.

I think assistment is not too forgiving, at least according to ***** . She has told me if she makes typographical errors that she'll be marked incorrect, as it is difficult to correct the error. Also, as I brought up in the teacher conference, ***** is often quite challenged on Assistment, and doesn't necessarily score too well, but then performs fine when it comes time to take tests. So, I presume this is a good place for her to be learning from her mistakes, but the assistment questions seem quite challenging for ***** . She'll typically tell me how many she got right, whether or not she understands why she got certain ones wrong, and then she'll sign off on my behalf.

I think the assistment program is great, but I'm not sure that my son would agree with me as he thinks it just adds to his load of homework or takes away from his free time. I have noticed some frustration with him when there is a problem with assistment and sometimes I have seen the assistment program ask for an answer that was wrong. For example when rounding decimals it tends to round down when the decimal should actually be rounded up. It also is sometimes unclear when the student should use 3.14 for Pi or not. I still think it is a great learning resource and with some improvements it would be even better. Thank's to Ms. Mulcahy being the first math teacher in middle school to make math teaching and learning enjoyable! It is truly a pleasure to not have to pressure my son to try to learn math and do the homework as he seems to enjoy it now!

Student is mainly independent, might be useful for others

I probably would be more interactive with Assistment if ***** was having trouble but she seems to be doing well. She generally wants to be independent with her school work and prefers to give me periodic appraisals of it!

I think the assistment program can be very useful, but it really depends on the child. My daughter, *****, takes her studies seriously. She has always put in her best effort and her grades reflect that. I do reward her when she gets a "4" on her report card. If she is struggling in a subject, I would certainly contact the teacher and check in with her more. This year she has been doing quite well and has really done all of her work independently. My son has a different style of learning which has required a great deal of contact with his teachers via email. Assistment would have been very useful for him. (He is a freshmen at *****'s. So, my point is, certainly the ease of communication is helpful. However, some students need it more than others.

I like to know if there is a problem with him not doing what is expected, but I don't believe it is in anyone's best interest (at least for Luke) that we (his parents) are too involved. He always does his homework without us asking him to, and he responds best to consequences at school if it is not done. If he doesn't understand something he will ask for help (rarely), but we let him decide when he needs help. This is what works for us.

I feel that it is *****'s responsibility to get her work done on time and correctly, so I very rarely get involved with her work. She knows that I will help her understand something if she has a question about something. She also understands that I expect her to do her best every day in all her subjects.

I appreciate the "heads up" from Ms Mulcahy. ***** is now in 8th grade and we are trying to walk that fine line of having her accept more responsibility but also hold her accountable. I feel if there is a general pattern of poor performance the teacher or the report card will notify us.

Positive feedback regarding ASSISTment or communication with teacher

I like the assistment features as it gives me a chance to see that my child is doing her work and what kind of work she is producing. I would like to see this type of monitoring for all her subjects. Also, it would be nice to have a section for her "at the present time" grade average. I feel this is a great program and excellent tool to see how your child is doing.

It's good to have a survey like this. It brings to the front any differences of how the process works and how I think it works.

I happen to be a high school math teacher, therefore I often get involved with *****'s homework, especially math. This seems like a good program,, ***** likes it. Assistent has been a good tool for ***** to self-check - especially using the hint/clue feature when she is stuck or gets a problem wrong. I (and she) like that it can prompt her, so she immediately sees what specifically she is doing wrong. As for ***** not liking math, as I indicated above - through the years she has always been overwhelmed by math and lacks self-confidence. Her learning style is to work at a slower pace with more check-in than an honors level class is designed for. I'm glad to see though that she seems to be performing at an acceptable level, and I do believe the challenge presented through the honors level has been good for her.