

THE IMPACT OF COMMUNICATION APPS ON STUDENT PERFORMANCE AND
ACCOUNTABILITY

by

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ABSTRACT

The purpose of this study was to determine whether the implementation of the communication app, BAND, in the science classroom would increase student performance and accountability. The BAND app was added to parents' phones or computers to receive updates and messages from the teacher in the science classroom. Students of the 2022-23 (pre-treatment) school year were compared to the students of the 2023-24 (post-treatment) school year. Quarterly grades, surveys, interviews, missing assignments, as well as parent, student, and teacher quotations were all analyzed to determine any gains. The analyzed data indicates that there was no significant increase or decrease in student performance. Qualitative data showed an increase in communication and positive relationships between home and school.

INTRODUCTION AND BACKGROUND

Context of Study

Whitewater Public Schools, located in Whitewater, MT, facilitates kindergarten through 12th grade. The school has an enrollment of 45 students and employs 13 teachers. Whitewater is a rural farm and ranch community of about 100 people, 73% of the community being white and 27% American Indian. Whitewater has a young demographic, with most people under the age of 35. Many locals are employed as teachers, bus drivers, and coaches at the school. The majority of household incomes fall below \$60K (Areavibes, 2022).

I have been teaching at Whitewater Public Schools for six years. I teach sixth through twelfth-grade sciences. These courses consist of general science, physical science, biology, chemistry, and health. Throughout my six years of teaching at Whitewater, I have conducted a total of 12 parent-teacher conferences. I usually do not see more than three out of 20 sets of parents during those conferences. We have struggled with parent participation when it comes to parent-teacher conferences and have tried different methods to boost these numbers. So far, we have had little luck with parents being involved in their child's education.

An online communication app is a method that many schools are implementing in their classrooms to bridge the gap in teacher-parent communication. Research studies show much success when implementing a communication system for parents and teachers to communicate throughout the school year. This is something I was interested in trying in Whitewater, and hopefully, would see the positive results that so many other schools are seeing.

Focus Statement

The purpose of this study was to evaluate the impact of parent-teacher-student communication through the use of an online app on student performance and accountability. My main research question was: Does the implementation of an online communication app impact student performance and accountability?

My sub-questions included the following:

1. Does the use of a communication app increase student performance and grades?
2. Does the use of a communication app increase parent interest in the classroom?

CONCEPTUAL FRAMEWORK

Effective Communication

Communication has made leaps and bounds from more historical forms of communication, such as letters and scrolls, to more modern forms such as cellular devices and the internet. It has gone from slow and individualized, to rapid, efficient, and able to reach masses of people. According to an article in Britannica, communication is defined as the exchange of meanings between individuals through a common system of symbols (Gordon, 2023). One mind must be influenced by another mind to find a common understanding between the two. Communication in the 21st century relies largely on visual communication as opposed to print communication. Therefore, an online communication app is ideal for current social standards.

Numerous social scientists have studied communication and the effects it has on human disposition. The father of the science of Cybernetics, Norbert Wiener, was a famous mathematician of the 19th century, and an expert on engineering and human communication. He predicted the achievements, as well as the downfalls, that society would face with the increasing use of technology (Norbert Wiener Learning Center, 2016). Norbert studied the effects of increased feedback on communication. He emphasized the importance of clarity for the sender and receiver, and their ability to alter the original message if misunderstood by the sender. Feedback is so important when it comes to effectively communicating with others. If a communication app is implemented, then immediate feedback can easily be obtained.

Effective communication can be defined as two or more people who can clearly express their intent and understand the focus or purpose of the conversation, while also allowing each

person to get their point across (Buckner, 2023). Effective communication is critical in a K-12 setting and relies on demonstrating understanding to improve student productivity; preventing conflict to increase positive behavior and attitude; improving engagement to help promote collaborative work between the student, parent, and teacher; sharpening problem-solving skills that can lead to increased transparency between the student, parent, and teacher; and increasing the opportunity to gain trust and respect between the individuals involved. An increase in communication between individuals involved in the classroom can lead to a positive atmosphere of optimal learning and a better relationship can be formed and nurtured (Buckner, 2023).

Closing the Gap

Researchers have theorized that there are multiple reasons why a performance gap exists between students who struggle and students who excel (Cooper et al., 2010). The gap can be blamed on poor economic standings or cultural backgrounds that cause barriers in the classroom. Some propose that this performance gap can be attributed to the lack of parental involvement with students at home. It is possible that all of these factors can be related in some form or another. Studies show considerable evidence that parental involvement has a direct effect on the success of students in the classroom. In addition to parental involvement, the relationship with educational staff is imperative and promotes academic achievement. An increase in communication between students, parents, and teachers promotes this achievement (Cooper et al., 2010).

In more recent years, the implementation of technology has increased in the classroom to help bridge the gap between parents and teachers to promote success for students (See et al., 2020). The choice to use technology is parent-dependent. Studies have shown that the

implementation of technology, to reach out to parents, has had a positive correlation between struggling students and the improvement of grades. The act of using technology to promote clear communication keeps parents abreast of their children's academic progress. However, this does not hold true for students who are already doing well (See et al., 2020). Therefore, integrating a parent-teacher communication method would be ideal to bridge the gap between lower-performing students and on-level students. Keeping parents up to date with classroom activities, progress reports, and test schedules can increase the likelihood of struggling students succeeding in the classroom.

Increase in GPA

In one study, researchers implemented an online communication center for teachers, parents, and students (Zappe et al., 2002). An overall increase in Grade Point Average (GPA) was seen for the students who utilized the program. The students who utilized the online program to keep track of grades, assignments, and communication with their teacher, as well as parents, showed an increased interest and investment in taking control of their education. Students also showed more motivation and engagement in class based on the use of the online communication platform (Zappe et al., 2002).

Similarly, educator Marilyn Raming (2022) found a direct positive correlation between teacher communication with students and parents, and an increased GPA when implementing a communication program with the school's 9th-12th grade students. Certain communication methods showed a positive correlation to GPA and student achievement while others did not. A positive correlation between GPA and students who participated in weekly web conferences was found, as well as with GPA and students who expressed positive feedback about the platform.

The method of note outreach had no correlation, but it received positive feedback. A positive correlation between GPA and overall communication methods used during the study was established. While certain methods excelled, cell phone mediums were not associated with a noticeable improvement or increase in GPA (Raming, 2022). No significant correlation was found between students who used email as a source of communication and GPA, although students did provide positive feedback for email use. A negative correlation between GPA and text messaging was found, although it did elicit positive feedback from students. Surprisingly, no correlation between phone calls and GPA was found; however, it did receive positive feedback. In Raming's (2022) personal experience of implementing the communication program, the most successful form of communication was text messaging when it came to student-parent response and timing. Although there is not enough data to reinforce a consistently positive correlation between specific sources of communication and GPA, overall positive feedback was seen as impactful on student growth in the classroom.

Increase In State Testing Scores

Jill Ashbaugh (2009), who performed a research study on parental involvement and student success, showed a significant increase in state testing scores, after implementing a communication program within the classroom, for students and parents in grades four through six for reading and math. This parent partnership program was set up to increase state testing scores by sending home weekly packets and online information to help parents assist their child with practice problems similar to the ones that would be seen on the state exam. Students whose parents chose to participate in the program had an overall high score that increased over four years. As expected, students who did not take part in the program did see an increase in scores,

but the increase was not nearly as drastic as for those who did participate. Ashbaugh (2009) saw increased state testing scores but did not see an overall significant difference in increased proficiency. The increased performance was correlated to the implementation of a communication program.

Another medium of communication that was researched used monthly informational progress packets. A parent-teacher communication system that was implemented for a total of six months involving sending out monthly information on student progression, assignments, tests, and other classwork had positive effects on the students' grade point averages, as well as on the state tests taken every year to assess student growth (Bergman, 2015). This study also found that student absences decreased alongside increased parental contact with teachers. In conclusion, after the research was analyzed, a positive correlation was found between increased communication between teachers and parents and student progress and GPA.

Positive Relationships Between Parents and Teachers

In Raming's (2022) study, parental satisfaction with the school was influenced by communication about the students and communication between teachers and parents. Attempted standard forms of communication that are now being used between the teacher and parents are emails, phone calls, and text messages. A new form of communication is the implementation of classroom apps that allow parents to be involved with what students are learning and to receive weekly grades or behavioral reports. As discussed earlier, email and phone conversations have shown no positive correlation with increased efficiency in the classroom for students (Raming, 2022). A classroom app, easily accessible to parents and students, could produce the growth that

is needed to show positive correlations by having an accessible bridge to communication and keeping parents updated on student progress, grades, and areas of concern.

When implementing a parent and community involvement program, using school-based mentoring with students, this form of communication helped bridge the gap between students, teachers, and parents when it came to communication and positive relationships (Arledge, 2019). Through teachers' methods of meaningful communication, the most successful being texting, teachers were able to build stronger, better relationships with their students' parents. When post-implementation surveys were sent out, parents had an overall increased positive outlook on communication with the school, and on their relationship with the teacher and school. In addition, parents suggested quality feedback on other areas that could be improved such as quicker responses from teachers, a monthly newsletter, and the need for more academic conversations about their child. The researchers struggled with getting 100% participation from students' parents because a large number of parents chose to not participate in the program (Arledge, 2019). Parents need to communicate with teachers because parental involvement in their student's education is critical to their success.

Through research, the use of technology in classrooms showed increased academic success as evidenced by increased GPA and standardized test scores. Parents have shown a negative view toward face-to-face communication as well as phone calls and emails. These findings have encouraged us as teachers to make changes in the way that we communicate to increase students' success rate in the classroom. Communication apps encourage the fostering of meaningful relationships between teachers and parents to increase student progress and efficiency by keeping parents updated and aware of their students' academic standings and areas

where improvement is needed. Communication apps are popular and should be encouraged to use in the classroom to keep parents interested and informed about their child's education.

METHODOLOGY

Treatment

The study involved 6th, 7th, and 8th -grade junior high science students as well as 9th-grade physical science, 10th-grade biology, 11th-grade chemistry, and 12th-grade health students ($N=18$). This area of the school was split between 50% female and 50% male students. Eleven percent of the students were American Indian and 89% were white. The average salary of the students' families was approximately \$50,000-\$60,000. The study focused on using an app to communicate with parents throughout the school year, as opposed to during two parent-teacher conferences with low attendance.

The treatment used for this study was a free application of the BAND app for communication with students and parents. This research study was completed over six months. The BAND app allowed for posting of daily activities, photos, updates on current studies, scheduled quizzes and test days, and personal messages. The students and parents who chose to participate in the study downloaded this free app onto their phones or computers and received updates on weekly class activities and progress reports once a month. The amount of contact between students, parents, and the teacher was documented. The results considered quarterly grades based on the implementation of BAND compared to the student's previous school year quarterly grades, as well as the progressing quarterly grades during the current school year. Interviews and surveys were conducted pre- and post-treatment to evaluate student and parent experiences towards the school and towards communication efforts. These qualitative interviews and surveys were categorized by positive and negative experiences.

The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for work with human subjects was maintained (Appendix A).

Data Collection and Analysis Strategies

The data collection instruments used were pre- and post-communication surveys, communication interview questions, journal entries, a science motivation questionnaire, and the evaluation of quarterly grades. The surveys and interviews were sent out pre-treatment as well as post-treatment. The journal entries were written throughout the research study and the science motivation questionnaire was sent out pre-treatment.

The Science Communication Parent/Student Surveys were given out to students and parents to assess their personal views on communication with the school and their science teacher. The surveys asked students to rate how much they agreed with a statement on a Likert scale of one to five, strongly disagreeing and strongly agreeing respectively. Surveys included statements about how often they heard about science class, what events were going on in science class, and the level of communication between students and the school. This was done to assess the level of communication and what type of relationship was currently present between the students, parents, and the science classroom. Additionally, Science Communication Surveys were given towards the end of the school year to assess whether there were any changes in the communication and relationship of the student, parent, and science classroom after implementing the BAND app. The data collected from the survey was put into an Excel spreadsheet and analyzed to see if students expressed increased or decreased communication from the beginning of the school year to the end. An emergent thematic analysis was done on the data to view

patterns or trends. Charts were made to show metrics and tracked changes in communication for parents or students (Appendices B & C).

The second tier of the research project was capturing qualitative findings via interviews pre- and post-treatment, administered by both parents and students. Science Communication Interview questions invited the students and parents to write down their thoughts about how well they communicate with each other and were distributed simultaneously with the communication surveys. This gave individuals the opportunity to relay any information that the communication survey may not have let them expand on and to expand on other requested information about weekly science classroom events. The interview questions consisted of asking how often parents discussed science class with their child, and whether communication had improved as a result of the BAND app. Each response to the interview questions, ranging from yes, no, maybe, sometimes, and I don't know, was manually entered into an Excel spreadsheet, and emergent thematic analysis was used to analyze the data (Appendices D & E).

Students were provided a final opportunity to convey their perceived experience about science class. The Student Science Motivation Questionnaire was a metric to define personal pursuits in science class, the amount of effort given for tests and daily classwork, and perceived feelings about class experience. The Motivation Questionnaire evaluated how students value science, studying for science, and the efforts put forth for science class. Statements such as "science is relevant to my life" and, "learning about science is interesting" were included. Students were allowed to score each statement on a Likert scale 0-5, from never to always. This questionnaire gave an idea of how much students value their time in science class. They were

sent out on a Google form so that students could anonymously respond. Bar graphs were created to visualize the data (Appendix F).

As the school year progressed, personal journal entries from the teacher documented the progress of the implementation of BAND. The journal entries were analyzed using anecdotal observations. Quarterly grades were assessed to see if there was a correlation between communication and the students' grades compared to the prior year when no communication app was used. Grades were also compared to each other as the treatment school year passed to monitor progressive changes. The quarterly grades were compared side by side in Excel. Grades from both years were then input into a chart to visually depict any changes that were seen after implementing the BAND app. Grade differences from quarters two to three of this current school year (August 2023 - May 2024) were also put in chart format to document changes. Normalized gains and effect size were used to analyze quarterly grade differences. A triangulation matrix shows how the focus questions of the research were addressed (Table 1).

Table 1. Triangulation of data sources for each focus question.

Focus Question	Data Source	Data Source	Data Source
<i>Research Topic:</i> Frequency of communications' effect on students' grades	Online app program data (Band)	Quarterly Grades in Infinite Campus 2022-2023 vs. 2023-2024	Quarterly Grades in Infinite Campus (comparison of 2023/24 Quarter 2 and 3)
<i>Subtopic:</i> Frequency of communications' effect on student's attitudes towards science	Online app program data (Band)	Science Communication Interview- Parent Science Communication Interview- Student	Student Science Motivation Questionnaire
<i>Subtopic:</i> Parents' and students' views towards communication and relationship with the school	Science Communication Parent Survey Science Communication Student Survey	Science Communication Interview- Parent Science Communication Interview- Student	Teacher journal entries

DATA ANALYSIS

Results

The results from the motivational questionnaire sent out to students' pre-treatment indicated that 60% of students thought that science was relevant to their lives either always or often, and 40% chose sometimes (Question 1) ($n=15$). Fifty percent of those students also chose always when asked if learning science was important for getting a good job, 40% chose often, and 10% chose sometimes (Question 5). When asked if it was important that they do better in science class than other students, 50% of students chose that this was always important, 10% often, 20% sometimes while 20% of students chose that this was rarely or never important (Question 2). The statements, "learning science is interesting" (Question 3), as well as "I study hard for science" (Question 8) both had similar results showing that 50% of students chose always. Seventy percent of students always thought it was important to receive a good science grade, while 20% chose often and 10% chose sometimes (Question 4). Sixty percent of students marked that it always mattered to score high on science tests (Question 6) and quizzes as well as receive an A (Question 10) in science class, while the remaining 40% chose often. Fifty percent of students always study hard to learn science, 20% often, 10% sometimes, and 20% rarely study hard (Question 8). Students were asked if science would be involved in their future choice of career and only 10% of students chose always, 40% often, 40% sometimes, and 10% rarely (Question 9). Students indicated that 40% rarely prepare well for tests and quizzes, while 40% often prepare well, and 10% either sometimes or always (Question 7). The stacked columns display the choices chosen by students for the motivational questionnaire (Figure 1).

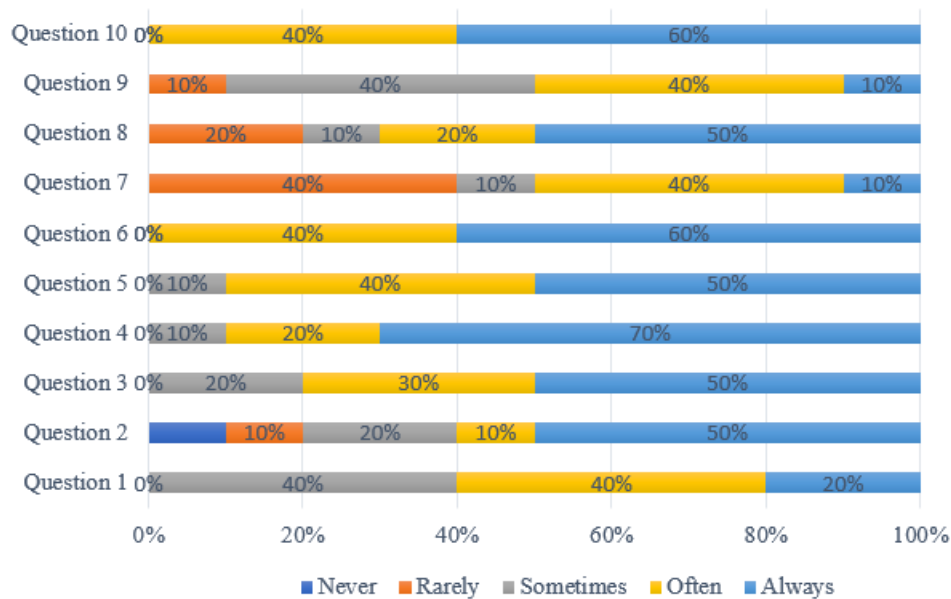


Figure 1. Motivational Questionnaire given to students' pre-treatment to assess values in science class, ($n=15$).

Communication Surveys showed varied responses and no significant gain. When asked if students enjoyed science class, results showed a decrease of 14% when strongly agreeing, and a 7% increase of agreement (Question 1) ($n=15$). Eighty percent of students agreed that they enjoyed science class. An increase of students, from 20% to 60%, strongly agreed that they were aware of what was going on in science class each week, while the remaining 40% agreed with this statement (Question 2). This showed an overall increase in classroom awareness. When asked pre-treatment if students knew when they had late assignments 73% strongly agreed, 7% agreed, 13% were neutral, and 7% disagreed (Question 3). Post-treatment, an increase in agreement was seen as students answered that 67% strongly agreed and 33% agreed that they knew when they had a late assignment. No change was seen with question four, with 67% saying they strongly agreed, 20% agreed, and 13% neutral, about knowing when a test or quiz was being administered the next day. An increase of 6% was seen for students strongly agreeing that

they were aware of homework in science class, growing from 67% to 73% of students, meanwhile, the remaining 27% agreed (Question 5). There was a slight decrease of 13% of students strongly agreeing about their satisfaction with the level of communication between the science class and themselves, lowering from 73% to 60% (Question 6). Twenty-seven percent remained consistent that they agreed with this statement and 13% of students became neutral with their response. When asked if they had a good relationship with their science teacher, an overall increase of 6%, from 67% to 73% of students strongly agreeing, was seen (Question 7). Seven percent more students agreed and 13% fewer students answered neutral to this statement. The normalized gain of the Student Communication Survey was assessed to be -0.203. This number showed that there were no significant changes from pre- to post-survey for students after the implementation of the BAND app. Although, one student stated, “My mom is always letting me know when I have a test or quiz coming up to make sure I studied”. Then, “My mom asks a lot more about class than she used to”. The following table shows the pre-and post-treatment survey responses for students (Figure 2).

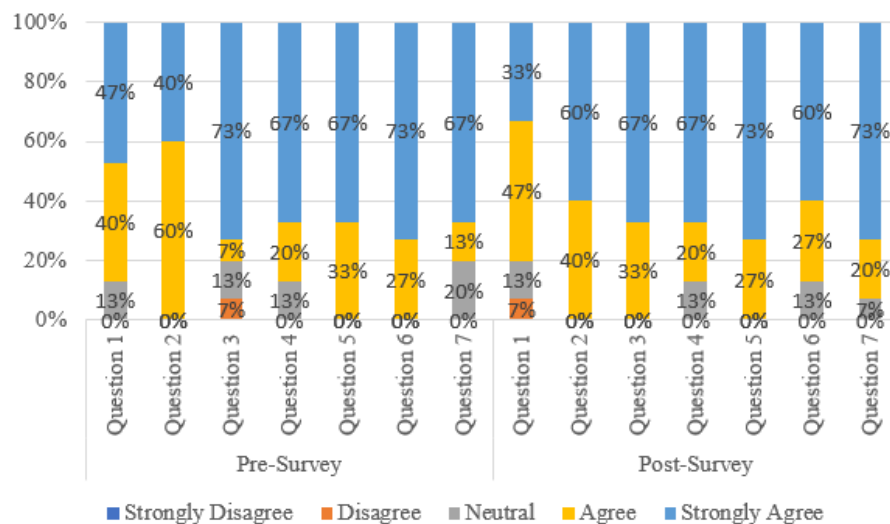


Figure 2. Pre- and post-survey responses from science students, ($n=15$).

Parent Communication Surveys showed no significant increase in awareness about science class activities and had mixed responses. Not all parents participated in the surveys. When parents were asked pre-treatment if they enjoyed hearing about science class from their students, 75% strongly agreed, 13% agreed, and 12% of parents strongly disagreed (Question 1) ($n=8$). After treatment was administered 50% either agreed or strongly agreed. Thirteen percent of parents also answered neutral, 12% disagreed, 25% strongly agreed, and 50% agreed to be aware of what is going on in science class each week (Question 2). Post-treatment, they became 50% neutral and 50% strongly agreeing. All parents became neutral to question three, “I know when my child has a late assignment” after treatment. They also all became neutral to question five, “I know when my child has homework in science class” post-treatment. Pre-treatment parents had mixed answers for knowing when tests were scheduled (Question 4). After treatment 50% of parents strongly agreed and 50% of parents were neutral. Pre-treatment, 88% of parents strongly agreed that they were satisfied with the level of communication with the school leaving 13% stating that they agreed (Question 6). Post-treatment results showed 50% strongly agreeing and 50% agreeing. For the final question, “I have a good relationship with the science teacher”, 88% strongly agreed and 13% agreed with pre-treatment. Post-treatment showed an increase of 12% strongly agreeing, coming to a total of 100% (Figure 3). The normalized gains of the Parent Communication Survey showed a low score of -0.12. This gain showed that there was no significant increase in communication due to the BAND app. However, parents did respond to messages with positive feedback. One parent stated, “I appreciate you taking the time to send updates”. Another parent said, “I love the app you are using! Every teacher in the school should have it!”.

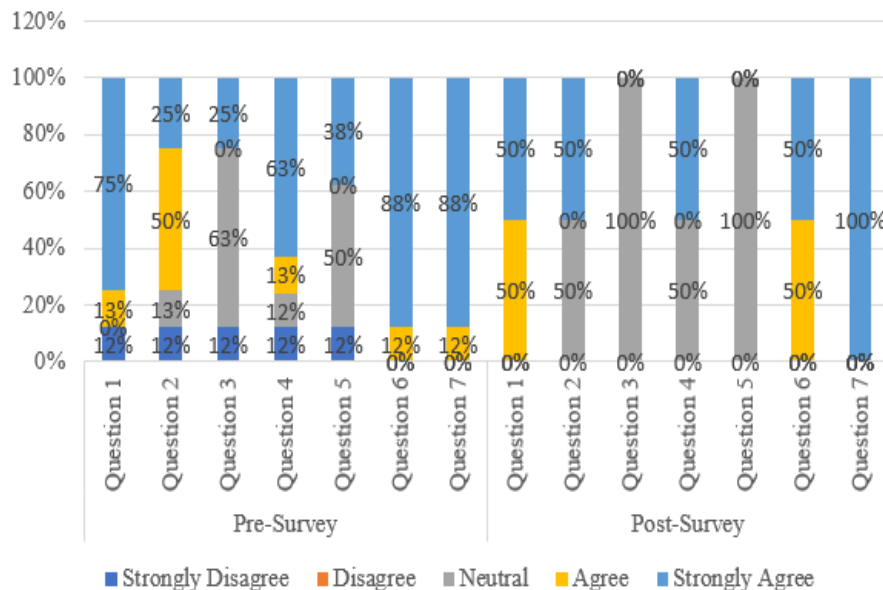


Figure 3. Pre- and post-survey responses from science parents, ($n=8$) ($n=3$).

Communication interviews showed an increase in students communicating with their parents about science class. When asked how often students discuss science class with their parents, 27% of students originally answered never and after treatment, 0% answered never (Question 1) ($n=15$). Forty-six percent of students went from answering rarely pre-treatment to 67% post-treatment. There was also a 6% increase seen for once a week, making it 33%. Students were also asked who initiated the conversation about science at home and an increase in the answer “student” was seen (Question 2). A 7% decrease for neither was seen, ending with 20% post-treatment. Forty percent of students who answered parent pre-treatment decreased to 20% post-treatment. There was a 27% increase in the answer of students initiating the conversation, ending in 60% of students. When asked if communication had changed due to the BAND app, pre-treatment a large increase in yes was seen (Question 3). Pre-treatment, 13% said yes, and 87% no. Post-treatment, responses changed to 60% yes and 40% no (Figures 4-6).

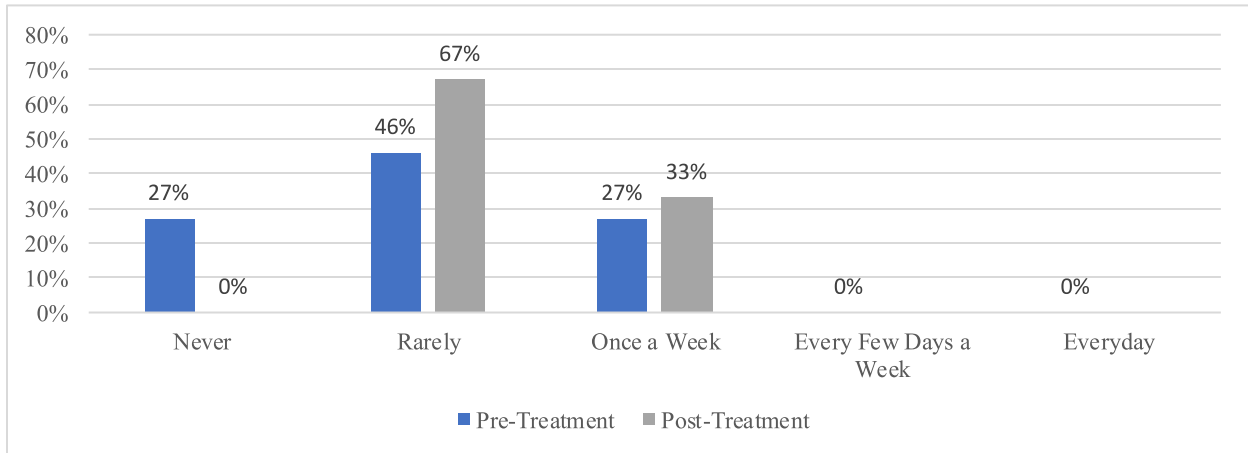


Figure 4. Frequency that students discussed science class with their parents, ($n=15$).

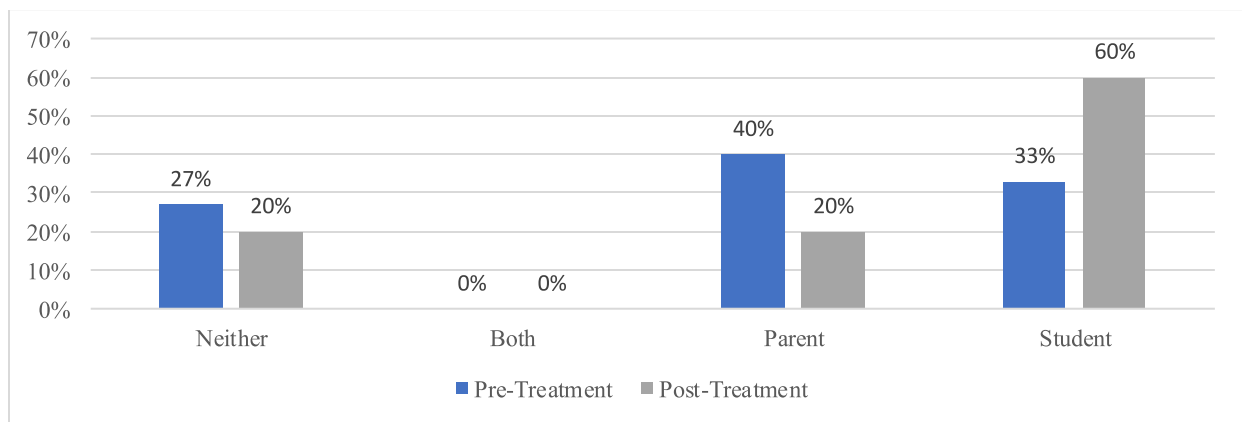


Figure 5. Who initiates conversations about science when at home, ($n=15$).

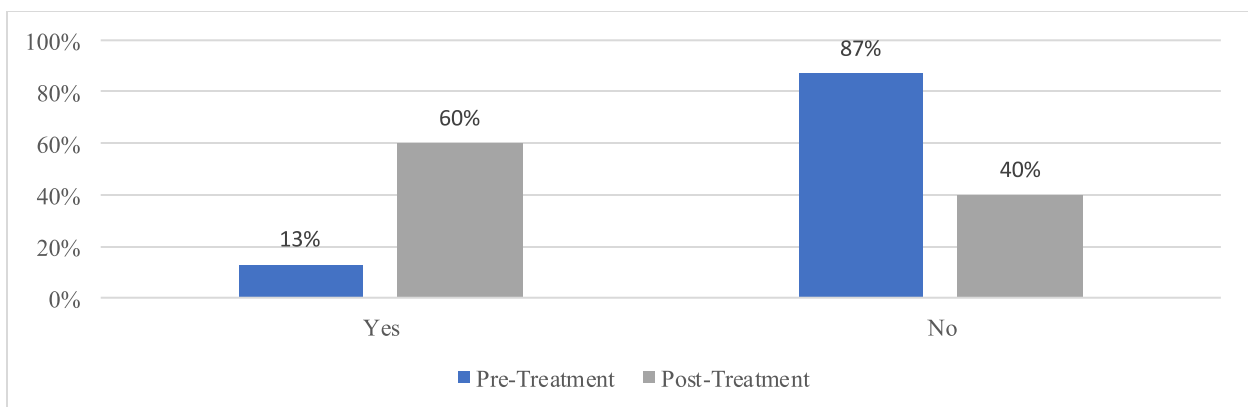


Figure 6. Whether or not communication has changed due to the BAND app, ($n=15$).

Parent Science Communication Interviews showed an increase in student initiation of science conversations at home. Only six parents participated in the interview questions. Parents were asked how often they discuss science class at home with their students (Question 1). Answers consistently stayed at 17% for both pre-and post-treatment for each answer of “never”, “every couple of weeks”, and “every day” ($n=6$). There was a 17% increase for “once a week” and a 17% decrease for “several times a week” (Figure 7). Parents were then asked who initiated the conversation about science (Question 2). Seventeen percent of parents answered “neither” pre-treatment and this dropped down to 0% post-treatment. The answer “both” consistently stayed at 17% for both pre-and post-treatment, as well as “parent” stayed at 67%. However, a 17% increase in the students initiating the conversation was seen (Figure 8). When asked if communication had changed due to the BAND app, answers consistently stayed at 50% yes and 50% no for pre- and post-treatment (Question 3) (Figure 9).

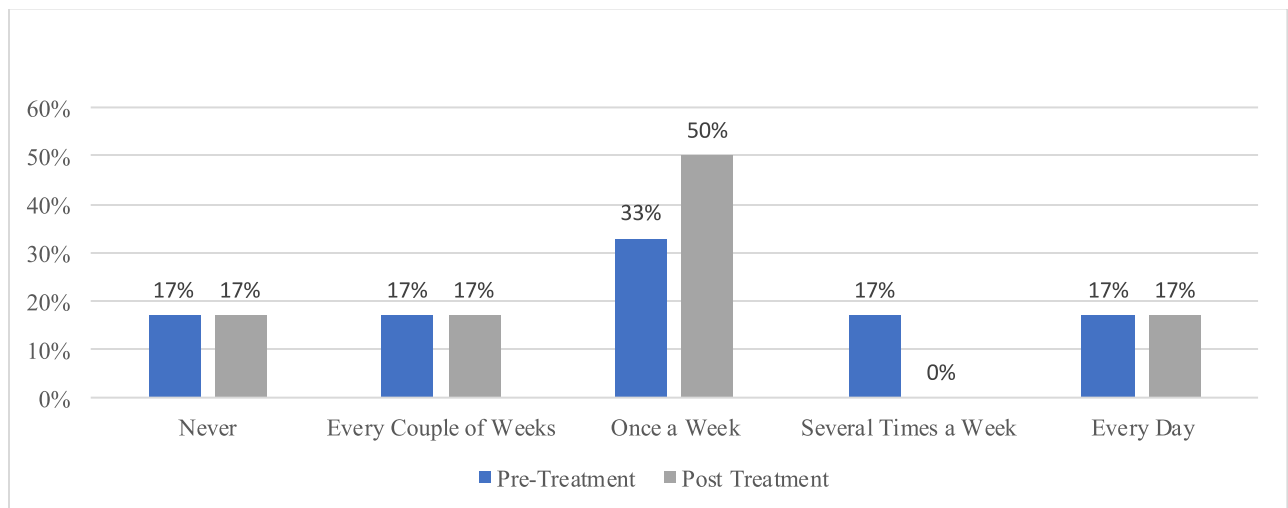


Figure 7. How often parents discuss science class at home, ($n=8$) ($n=3$).

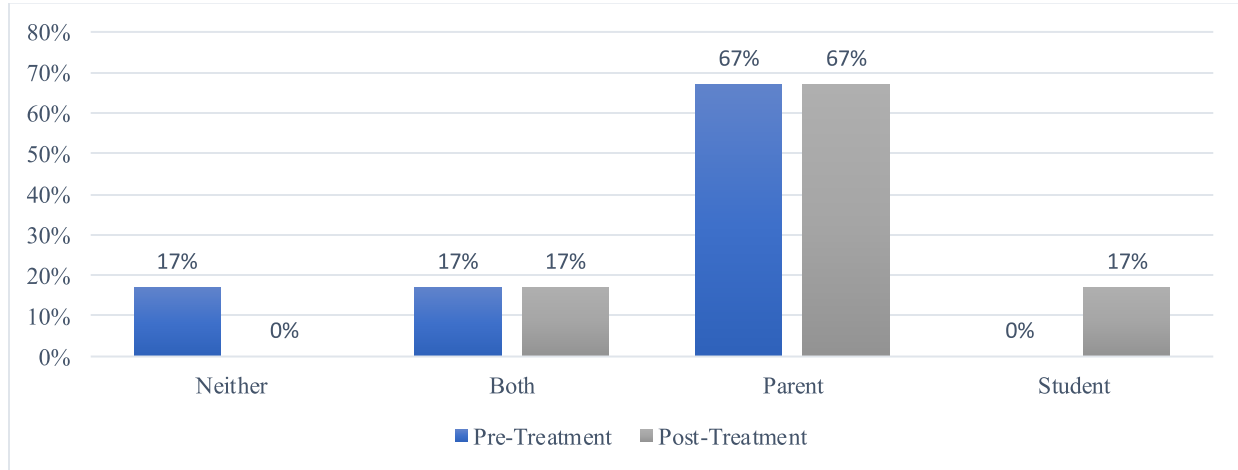


Figure8. Parents were asked who initiates the conversation of science class at home, ($n=8$) ($n=3$).

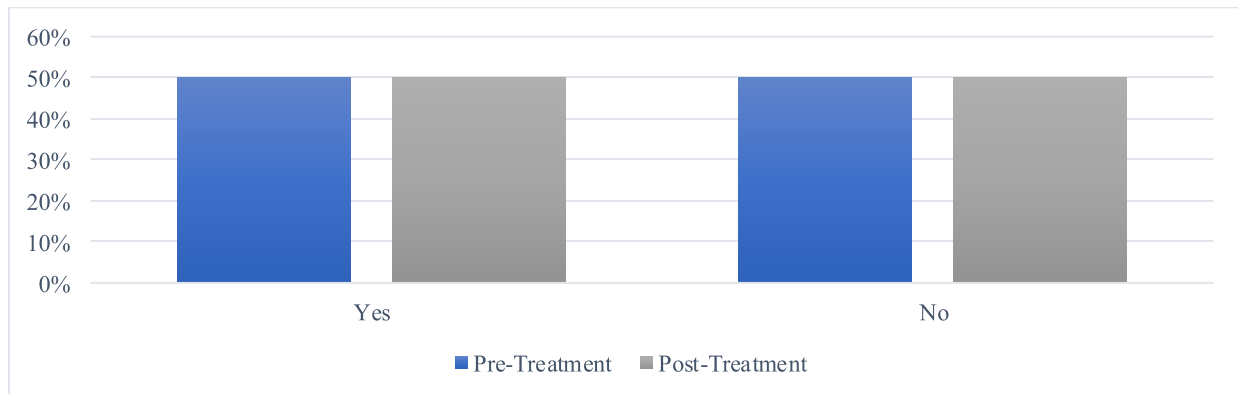


Figure 9. Parents were asked if communication has changed since the implementation of the BAND app, ($n=8$) ($n=3$).

Throughout the research of the implementation of the BAND app, data from the app itself was tracked and recorded. It was possible to track if parents had viewed a posted photo or video, scheduled test or quiz, read a monthly progress report and responded to messages, or viewed a topic update post. Every view or response was recorded. The sixth-grade science classroom page showed that 50-100% of the monthly progress reports received a response from parents ($n=4$). These progress reports were sent every month from September through February. Thirty-eight to 75% of the photo or video posts were viewed during these months as well. The few miscellaneous messages that were sent went from a 75% response rate down to a 25% response

rate by February. Quiz and test event schedules ranged from a 0% view rate to a 38% view rate during the time that BAND was utilized (Figure 10). The seventh and eighth-grade science classroom progress reports were viewed 50-100% of the time ($n=4$). Photos and videos were viewed at a high of 25% down to 0%. Scheduled quizzes and tests started at a 38% view rate and declined down to a 0% view rate by February. The few topic updates received a 38% view rate. No miscellaneous messages were sent for this classroom between September and February (Figure 11). The ninth-grade physical science classroom received 50-100% response rates for monthly progress reports ($n=2$). Photo and video posts ranged from 50-100% and dropped down to 0% in December, but increased again as the year progressed. Quiz and test date posts started at a 25% view rate and dropped down to 0% for the remaining five months. No topic updates or miscellaneous messages were sent to the ninth-grade classroom (Figure 12). The 10th-grade biology classroom received a 33-67% response rate for monthly progress reports ($n=3$). Photo and video posts started with a 0% view rate and increased to a 67% view rate by month six. Quiz and test date views started at a 50% view rate, but decreased to a 33% view rate over the next three months, and then decreased again to a 0% view rate. There were no topic updates or miscellaneous messages sent for the 10th-grade biology classroom (Figure 13). The 11th-grade chemistry classroom received a 50% response rate for monthly progress reports for the first month of research and then decreased to 0% for three consecutive months ($n=2$). In January and February, responses were back up to 50% again. Quiz and test dates received a 0% view rate for the entire six months. Topic updates and photo and video posts also received a 0% view rate for all six months. No miscellaneous messages were sent to the 11th-grade classroom (Figure 14). No chart was formed for the 12th-grade classroom as no responses or views were made on that

page in the BAND app ($n=2$). Overall, the average response rate for monthly progress reports ranged from 24-61%. Photo and video views ranged from 18-57%, miscellaneous messages from 0-75%, topic updates from 38-50%, and test and quiz dates from 0-23% (Figure 15) ($N=11$).

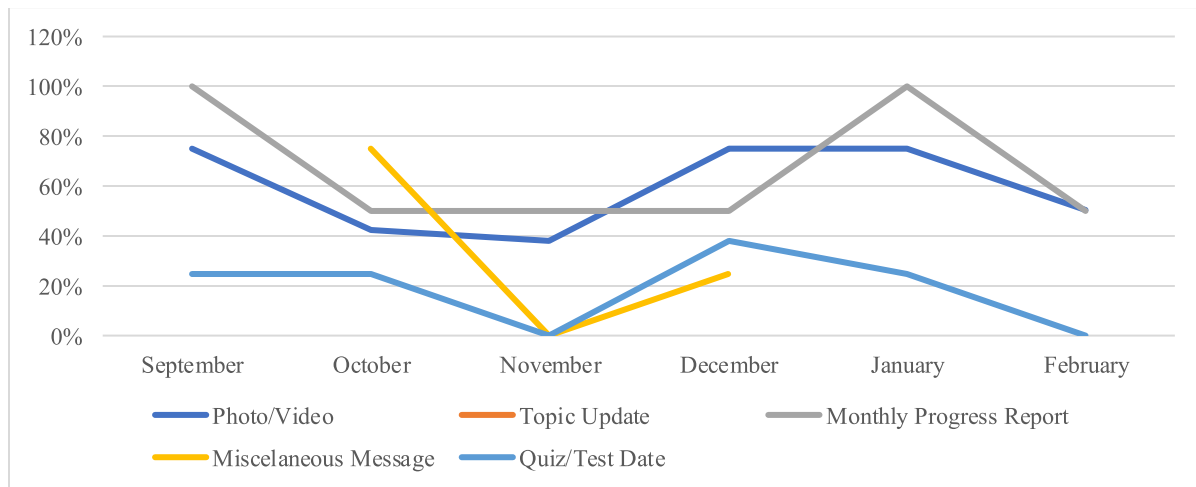


Figure 10. Sixth-grade class BAND app view and response rates, ($n=4$).

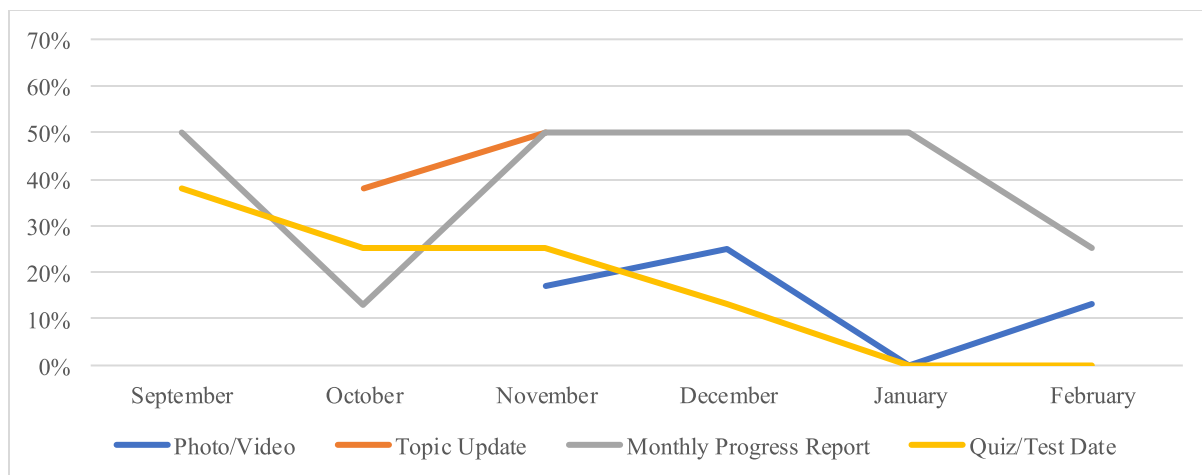


Figure 11. Seventh and eighth-grade class BAND app view and response rates, ($n=4$).

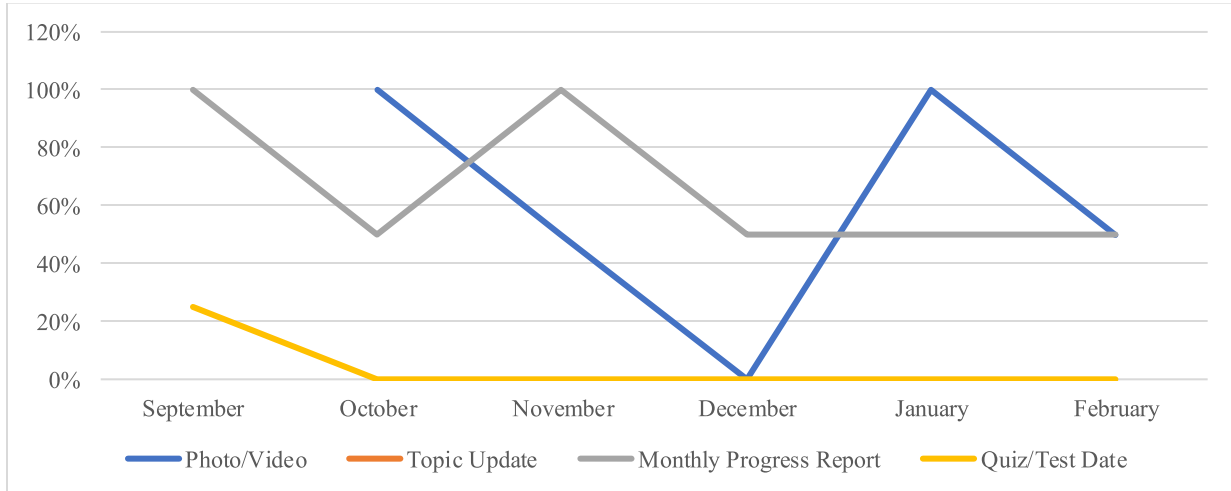


Figure 12. Ninth-grade class BAND app view and response rates, ($n=2$).

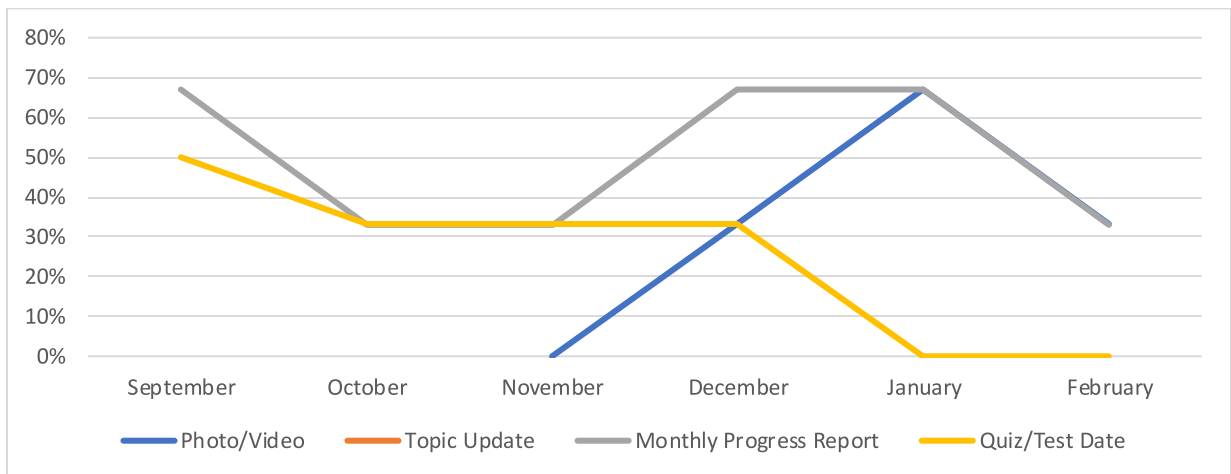


Figure 13. 10th-grade class BAND app view and response rates, ($n=3$).

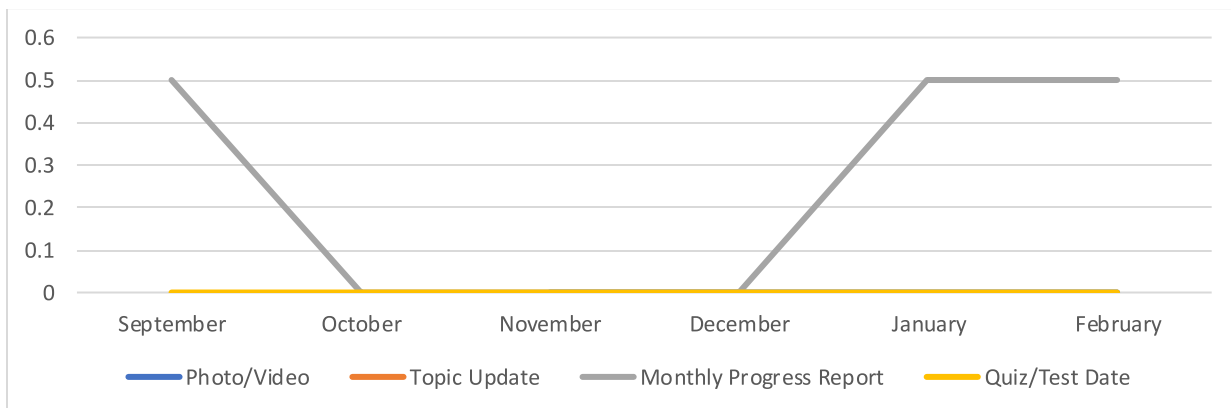


Figure 14. 11th-grade class BAND app view and response rate, ($n=2$).

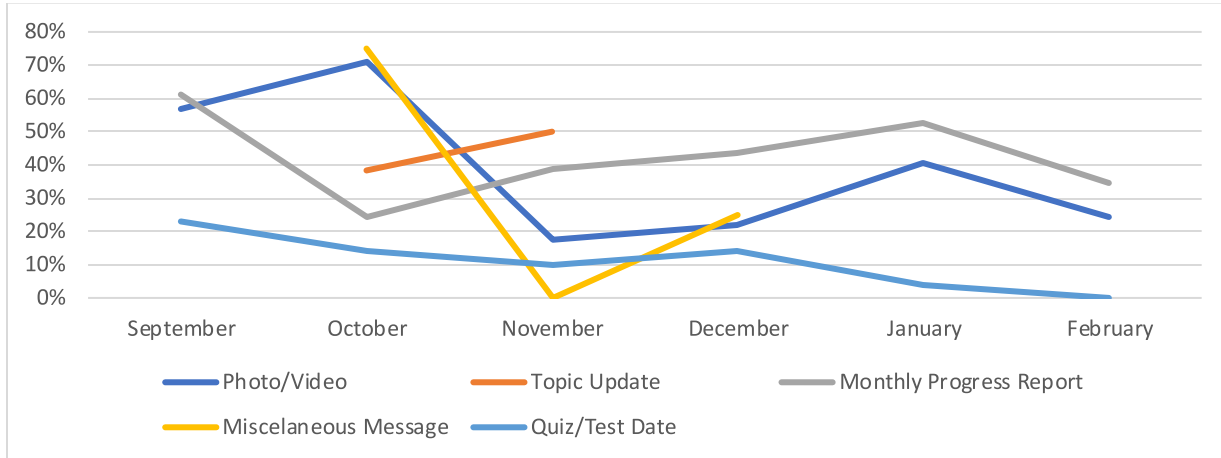


Figure 15. Overall average BAND app view and response rates, ($N=17$).

Missing assignments that were tracked during the six months of research were recorded. In September the seventh- and eighth-grade science classroom had two missing assignments and did not have any other missing assignments for the remainder of the research ($n=4$). The 10th-grade biology class had one missing assignment in September and did not have any other missing assignments for the remainder of the research ($n=3$). In October there were no missing assignments. In November and December, the sixth-grade science class had two assignments missing ($n=4$). In January, the 11th-grade chemistry class had one assignment missing and no other missing assignments in the other five months of research ($n=2$). In February, the sixth-grade science class had one missing assignment and the 12th-grade health class had one missing assignment ($n=6$). The ninth-grade physical science class had no missing assignments for all six months ($n=2$). These all come to a total of eight missing assignments for all seven classes in the six months of research (Figure 12) ($N=17$).

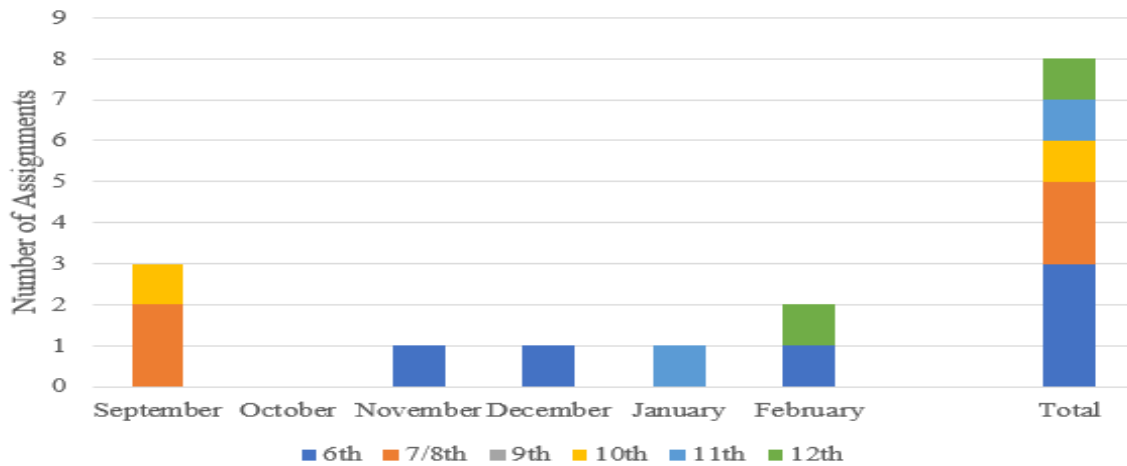


Figure 12. Missing assignments for grades 6-12 science between September and February, ($N=17$).

Quarter grades were assessed for all science classes, grades sixth through twelve. Sixth- and seventh-grades were analyzed separately as I did not have 2022-23 grades for these classes. The results from the sixth through seventh grade were mixed and every student responded differently to treatment. Three students fell below 0.2 for effect size with no gains ($n=5$). One student fell between 0.2 and 0.5 with a small gain. One student fell above 0.8 with a large gain (Table 2). Ranges for effect size vary from the following; below 0.2 being no significant change, 0.2 - 0.5 being small significant change, 0.5+ - 0.8 being medium significant change, and 0.8+ and up being large significant change.

Table 2. Normalized gains and effect size for students in 6th-7th grade, as well as 2023-24 average grades for Quarter 1 and Quarter 3, ($n=5$).

6th-7th Grade 1st Quarter to 3rd Quarter Comparisons			
Student	Normalized Gains	Standard Deviation	Effect Size
A	0.25	4.17	0.24
B	0.31	4.17	0.96
C	-0.67	4.17	-1.44
D	-0.17	4.17	-0.24
E	-2.50	4.17	-1.20

The results for grades eight through twelve were also mixed with no significant changes seen ($n=13$). When comparing grades eight through twelve, the effect size for Quarter 1 of 2022 to Quarter 1 of 2023 was -0.13 with no gain. The effect size for Quarter 2 of 2022 to Quarter 2 of 2023 was 0.21 with a small gain. The effect size for Quarter 3 of 2023 to Quarter 3 of 2024 was 0.02 with no gain (Table 3).

Table 3. 2022-2023 Quarterly grades compared to 2023-24 Quarterly grades, ($n=13$).

Quarterly Grades for 8th-12th Science Classes						
	Quarter 1 2022	Quarter 1 2023	Quarter 2 2022	Quarter 2 2023	Quarter 3 2023	Quarter 3 2024
Mean	96.08	95.50	95.42	96.08	95.58	95.67
Median	97	97	96.5	96	96	96
Mode	97	99	99	95	99	96
	Standard Deviation Quarter 1	Standard Deviation Quarter 2	Standard Deviation Quarter 3			
	4.60	3.18	3.57			
	Effect Size Quarter 1	Effect Size Quarter 2	Effect Size Quarter 3			
	-0.13	0.21	0.02			

The grades for eight through 12 were averaged and no significant changes were seen ($n=13$). Average overall results for grades for eight through 12 science classes were compared for the years 2022-23 and 2023-24. Nine of the 12 students received an effect size of less than 0.2 with no gain. Two of the 12 students received an effect size between 0.5 and 0.8 with a medium gain, and one student received an effect size greater than 0.5 with a large gain. When normalized gains for all students were averaged out, a normalized gain of 0.00 was seen (Table 4).

Table 4. Average 2022-23 to 2023-24 overall grade comparisons for 8th-12th grade, ($n=13$).

Averages 2022-23 to 2023-24 Comparisons			
Student	Normalized Gain	Standard Deviation	Effect Size
F	-1.96	3.35	-0.30
G	-3.586	3.35	-0.78
H	-0.556	3.35	0.12
I	-2.263	3.35	-0.39
J	-0.367	3.35	0.18
K	-3.58	3.35	-0.81
L	-0.387	3.35	0.18
M	1.027	3.35	0.60
N	1.37	3.35	0.69
O	3.063	3.35	1.19
P	-1.993	3.35	-0.30
Q	-2.25	3.35	-0.39
	Overall Averages 2022-23	Overall Averages 2023-24	Normalized Gain
	95.68	95.68	0.00

CLAIMS, EVIDENCE, AND REASONING

Claims From the Study

The goal of this action research was to determine if students' grades and accountability increased with increased communication through the use of the BAND app. With the seven different grade levels of science, there were 17 students and 11 parents participating in the study. The research was conducted over a six-month time frame with three separate quarters of grades being assessed as well as a pre-and post-communication survey and interview, motivational science questionnaire, and a record of missing assignments for each class. The quantitative data collected for each data collection instrument showed no significant changes made from the implementation of the BAND app. However, qualitative data through parent feedback and student quotes shows an increase in communication compared to previous years. I had expected the BAND app to have a positive impact on parents and them getting a glimpse into our daily classroom life. I was excited that a few of them appreciated the posts on the BAND app and voiced this to me throughout the entire research process.

The Student Science Motivation Questionnaire showed that most students were competitively motivated. The majority of students thought that it was important to do better compared to other students. This reflects the competitive nature of this group of students, as most of them are sports-oriented children. All students in Whitewater participate in multiple sports and grow up competing in multiple events from grade school up. The entire class agreed that it is important to score high on tests and quizzes. With their competitive nature, the students also compare scores on tests and quizzes with their peers. This is something I do not encourage them to do but seems to be a frequent practice. The two questions that seemed to have lower scores

were “I prepare well for science tests and quizzes” as well as “My career will involve science”. I am not surprised at the lack of preparation for tests and quizzes as most of the students dislike studying and only do it if they feel like they have to, such as for semester finals. Having the parents more aware of test and quiz dates may have had an effect on study time done at home since they were sent reminders one day before each test or quiz. I was, however, surprised about the lower score of science being involved in their career. This could be due to kids not knowing what career they even want to go into by the time they graduate or an awareness of how intertwined science is with most careers. Overall, most of the students scored high on their motivation for science, and in return, this helped with engagement and retention when learning new topics in the last six months.

The Science Communication Student Survey had overall varied responses and therefore ended with low normalized gains and no significant changes. It is important to remember the low participation count in this research project, as I teach in a very rural school consisting of only 18 students from grades 6th-12th. These low numbers had a large effect on my results. I do think if I had individually kept track of responses for every student, I would have been able to track progress and changes more accurately.

The Science Communication Parent Survey also had varied responses as well as no significant changes with low normalized gains. One big problem I had with parent responses was the number of parents who did not participate in post-treatment responses. I had two or three parents who were very good about looking at the BAND app regularly and responding to messages consistently but then other parents who did not check in at all. Four of these parents who did not check in at all were parents who work within the school. I feel that since they work

here, they can just walk down to my room and talk to me if they have a problem or question as well as are more aware of what is happening in my class than a parent that does not work in the school. Those parents who did participate were all very grateful for the monthly progress reports and activity photos.

Student Communication Interview questions showed an increase in student initiation of science conversations at home as well as the Parent Communication Interviews showing the same change. Most other answers stayed the same or were inconclusive with insignificant changes. I did observe that students were not happy with the increased level of parents asking if they had studied or about an activity that we had done that day in class. They do not seem to want to talk about science at home and would like to just leave it at school if at all possible. This contradicts the results of the students initiating conversation more often. Once again, having a lack of parents participating in interviews post-treatment also affected the results for these interview questions.

When recording responses and views of the BAND app, I found that the monthly progress reports were the most popular form of communication. Behind the monthly progress reports, parents also seemed to enjoy the photo and video posts of students performing labs in class. These received many comments or “likes.” I was not as consistent with my topic update posts as I could have been, so those posts were not as consistent as progress reports, photos, and event updates. During the first half of the research, parents frequently viewed the event posts that included test and quiz dates. These posts slowly fizzled as the year progressed. This could have been due to the students’ continuously good grades and positive progress reports or they became uninterested in this form of communication within the app. I also noticed that the older the

students were, the less communication between me and the parent. When students are sixth graders, they are new to my class, so parents probably feel the need to check in more often to see if they are behaving or completing their assignments and doing well on tests. As they get older the parents and students become more familiar with my teaching practices and probably feel less of a need to check in. This would reflect the complete absence of the senior class parents and very rare communication with the junior class parents. Three out of the four of these parents in these two classes were all teachers as well. All of the school-affiliated parents had almost no communication with me on the BAND app during the six months of research. When analyzing quarterly grade comparisons, data did show that a few students had some sort of positive gain during my research. These were difficult to analyze further as I did not individually separate interviews, surveys, and questionnaires for each student.

Consideration for Future Research

If I were to conduct my research again, I would separate each student and keep track of survey, interview, and questionnaire results as well as parent responses to see if specific students responded better to the increased communication than others. I believe this would be more appropriate with my low numbers of participation. Tracking individual progress with connections to parent participation would have given me a better picture of how each student responded to the research. In a large school, this may have worked fine but for a small, rural school it doesn't give a complete picture of the results.

Impact of Action Research on the Author

My research on implementing the BAND app within my science classroom has had a positive impact on my teaching practices and the communication between me and my students' parents. We had two sets of parent-teacher conferences this year, one of them being after I had had the BAND app going for about five months. I was much more confident in my relationships with most of the parents than I was at the previous conference. As said before, in previous research, even when specific methods of communication were ineffective, positive feedback and relationships were formed (Raming, 2022). The parents of the students who had slight behavioral issues or problems with classwork had already been contacted and were aware of those situations. I feel I was able to better serve some of my students as I and their parents were able to work together to solve problems such as showing work on Chemistry problems. Sometimes if you as a teacher cannot get through to a student, it is helpful to have someone at home encouraging them to change or correct behaviors for class. The few students that did have a larger impact from the BAND app made the time put into the app worth every second. My results reflect much of the previous research done on communication apps in the classroom. Many results were insignificant, especially for students who already excel in the classroom. As stated earlier, students who already excel in the classroom show less improvement through increased communication (See et al., 2020). However, qualitative data showed that a positive impact was made on the overall relationship between teacher, parent, and student. Previous research has shown that meaningful communication between teachers and parents has had a positive impact on relationships between these individuals (Arledge, 2019).

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APPENDICES

APPENDIX A

IRB APPROVAL

Your protocol was reviewed by the IRB and has been approved.

PI: Hammond, Carly

Approval Date: 9/8/2023

Title: THE IMPACT OF COMMUNICATION APPS ON STUDENT PERFORMANCE AND ACCOUNTABILITY

Protocol #: 2023-939-EXEMPT

Review Type: Exemption

Expiration Date: 9/8/2028

Work described under this protocol may now commence. The PI is responsible for ensuring that the protocol accurately describes research practices being conducted.

- > Review Category designation determined by the IRB can be found in the final section of your protocol.
- > IRB-stamped active Consent Forms are attached within your protocol where applicable.
- > Any changes must be submitted via Amendment prior to implementation.
- > Per the Common Rule, research only requires Interim (annual) Review by the IRB if 1) it was reviewed via Full Committee or 2) is regulated by the FDA.
- > All research is subject to post approval monitoring.
- > All protocol types must be renewed 5 years after approval.
- > Inform the IRB once your research is complete so that the protocol may be inactivated.

APPENDIX B

SCIENCE COMMUNICATION PARENT SURVEY

You are being asked to participate in a research study on improving educational goals through increased communication. The following survey will help me evaluate your current views towards communication between you and your child, as well as you and your student's teacher. Completion of this survey will help me assess information about the class and progress of your student throughout the school year. Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in anyways.

	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1
1. I often enjoy hearing about my child's science class.	5	4	3	2	1
2. I am well aware of what is going on each week in science class.	5	4	3	2	1
3. I know when my child has a late assignment.	5	4	3	2	1
4. I know when my child has a quiz or test the next day.	5	4	3	2	1
5. I know when my child has homework for science class.	5	4	3	2	1
6. I am satisfied with the level of communication I receive from the school about my child.	5	4	3	2	1
7. I feel like I have a good relationship with my child's science teacher.	5	4	3	2	1
8. Is there anything else that you would to know or be updated on?					

APPENDIX C

SCIENCE COMMUNICATION STUDENT SURVEY

You are being asked to participate in a research study on improving educational goals through increased communication. The following survey will help me evaluate your current views towards communication between you and your teacher. Completion of this survey will help me assess information about the class and your progress throughout the school year. Participation in this research is voluntary and participation or non-participation will not affect your grades or class standing in anyways.

	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1
1. I often enjoy science class.	5	4	3	2	1
2. I am well aware of what is going on each week in science class.	5	4	3	2	1
3. I know when I have a late assignment.	5	4	3	2	1
4. I know when I have a quiz or test the next day.	5	4	3	2	1
5. I know when I have homework for science class.	5	4	3	2	1
6. I am satisfied with the level of communication I receive from the school about my work or behavior.	5	4	3	2	1
7. I feel like I have a good relationship with my science teacher.	5	4	3	2	1
8. Is there anything else that you would to know or be updated on?					

APPENDIX D

SCIENCE COMMUNICATION INTERVIEW – PARENT

You are being asked to participate in a research study on improving educational goals through increased communication. The following interview questions will help me evaluate your current views towards communication between you and your child/parent, as well as you and your student's teacher. Completion of this survey will help me assess information about the class and progress of your student throughout the school year. Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in anyways.

7. How often do you and your child discuss science class?

8. Who initiates the conversation?

9. Has your parent/child communication about science changed as a result of the Band app?

10. What else do you want me to know?

APPENDIX E

SCIENCE COMMUNICATION INTERVIEW – STUDENT

You are being asked to participate in a research study on improving educational goals through increased communication. The following interview questions will help me evaluate your current views towards communication between you and your child/parent, as well as you and your student's teacher. Completion of this survey will help me assess information about the class and progress of your student throughout the school year. Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in anyways.

11. How often do you and your parent(s) discuss science class?

12. Who initiates the conversation?

13. Has your parent/child communication about science changed as a result of the Band app?

14. What else do you want me to know?

APPENDIX F

STUDENT SCIENCE MOTIVATION QUESTIONNAIRE

Statements	Never 0	Rarely 1	Sometimes 2	Often 3	Always 4
1. The science I learn is relevant to my life.					
2. I like to do better than other students on science tests.					
3. Learning science is interesting.					
4. Getting a good science grade is important to me.					
5. Learning science will help me get a good job.					
6. It is important to get an “A” in science.					
7. I prepare well for science tests and quizzes.					
8. I study hard to learn science.					
9. My career will involve science.					
10. Scoring high on science tests and quizzes matters to me.					