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Parent Reciprocal Teaching: Comparing Parent and Peer Reciprocal  
Teaching in High School Physics Instruction

Jonathan Jacob Welling

A thesis submitted to the faculty of  
Brigham Young University  
in partial fulfillment of the requirements for the degree of  
Master of Science

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## ABSTRACT

### Parent Reciprocal Teaching: Comparing Parent and Peer Reciprocal Teaching in High School Physics Instruction

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Effective strategies are needed to help parents become more involved in the education of their teenage children. Parent Reciprocal Teaching (PRT) is proposed as an effective strategy to increase parent involvement and help students increase academic performance. 120 students in a 10th-grade high school physics course participated in either the PRT homework assignments or traditional reciprocal teaching (TRT) assignments. The PRT homework assignments required students to teach their parents/guardians at home, while the TRT assignments required students to teach a peer during class time.

Data was collected through test scores and surveys sent home to parents and students. Findings indicate that (1) PRT very comparable, and in some instances, better than TRT in its academic benefit, (2) resulted in parents feeling more involved in their child's education, (3) parents were more aware of what their child was learning and more mindful of how well their child understood the course content. It is suggested that more educators incorporate the practice of PRT so that students can benefit from the effect of increased parent involvement as found in other studies on parent involvement: stronger academic achievement, improved school attendance and behavior, more positive perceptions of school and self, and higher educational aspirations.

Keywords: parent involvement, reciprocal teaching, secondary education, science education

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## 1 INTRODUCTION

Research has shown that parent involvement is strongly correlated with student learning (Desforges and Abouchar, 2003; Harris and Chrispeels, 2006; Colombo, 2006). Yet, during a student's high school years, parent involvement is at its lowest (Hornby & Lafaele, 2011; Simon, 2000). This means that many students will not receive the benefits from more involved parents until methods have been found to increase parent involvement at the high school level.

There has been a significant amount of research dedicated to the various way parents can get involved in their child's education (Fan, & Chen, 2001). While it is important for parents to get involved at the school, parental engagement in the home makes the greatest difference to student achievement (Harris & Goodall, 2008). One of the more influential methods for parents to engage with their children academically is by having conversations with their child regarding what they are learning at school (Voorhis, 2000; Ho & Willms, 1996).

Joyce Epstein, a renowned researcher on parent involvement, pointed out that "teachers need new approaches, organized strategies, and specific tools to help parents become productively involved at home" (2001). Since then, Epstein has helped develop a program call TIPS (Teachers involve parents in schoolwork) which requires elementary and middle school students to do homework assignments consisting of activities that require parent/family participation. This study aims to further the ideas of TIPS with a new homework method it calls Parent Reciprocal Teaching (PRT). PRT requires the students to teach their parents/guardians

concepts learned in class. PRT is unique from TIPS in that its design is focused on involving parents at the high school level when parent involvement is at its lowest.

Since this is the first time PRT has been studied, this study not only investigates the influence of the PRT assignments, but also how it compares to a more traditional reciprocal teaching (TRT) model. The TRT model in this study is defined by the more common reciprocal teaching practice which requires student to reteach concepts they learned in class to their peers rather than their parents. Reciprocal teaching has been well documented as an effective learning practice (Hattie, 2017); however, researchers have not yet looked into what differences might occur from a parental audience rather than a peer audience.

During this study, students were given the opportunity to participate in four PRT assignments. They were assigned approximately one per month, each one on a separate unit or topic in their physics class. The four units were: Circuits, Waves, Linear Motion, and Forces.

Four regular sophomore level Physics with Technology classes participated in this study, totaling 120 students. Two classes participated in the PRT assignments (59 students) and two participated in TRT assignments (61 students). Both the TRT and PRT class periods received the same lessons, labs and assignments. The reciprocal teaching assignments were also identical, except that the TRT classes paired up and taught a peer during class time, and the PRT classes took the assignment home and taught their parent(s).

The study uses both quantitative and qualitative research methods. In the quantitative analysis, an analysis of variance and covariance tests were used to compare the unit test scores of three groups: 1) those who participated in the PRT assignments with 2) those who did not participate as well as with 3) those who participated in the TRT method. The qualitative research method involved Likert scale surveys that were sent out to parents and students. These surveys

investigated possible impacts on parent involvement resulting from participating in the PRT assignments. A second open-response survey was also sent to 11 parents asking about their opinions about the PRT assignments.

The primary research question of this study is: what is the impact of the PRT method on student learning and parent involvement? However, there are four sub research questions which help answer the primary question. Those questions are:

1. Is there a statistically significant difference between the test scores of those who completed the PRT assignments and those who did not participate in the PRT assignments?
2. Is there a statistically significant difference between the test scores of those who completed the PRT assignments compared against those who completed the TRT assignments?
3. From the parent's perspective, how do the PRT assignments affect their ability to be involved in their child's education?
4. From the student's perspective, how do the PRT assignments affect their perceptions of their parent's involvement in their education?

## 2 REVIEW OF LITERATURE

### ■ The Need for More Parent Involvement

Many researchers have concluded that parental engagement is one of the key factors for student achievement and school improvement. (Desforges and Abouchar, 2003; Harris and Chrispeels, 2006; Colombo, 2006). This has been found to be true for grades levels kindergarten up to 12th grade (Desforges and Abouchar 2003). The list of benefits for parent involvement is extensive and well-studied. The main conclusions are that parental involvement has been associated with stronger academic achievement, improved school attendance and behavior, more positive perceptions of school and self, and higher educational aspirations (Hoover-Dempsey, Walker, Jones, Reed, 2001; Mellon and Moutavelis, 2009).

Getting parents involved in their child's education has been a complicated issue for a long time. Although research has shown that the majority of parents do care about their children's education, and want to get involved (Epstein, 2001), many parents say they need more guidance in how to help at home (Sanders, M. G., Epstein, J. L., & Connors-Tadros, L. 1999). The most common reason for a parent's lack of involvement is a deficiency in time due to work commitments (Harris & Chispeels, 2006).

According to the U.S. Bureau of Labor Statistics, 27% of children under 18 live with a single working parent (2016). The United States Census Bureau reports that in 33% of married homes, both husband and wife work (2016). Accordingly, nearly 60% of children under 18 live

in households where all parental figures work, and therefore (potentially) have limited time to be involved in their sons' or daughters' academic life.

Coincidentally, students are also busier as teenagers. Teenagers are typically much more engaged in school – in the form of athletic teams, academic clubs, and much more, and also take on part time work, and are much more social – participating in more social gatherings. Couple their increased demands of time with their independence that comes from driving, teenagers are typically in the home much less than their younger years. The combination of busy parents and busy teens means their interactions with each other are rarer and more intermittent than any other time in their youth.

It is also widely acknowledged that parent involvement decreases as children grow older and is at its lowest level during the child's high school years. (Hornby & Lafaele, 2011; Simon, 2000). However, this is not because parent involvement is unwanted by teenage students. One study found that high school students overwhelmingly saw the value of parental engagement and appreciated the moral support and interests from their parents (Harris & Goodall, 2008).

There has been a significant amount of research dedicated to the various way parents can get involved in their child's education. Parent involvement, as defined by Hornby and Lafaele (2011), can be categorize as either home-based or school-based involvement. Home-based involvement includes activities such as listening to children read, monitoring or helping them with their homework, and praising or rewarding a child for their academic accomplishments (Hoover-Demsey, 2001). School-based parent involvement includes activities such as attending parent education workshops and parent–teacher meetings and volunteering at the school or in the child's classroom. (Hornby & Lafaele, 2011). While it is important for parents to get involved at

the school, Harris and Goodall (2008) found in their case study of 20 school in the UK, that it is parental engagement in the home that makes the greatest difference to student achievement.

## ■ **Methods Used in Increase Parent Involvement**

There are various methods used by teachers to encourage home-based parent involvement. These methods include: students reviewing a test or a project with a parent (Voorhis, 2004), homework sign-off sheets, and weekly assignments asking a parent to listen to a child read or review a few of the child's math problems (Walker, Hoover-Dempsey, Whetsel, & Green, 2004). Some homework assignments are designed to initiate conversations between parents and child about what the child is learning (Voorhis, 2000). It has even been recognized that these parent-child homework interactions can increase parent-child relations (Epstein, 2001).

Assignments that require students to conduct conversations with family members about what they are learning in class have been found to be effective review and cognitive development tools (Voorhis, 2000). Voorhis analyzed multiple studies about this type of conversations and found they correlate with students having better homework completion rates and higher academic achievement in the middle and high school years (2001). Ho and Willms (1996) examined the effects of four types of parental involvement (home discussion, school communication, home supervision, and school participation) on the mathematics and reading achievement of eighth-grade students. Discussion of school-related activities at home had the strongest effects of all the parental involvement variables on mathematics and reading achievement.

Research suggests that an effective way for parents to get involved in their child's education is to talk more with the child about what they are learning in school (Voorhis, 2000).



However, as Epstein called out in 2001, “Teachers need new approaches, organized strategies, and specific tools to help parents become productively involved at home” (pp. 186). Since then, very few effective strategies have surfaced in the research literature regarding parent involvement, and even less are geared towards high school students. One approach worth mentioning called TIPS, Teachers Involved Parents in Schoolwork, had some notable success. This homework method required middle school students to conduct science experiments at home with their parents. More details about TIPS will be discussed later on.

### **■ The Role of Technology in Parent Involvement**

Some educators are trying to involve parents through social media platforms like Facebook, Twitter, and Instagram. Other common technologies used to involve parents are online blogs and text message programs like Remind. These methods of parental involvement have had some success in allowing parents to better supervise their child’s academics (Sad, Konca, Özer, & Acar, 2016). One study used a class blog which allowed parents to view the blog posts of their children. According to the survey results from parents, the parents felt their participation improved the academic learning of their child and increased the child motivation to do their school work (Portier, Peterson, Capitaio-Tavares, Rambaran, 2013). Online blogs and other collaborative web-based tools are becoming more popular in schools, but these tools may not be addressing the most important issues of parent involvement.

These technologies may improve a parent’s awareness for what their child is doing during school hours, but they may not directly increase communication between parent and child about their academics and school life. Many of these new technologies increase parent-teacher communication, which is helpful, but not sufficient. Voorhis concluded in a study that required

students to involve their parents in their homework assignments, that the extra parent-child connection increased the student's grades and success in the class (Voorhis, 2000). Student need is an increase in dialogue with their parents, not increased dialogue between parents and teachers.

### ■ Teachers Can Affect Home Based Parent Involvement

One intervention aimed to increase parent-child interaction was an interactive homework method called TIPS. TIPS was used on middle school grades and had students involve their parents in simple science experiments in the home. The study found that the students who completed the assignments with their parents outperformed their peers in tests scores (Voorhis, 2003). The study also showed that the TIPS assignments significantly increased the amount of parent involvement in the child's homework time. Joyce Epstein has continued the TIPS program and evolved it into a program designed for grades kindergarten through third grade (Epstein, 2016).

What is so unique about the ideas behind TIPS is that it makes the bold assumption that teachers can influence the amount of academic dialogue between parents and students. Figure 1 is a drawing depicting the Parent-Teacher-Student Triad. It is commonly assumed that teachers have an impact on parent-teacher and student-teacher communication, but rarely is it considered that teachers can also impact parent-child communication.

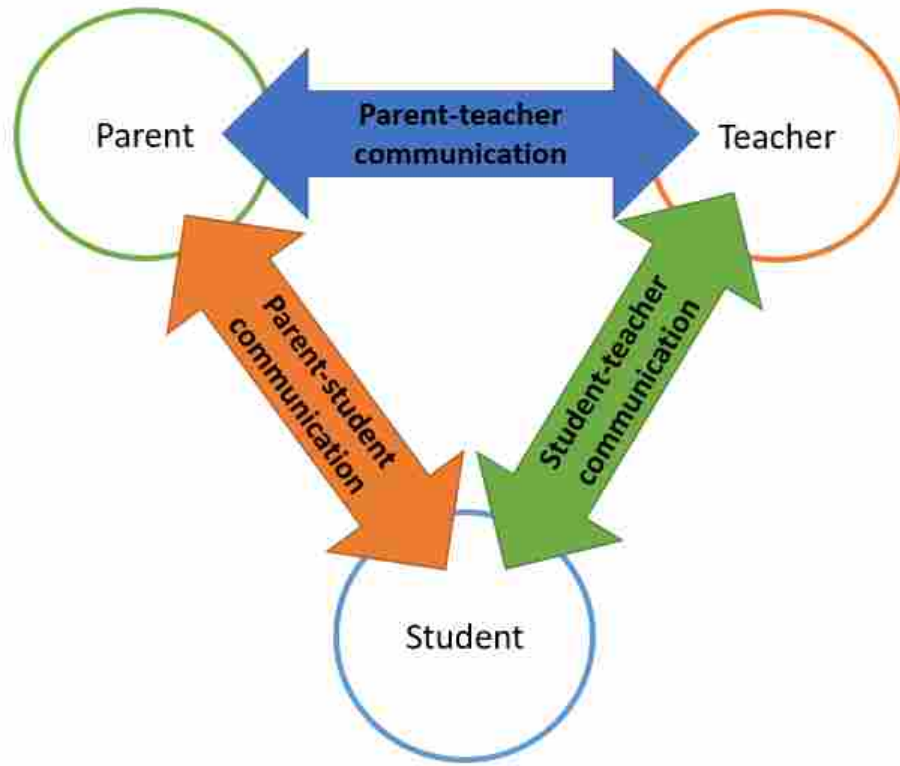


Figure 2-1: Parent-Teacher-Student Triad

Epstein's advances in the TIPS program indicates that she clearly believes that teachers can impact the academic dialogue between parent(s) and children. The researchers of this study also believe that through unique homework assignments, teachers can provide an enjoyable, time-sensitive, educational activity that results in improved student academic performance, and increased parent involvement. Improving student academic performance and increasing parent involvement do not have to be mutually exclusive practices, but as suggested in this study, can be accomplished simultaneously.

### 3 METHODOLOGY

The methods used in this study are both qualitative and quantitative. The details of the PRT and TRT assignments will first be explained. Following, the qualitative and quantitative methodologies will be defined. The n-size of the study included four regular sophomore level Physics with Technology classes participated in this study, totaling 120 students. These students were divided into two groups: PRT participants, and TRT participants. 59 students were in the PRT group, and 61 students were in the TRT group. The parents of all the students were emailed surveys; 25 parents participated in the surveys.

#### **■ The Demographics of the High School**

The High school used in this study had a student population of about 1800 with 82.5% White/Caucasian, 15.9% Hispanic, and 1.6% other ethnicities. The socioeconomic status of the school shows that 26.7% of the high school student population was eligible for free/reduced lunch. The high school was also a one-to-one school, meaning that every student is provided a laptop computer for the school year. This allowed for the PRT assignments to be done online on the student's computer. To effectively participate in this study, parents did not need to have their own computer, however, home internet was required.

The four Physics classes that participated in this study consisted of 93% 10<sup>th</sup> grade student and 7% 11<sup>th</sup> grade students. It should be noted that these classes were regular physics

classes rather than Honors Physics, which was also offered to 10<sup>th</sup> grade students. About 30% of the students who take physics took Honors Physics rather than Regular Physics.

### **■ The PRT Assignments**

During this study, students were given the opportunity to participate in four total PRT assignments. They were spaced out to be about one per month, each one on a separate unit or topic in their physics class. The four units were: Circuits, Waves, Linear Motion, and Forces.

The online platform used for the PRT assignments was Canvas. The main reason for this was because almost everything done in their physics class was done on Canvas, so the platform was very familiar to the students. Canvas also allows assignments to be locked with an access code. The access code to the assignments was not given to the students but emailed out to their parents. This helped prevent the students from completing the assignment without first talking to their parents.

The PRT assignments also effected the student's grade. They were comparable in point value to a standard homework assignment, being about five points. Students were also encouraged to do them as an extra study practice for the unit tests since questions similar to those found in the PRT assignments would be on their tests.

The questions asked in the PRT assignments are different than what the students find in their typical homework assignments. The PRT questions require no mathematical calculation, but focus on phenomenon common in everyday life, and are based off of experiences the students had in class. The assignments contained four to five open ended questions designed to generate discussion about an important physics principle. To award points to the students for explaining the concepts, the parents simply checked a box labeled "Explained."

Since many of the parents have no background with the content taught in the physics class, it was important that the questions focus on concepts familiar to the parents. For example, one question asked about why the newer Blu-ray DVD players were better than the older DVD players. Another question asked about the purpose of the third prong that only appears on the power cords of certain electronics. These questions deal with objects or phenomenon relatable to the parents. Also, hopefully the questions were interesting to the parents, therefore further promoting a more engaging conversation.

Other questions asked in the PRT assignments refer to experiences the students had in class. For example, during the unit on sound, students built kazoos out of inexpensive drinking straws. It was discovered that the pitch of the kazoo could be changed based on the length of the straw. This experience taught the basics between the relationship between wavelength and pitch. A PRT question asked students to explain what they discovered as they built various lengths of kazoos. See appendix A for copies of the PRT/TRT assignments.

### **TRT vs. PRT Assignments**

This study involved four regular sophomore level Physics with Technology classes. Two regular physics classes participated in the PRT assignments and two other regular physics classes participated in the TRT assignments. Both the TRT and PRT class periods received the same lessons, labs and assignments. The PRT and TRT assignments were identical, the difference only being that the TRT classes paired up and taught a peer, and the PRT classes took the assignment home and taught their parent(s)/guardians(s).

There is another important difference between the PRT and TRT assignments. The students participating in the TRT assignments traded off teaching every other question with their

partner. This means that the responsibility of teaching was shared, and the TRT participants taught half as many questions as the PRT participant. However, the TRT participants also had the advantage of a knowledgeable peer to help clarify any misunderstanding as the concepts were taught; that is, unless, the PRT student had a parent knowledgeable about the PRT content.

The TRT/PRT assignments took place towards the end of the unit, but before the day of the test. Since the PRT assignments were given as homework, the students had at least four days before the unit test to complete the assignment to provide sufficient time for parents to participate with their child. The TRT assignments were done at the beginning of class two days before the unit test.

### **Method for the Qualitative and Quantitative Analysis**

The primary research question of this study is: what is the impact of the PRT method on student learning and parent involvement? To address this, there are four sub research questions which help answer the primary question. Those questions are:

1. Is there a statistically significant difference between the test scores of those who completed the PRT assignments and those who did not participate in the PRT assignments?
2. Is there a statistically significant difference between the test scores of those who completed the PRT assignments compared against those who completed the TRT assignments?
3. From the parent's perspective, how do the PRT assignments affect their ability to be involved in their child's education?

4. From the student's perspective, how do the PRT assignments affect their perceptions of their parent's involvement in their education?

Questions 1 and 2 are addressed with quantitative methods, and questions 3 and 4 with qualitative methods.

In this study there are three groups of interest: The TRT classes, the PRT participants, and the non-participants. Since the students participating in the TRT do the assignment in class there are very few non-participants. In contrast, there were a significant number of students who choose not to participate in the PRT assignments, resulting in a selected sample.

To answer question 1, ANOVA tests were used to compare the test scores of the PRT participants with the test scores of those who did not participate in the PRT assignments. Because not all the test questions correlated with the specific PRT assignment questions, this study also looked at both the entire test score and just the test questions related to the topic addressed in the PRT assignments. Question 2 was addressed using ANOVA tests comparing the test scores between the PRT participants and the TRT participants to determine if the benefits of teaching a parent differ from teaching a peer.

Questions 3 and 4 focus on understanding how the PRT assignments influenced the parent involvement of the students from both the student's and parent's perspective. This was accomplished with surveys sent to all the students and their parents. Towards the end of the study, 11 parents who were active in their participation in the PRT assignments were selected as a second survey group and were given a larger open response survey.

The surveys were administered using an online software and sent to parents via email, whereas the students accessed the surveys during class on their school computers. Both parents and students understood that their survey responses were anonymous and in no way linked to



their grade. All parents and students answered four questions on a seven-point Likert scale on parent involvement. The Parents and students who participated in the PRT assignments answered an additional four questions specific to parental involvement regarding the PRT assignments. For examples of questions asked in the surveys see Appendix B.

## ■ The Analysis of the Survey Responses

In order to understand how the PRT assignments affected perceptions of parent involvement from the perspective of both parents and students, the survey responses were divided into three levels of analysis.

Level 1 – Direct comparison between PRT and TRT.

Level 2 – Understanding the PRT experience

Level 3 – Open response survey responses.

In the first level, identical survey questions were asked to both the parents and students participating in the PRT assignments as well as the parents not participating in the PRT assignments, namely, the parents of the students in the TRT classes. This allowed for a direct comparison of topics that potentially influenced by the PRT assignments. The second level dealt with questions only asked to parent and students participating in the PRT assignments. These questions focused more on the experience of the assignment. The third level of analysis only dealt with parents who actively participated in the PRT assignments. These parents were those in the second survey group and completed a longer free response survey. See Figure 2 for a chart showing the different levels of analysis.

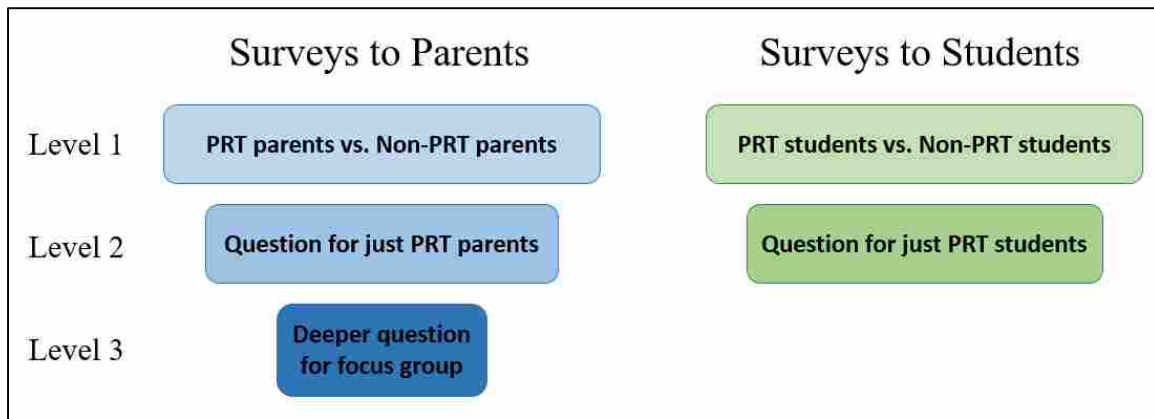


Figure 3-1.1: Levels of Survey Analysis

### 3.5.1 Level 1 - Direct Comparison

The survey questions in the first level of analysis compare the responses from those participating in the PRT assignments with those who did not. These survey topics allow the study to make conclusions about how the PRT assignments are affecting parent involvement.

Participants responded to each question on a seven-point scale (Strongly agree, agree somewhat, agree, somewhat disagree, disagree, and strongly disagree). The questions focused on four areas:

1. Feeling of involvement - How well they feel they are involved in their child's education in their Physics class.
2. Content awareness – How well they feel they are aware of what their child is learning in the Physics class.
3. Competency awareness - How well they feel they are aware of their child's level of understanding with the concepts being taught.
4. Awareness of their child's struggles – How aware the parent is of the struggles their child deals with in their Physics class?

The four questions in the Level 1 survey analysis investigated four aspects of parent involvement: a sense of involvement (question 1), awareness of not only what their child is learning (question 2), but how well they are understanding it (questions 3), and any negative emotional responses that indicate a need assistance or intervention (question 4). Question 4 may seem unique compared to the other three, but it was included because often struggling students do not know how to talk about their difficulties at school. Because the PRT assignments require a one-on-one interaction with child and parent, the situation may allow parents or child to bring up other topics outside the physics content referenced in the assignment. This may cause parents who participate in the PRT assignments to feel more aware of unknown issues the child deals with at school.

The Level 1 analysis was also done with student surveys to gain an understanding of the student's perspective; since their perspective is likely different than their parent's. For example, though the PRT assignments may cause some parents to feel involved, such involvement may be insignificant in the eyes of the child. For both the parents and the students, analysis of variance tests were used to compare the PRT responses with the TRT responses to determine any significant differences were present.

### **3.5.2 Level 2 - Understanding the PRT Experience**

The survey questions in the second level of analysis aimed to get a deeper understanding of the parent's and child's experience with the PRT assignments. The same seven-point scale was used for these survey questions. The following five topics were addressed in the survey:

- Enjoyment – How well participants enjoyed the PRT assignments.

- Effective content mastery tool – If they felt the PRT assignments helped their child learn the physics content.
- Effective method of parent involvement – If they feel the PRT assignments allow them to participate in their child’s education.
- Awareness of their child’s struggles in school life – If the PRT assignments initiated other conversations about the child’s struggles in school life.
- Worthwhileness – If they would like other teachers to do similar PRT assignments.

Enjoyment, effectiveness, parent involvement and worthwhileness are all aspects of the assignment that contribute to motivation. The PRT assignments are done every unit, and if the students or parents don’t enjoy doing them, or believe they are not an effective tool, they likely will stop doing them. Williams, Williams, and Ullman once sent surveys to over 2000 parents of children between ages 5 and 16 and found that 72% of all the parents agreed that they wanted to be more involved in their child’s education (2002). Since parents want to be more involved in their child’s education, if the PRT assignments can help satisfy these desires, parents are likely to continue participating in them throughout the year.

In the first set of survey questions in this study, the parents were asked about their awareness in regards to their child’s struggles in school life. The question is again presented here so that parents may expound about any possible conversations that emerged regarding student struggles as they participated in the PRT assignments.

The last part of the level 2 survey questions contained open ended questions that allowed parents and students to describe the benefits and suggestions they had regarding the PRT assignments. These responses were reviewed to identify common themes as to what parents and students felt where the most important benefits of the PRT assignments.

### 3.5.3 Level 3 - Second Survey Group to Parents

Towards the end of the study, after all four PRT assignments had been completed, 20 parents who had participated in at least three of the PRT assignments were invited to participate in a second survey group. These parents were promised a \$20 gift card to the BYU bookstore if they completed a ten-question free response survey. Eleven parents completed the survey. The second survey group survey focused on the following five topics:

- The time commitment of the PRT assignments
- Their educational value
- Benefits beyond students learning the physics principles
- Parent-Teacher relationship
- If similar assignments should be used in other classes?

It can be noted that most of the questions asked in this second survey group survey are similar to the questions asked in the Level 2 questions. The response type for this third level was free response, providing opportunity for more detailed responses than the seven-point scale responses.

One new question in their third survey asked parents to talk about how the PRT assignment affected their parent-teacher relationship. This was an interesting concept because although the PRT assignments did not put the parents in direct contact with the teacher, the parents became involved with the class content in an indirect way. Thus, the researcher decided to investigate if this indirect contact influenced the perceived parent-teacher relationship.

The data from these survey responses was analyzed by question. Emergent themes were identified among the responses and general conclusions were made based off the common themes.

## 4 FINDINGS

The findings are organized by the four research questions:

1. Is there a statistically significant difference between the test scores of those who completed the PRT assignments and those who did not participate in the PRT assignments?
2. Is there a statistically significant difference between the test scores of those who completed the PRT assignments compared against those who completed the TRT assignments?
3. From the parent's perspective, how do the PRT assignments affect their ability to be involved in their child's education?
4. From the student's perspective, how do the PRT assignments affect their perceptions of their parent's involvement in their education?

Besides focusing on the four research questions, this study will also address two other questions that emerged because of unexpected confounding variables. While answering question 1, it was noted that significant differences distinguished those who chose to complete the PRT assignments and those who did not. These differences will be addressed. I was also noted that some PRT questions yielded statistically significant results while others were not significant. To understand the reasons behind the inconsistency, an analysis was done on the individual PRT

questions to determine what question characteristics resulted in stronger correlations with student performance. This analysis will be presented after answering question 2.

### ■ Question 1 - PRT Participants vs. Non Participants

Is there a statistically significant difference between the test scores of those who completed the PRT assignments and those who did not participate in the PRT assignments?

To answer question 1, the study focuses just on the classes where students had the PRT assignment given as an assignment. The data is divided into two groups, those who completed the PRT assignments and those who chose not to. It should be noted that at this point it is assumed that the PRT and non-participant are equal in skill-level, save the possible benefit of participating in the PRT assignment. This assumption is addressed later.

The data is also divided by unit. This is because different students chose to complete the PRT assignments each time the assignments were given. Between 20 and 26 students completed the PRT assignments each unit, leaving 33 to 41 who did not complete the PRT assignments. More details about the low PRT participation will be addressed in the delimitations of this study.

An analysis of variance test was used to compare the different means of those who participated in the PRT assignments with those that did not. An example of this test is shown in Figure 4-1 and Table 4-1. In the example, participation in the PRT assignment is indicated by a 1 (participated) or 0 (did not participate). This comparison is looking not at how the students performed on the circuits test as a whole, but only on the specific questions related to what they taught their parents in the PRT assignment.

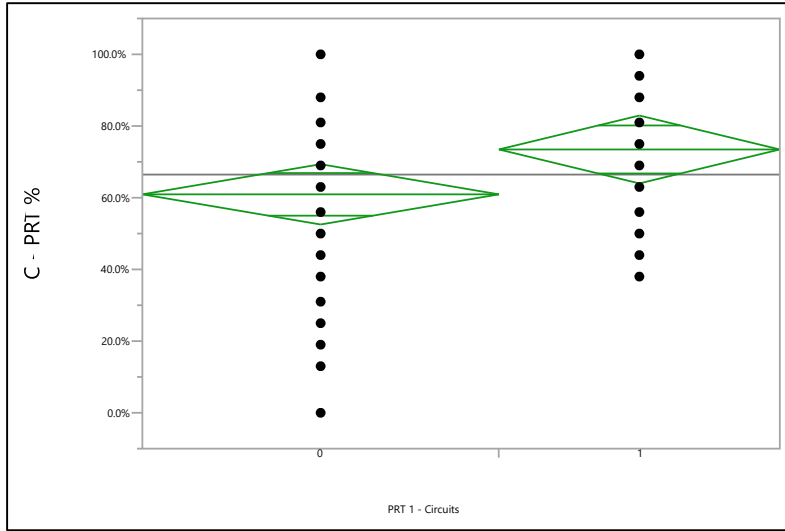


Figure 4-1: Circuits PRT Q's by PRT Participants

Table 4-1: ANOVA for Circuits PRT Q's by PRT Participants

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
PRT 1 - Circuits	1	0.2280304	0.228030	3.9192	0.0526
Error	57	3.3164340	0.058183		
C. Total	58	3.5444644			

This example shows that though there is a difference in the means, at the .05 p-value, no statistically significant evidence can be found ( $p = .053$ ); meaning that the PRT assignments did not statistically correlated with a higher score on the related test questions on the circuits unit test.

Overall, eight ANOVA tests (two sets of four) were performed to create the data tables below. Table 4-2 shows the n-values for the PRT participants and those who did not do the PRT assignments (No-PRT). Table 4-3 displays the data for how the PRT participants performed



overall on their test compared to the non-participants. Table 4-4 looks only at the questions from the unit tests that asked questions related to the same principles as what was taught in the PRT assignment.

Table 4-2: n-Values for PRT and No-PRT

Unit	No-PRT	PRT
Circuits	33 (56%)	26 (44%)
Waves	38 (62%)	23 (38%)
Motion	41 (67%)	20 (33%)
Forces	41 (67%)	20 (33%)

Table 4-3: Mean Scores on Unit Tests by PRT & No-PRT

Unit	No PRT mean %	PRT mean %	DF	t-value	p-value
Circuits	65.9%	77.0%	56	2.423	0.019
Waves	79.8%	85.7%	59	1.457	0.150
Motion	76.2%	84.9%	58	1.906	0.062
Forces	76.0%	80.0%	59	.9928	0.325

Table 4-4: Mean Scores Only Q's Related to PRT Assignments for PRT & No-PRT

Unit	No PRT mean %	PRT mean %	DF	t-value	p-value
Circuits	60.9%	73.5%	57	1.979	0.053
Waves	83.7%	90.9%	59	1.517	0.135
Motion	63.7%	61.4%	59	-.2984	0.767
Forces	80.6%	77.9%	59	-.5850	0.561

Statistical significance was only found for the students who participated in the PRT assignments and higher test scores on the circuits test ( $p = .019$ ). It was noted during the study that a possible difference existed between those who completed the PRT assignments and those who did not. The following section diverges from the initial research questions in order to address some possible confounding variables in the study.

### **Who Completed the PRT Assignments**

The results in the previous analysis assumed that the two groups, PRT and non-participant, are equal in skill-level, save the possible benefit of participating in the PRT assignment. It became apparent that this assumption needed to be verified because it could be that more capable students were choosing to complete the PRT assignments and skewing the results. There could also be other factors that differentiated those who chose to complete the PRT assignments and those who did not. To help define what type of students choose to complete the PRT assignments, this study analyzed three characteristics: SAGE proficiency, ethnicity and gender.

#### **4.2.1 SAGE Proficiency**

It was decided that the best way to measure a student's proficiency was with their state test results from the previous school year. The state test (SAGE) scored students (1 to 4) in three areas: math, science, and ELA (English Language Arts). This study combines those three categories so that students' scores range from 3 to 12.

An analysis of variance test was performed to compare the SAGE scores of those who chose to do the PRT assignment versus those who did not complete the assignment for each unit. The results are shown below in Table 4-5.

Table 4-5: PRT Participation by Sage Score by Unit

Unit	PRT avg. SAGE	Non-PRT avg. Sage	DF	t-values	p-value
Circuit	7.46	5.31	58	3.204	.0022
Waves	7.46	5.31	56	2.528	.0143
Motion	7.00	5.89	58	1.476	.145
Forces	6.57	6.12	56	0.585	.561

The ANOVA test reveals that during the first two units, those who completed the PRT assignments correlated with significantly higher SAGE scores ( $p = .002$ ,  $p = .014$ ). This means those first two units, the data for the PRT participants may have been skewed because the student who also chose to do the PRT assignments were also more likely to be more proficient students. This means the analysis for question 1 may be misrepresented. The significant correlations found for the circuit and waves unit tests could have been only a result of an uneven distribution of proficiency between the PRT and non-PRT groups.

The latter two units, motion and forces, did not follow the same pattern and no significant correlation between SAGE proficiency and PRT participation distinguished the PRT participants from the non-participants. This means that it is not always the more competent students who are more likely to complete the PRT assignments.

### 4.2.2 Gender & Ethnicity

To test if any correlations existed between gender and ethnicity, ANOVA tests were performed comparing gender/ethnicity verses PRT assignment submissions by unit. Tables 4-6 and 4-7 show the n-values and means for the gender differences between the PRT assignments by unit.

Table 4-6: PRT by Gender, n-values and Percentages

Unit	# of Males	# of Females
Circuit	7 (26%)	19 (56%)
Waves	6 (22%)	17 (50%)
Motion	7 (26%)	13 (38%)
Forces	3 (11%)	16 (47%)

Table 4-7: PRT by Gender, Means

Unit	Male Mean	Female Mean	DF	t-values	p-value
Circuit	0.2593	0.5588	59	-2.423	0.0185
Waves	0.2222	0.5000	59	-2.281	0.0262
Motion	0.2592	0.3823	59	-1.009	0.3171
Forces	0.1481	0.4706	59	-2.788	0.0071

There is convincing evidence that females are more likely to complete the PRT assignments than males for all the units except motion ( $p < .03$  for the other three units).

The ethnicity breakdown of the classes participating in the PRT assignments was 13% Hispanic and 87% White/Caucasian. Table 4-8 and 4-9 shows the n-values and means for how ethnicity effected who participated in the PRT assignments.

Table 4-8: PRT by Ethnicity, n-Values

Unit	# of Hispanic who did the PRT (out of 8)	# of White/Caucasian who did the PRT (out of 53)
Circuit	1	25
Waves	3	20
Motion	2	18
Forces	3	17

Table 4-9: PRT by Ethnicity, Means

Unit	# of Hispanic	# of White/Caucasian	DF	t-values	p-value
Circuit	12.5%	47.2%	59	1.871	0.066
Waves	37.5%	37.7%	59	0.0126	0.990
Motion	25.0%	34.0%	59	0.496	0.622
Forces	37.5%	32.1%	59	-0.2998	0.765

Only the first unit (circuits) showed a suggestive correlation between ethnicity and completion of the PRT assignments ( $p = .06$ ). Though it should be noted that the n-value for the Hispanic population is small, so one student can have a large effect on the overall results. Also, the pattern is not consistent since the forces unit had a higher percent of Hispanic participants than

White/Caucasian participants. According to the overall trend, ethnicity did not have a significant effect on who chooses to complete the PRT assignments.

## ■ Question 2 - PRT vs. TRT

Is there a statistically significant difference between the test scores of those who completed the PRT assignments compared against those who completed the TRT assignments?

By comparing the data from the PRT participants to the TRT participants, the study aims to investigate how doing the reciprocal teaching assignments with a parent compares against doing the assignment with a peer. The environment of teaching a parent at home is different than teaching a peer in the classroom. This may cause a difference in how the reciprocal teaching effects student performance. Table 4-10 shows the n-values for those who participated in the PRT assignments and for those who completed the TRT assignments. Table 4-11 shows how the two treatments compared on their unit tests. Table 4-12 show how the two groups compared on just the questions on the test related to what was taught in the PRT/TRT assignments.

Table 4-10: PRT vs. TRT, n-values

Unit	PRT	TRT
Circuits	26	59
Waves	23	60
Motion	20	58
Forces	20	58

Table 4-11: PRT vs. TRT by Unit Test Score

Unit	PRT mean	TRT mean	DF	t-value	p-value
Circuits	77.0%	66.9%	83	-2.845	0.0028
Waves	85.7%	80.8%	81	-1.508	0.0677
Motion	80.0%	75.5%	76	1.307	0.0976
Forces	84.9%	73.6%	76	-2.944	0.0021

Table 4-12: PRT vs. TRT by Just Test Q's Related to PRT/TRT Questions

Unit	PRT mean	TRT mean	DF	t-value	p-value
Circuits	73.5%	63.5%	83	-2.077	0.0204
Waves	90.9%	86.3%	81	-1.391	0.0840
Motion	77.9%	80.3%	76	0.4925	0.6882
Forces	61.4%	60.4%	76	-0.1326	0.4474

The results show a statistically significant difference between the students who participated in the PRT assignments and higher test scores on the circuits and forces test ( $p = .003$ ,  $p = .002$ ) when compared to TRT mean scores on the test. In looking at only the questions correlated with the PRT assignments, only the circuits test produced a convincing correlation with high scores for the PRT students ( $p = .02$ ). As noted earlier, there is statistical evidence that the higher performing students on the SAGE test correlate with participating in the PRT assignments for the Circuits and Waves unit. A better analysis would also take into account student SAGE scores.

To incorporate both the SAGE score (a continuous variable) and the PRT participation factor (a grouping variable) an analysis of covariance test was used. The analysis below looks at three factors: 1) the difference in the means of the test scores from the PRT and TRT treatments, 2) the slope of a regression line as SAGE scores are plotted with the test percentages, and 3) if the slopes of the regression lines for the PRT students test scores significantly differs from that of the TRT students. The example bellows in Figure 4-2 and Table 4-13 and Table 4-14 shows a comparison between the PRT participants compared and the TRT participants taking into account both the circuits test scores and the student’s SAGE score.

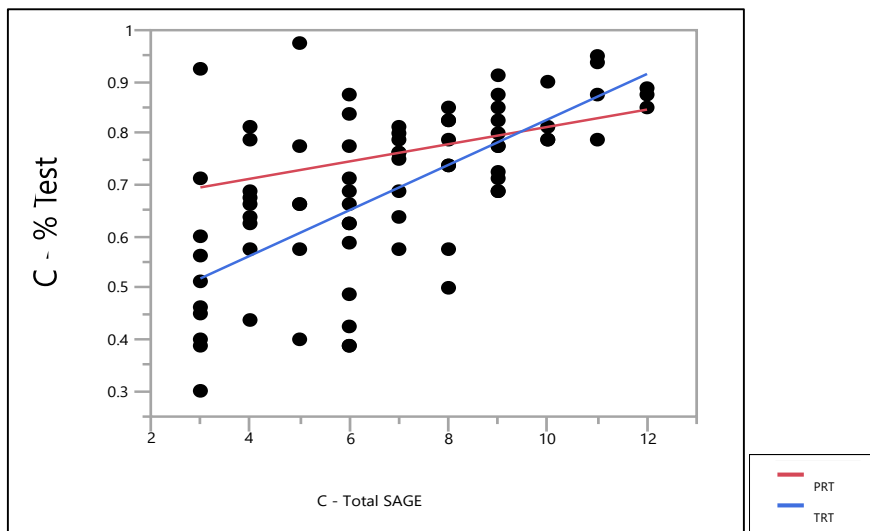


Figure 4-2: Regression Plot for PRT vs. TRT w/ SAGE Scores

Table 4-13: Least Squares Means, PRT vs. TRT w/ SAGE

Level	Least Sq Mean	Std Error	Lower 95%	Upper 95%	Mean
PRT	0.75856616	0.02482519	0.70911185	0.80802047	0.769712
TRT	0.68559277	0.01692464	0.65187716	0.71930838	0.671226



Table 4-14: PRT vs. TRT w/ SAGE, Covariance Summary Chart

Mean % PRT	Mean % TRT	DF	t-value	PRT p-value	Slope	t-value	p-value for slope	Mean % for Difference in slopes	t-value	p-value
75.9%	68.5%	75	2.88	0.005	4.4%	6.59	<.0001	-2.7%	-2.31	0.024

The results show some evidence that those who did the PRT assignment with their parents correlated with better test scores, 25% higher [8%, 44%] than those who only taught their peers ( $p = .005$ ). The students SAGE scores also had a significant correlation with their test score with an average increase of 4.4% [3.1%, 5.7%] per point ( $p < 0.001$ ). The slopes between the two regression lines also reveal a significant correlation ( $p = 0.024$ ). The difference in slopes communicates that the PRT assignments slightly decreased by the impact of the SAGE scores by -2.7% [-5.1% to 0.3%] on the circuits test. In other words, though the PRT assignment correlated with higher test scores overall, it slightly decreased the positive correlation of one's SAGE scores with their final test score.

In total, eight analysis of covariance tests were performed (four for the unit tests and four for the specific PRT questions by unit). However, only the circuits test showed statistical significance in the difference between the slopes of the SAGE regressions lines for the PRT and TRT treatments. Because of this, it was decided that for the other seven tests shown below in Table 4-15 and Table 4-16, to not include the crossed relationship between SAGE and the PRT grouping variable. Table 4-15 provides the analysis of the unit test scores, and Table 4-16 shows the analysis of the scores for just the specific PRT questions.

Table 4-15: Covariance Test for PRT vs. TRT Test Scores

Unit	Mean PRT Group	Mean TRT Group	DF	t- value	p-value for PRT	Slope	t-value	p-value for SAGE slope
Waves	83.5%	82.5%	73	0.44	0.659	1.0%	8.92	<0.001
Motion	79.5%	74.9%	68	1.52	0.133	2.9%	5.43	<0.001
Forces	83.7%	73.7%	69	2.99	0.004	3.3%	5.63	<0.001

Table 4-16: Covariance Test for Only Q's Related to PRT/TRT Assignments

Unit	Mean % PRT Group	Mean % TRT Group	DF	t- value	PRT p-value	Slope	t-value	p-value for SAGE slope
Circuits	71.4%	64.4%	76	1.47	0.146	3.6%	3.58	0.001
Waves	89.2%	87.9%	73	0.46	0.646	2.7%	5.55	<0.001
Motion	77.2%	80.4%	68	-0.62	0.535	1.5%	1.66	0.102
Forces	60.6%	61.2%	69	-0.08	0.939	2.3%	1.66	0.102

For all the unit tests, it was found that a positive correlation existed between a higher SAGE score and a higher test score ( $p < 0.001$ ). The SAGE scores also correlated with doing better on the specific PRT questions, but only for the circuits and waves tests ( $p = .001$ ), and a suggestive relationship for the other two units. For the forces test PRT participants averaged 10% higher [3.3% to 16.6%] than the TRT participants ( $p = .004$ ). The PRT assignments only had a statistically significant effect on the total test score for the circuits and forces test, but they did not have significant correlation with doing better than the TRT students on the specific PRT questions for any of the units.

## ■ Deeper Look at the PRT Questions

There is a pattern in the data that suggests students who participated in the PRT assignments outperformed their TRT or non-PRT participant only in particular units. In looking at just the test results of the specific PRT/TRT assignment questions, the PRT participants outperformed their non-PRT participating peers in the circuits and waves units (see Table 4-4). They also outperformed their TRT peers in the circuits unit (see table 4-16). This is an important detail to look into because it reveals which type of PRT/TRT questions were most effective for those students.

The PRT assignment questions were often not identical to the questions students found on their unit tests. They were always linked by the central concept or principle, but the topics varied. For example, a student may have taught a physics principle using one scenario in their PRT assignment, but on the unit test they were asked about the same principle in a different scenario. This testing procedure measures not only if the students understand the principle, but if they can apply their understanding to different scenarios. Though this is an effective testing practice, for this study it produced a confounding variable: the amount a student had to stretch their understanding and apply their knowledge to a new phenomenon.

To understand what type of questions worked well for the PRT assignments, ANOVA tests were first used to identify which questions showed a significant difference between the PRT, TRT and non-participant groups. As these ANOVA tests were performed, a few different question types were identified. Two examples are shown below.

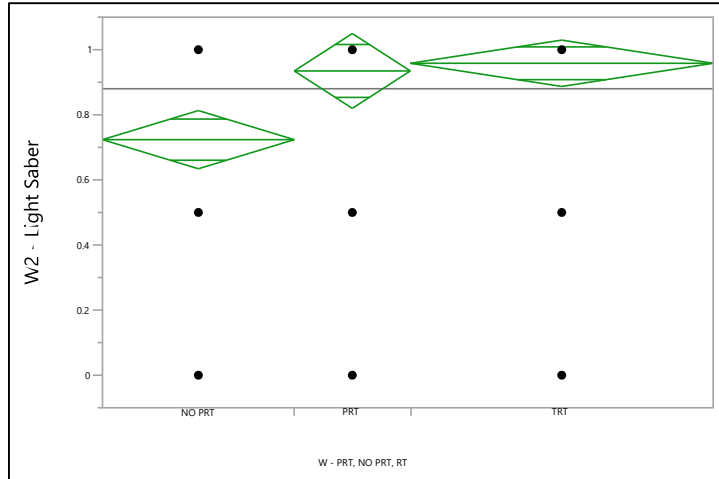


Figure 4-3: PRT Q2 on Waves Test

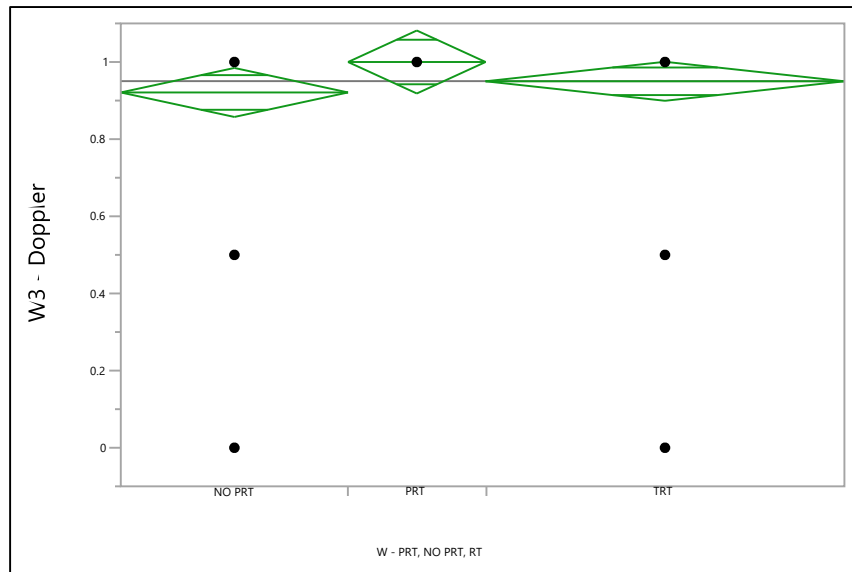


Figure 4-4: PRT Q3 on Waves Test

For the first example, as shown in Figure 4-3, the question on the waves test that was identical to what the students taught their parents, and the outcome is what one might expect. The PRT and TRT participants outperformed the non-participants. This question clearly shows

that those who taught either their parent or a peer were correlated with a higher change of answering the question correctly ( $p = .0003$ ).

This next example in Figure 4-4 comes from another question where the PRT question and the test question were similar. This question was also found on the waves test. In this case, even though the questions were similar, a very different outcome resulted between the different groups. It is clear that very little correlation existed between the three different groups ( $p = .322$ ). This is likely because this was an easy question. Within all three groups the average was above 92%.

A third example in Figure 4-5 shows a question from the motion unit test that supposedly aligned with a question in the PRT assignment for that unit. The regression plot for this question is significantly different than the previous examples.

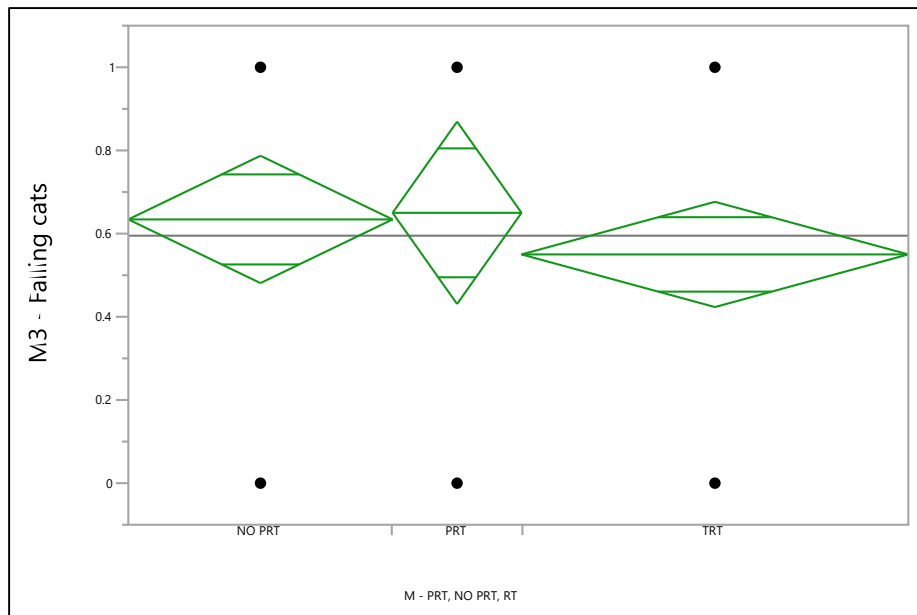


Figure 4-5: PRT Q3 from Motion Test

In this example, it is clear than no significant correlation existed between the three groups ( $p = .608$ ). It can also be noted that the average score ranged from 55% to 65% and all three groups had large ranges in the 95% confidence interval. This may have resulted from the difficulty of the question, because even those who did the PRT or TRT assignments were not able to answer the question any better than the non-participants. Accordingly, it can be concluded that the PRT or TRT assignments can be effective but only under certain conditions: the questions can't be too easy such that the reciprocal teaching practice isn't actually needed to increase performance, nor can the questions be too difficult such that the amount the students have to stretch and apply their understanding to a new situation is beyond their ability.

The next step in the analysis was to examine all the questions associated with the PRT/TRT assignments. The four tables below (one for each unit) display the results from all the unit test questions that appeared to correlate with the PRT assignment principles.

Table 4-17: PRT Q's on Circuit Test

Questions	No PRT n=35	PRT n = 26	TRT n = 60	DF	F Ratio	p-value
C-1	62.5%	74.5%	67.1%	118	1.95	0.1467
C-2	41.4%	69.2%	41.7%	118	3.38	0.0256
C-3	62.9%	75.0%	73.3%	118	0.74	0.4806

Table 4-18: PRT Q's on Waves Test

Questions	No PRT n=38	PRT n = 23	TRT n = 60	DF	F Ratio	p-value
W-1	86.8%	84.8%	85.8%	118	0.04	0.9604
W-2	72.4%	93.5%	95.8%	118	8.81	0.0003
W-3	92.1%	100.0%	95.0%	118	1.14	0.3226
W-4	86.8%	93.5%	85.8%	118	0.74	0.4809
W-5	76.3%	78.3%	63.3%	118	1.37	0.2578
W-6	84.2%	87.0%	75.0%	118	1.70	0.1876

Table 4-19: PRT Q's on Motion Test

Questions	No PRT n=41	PRT n = 20	TRT n = 60	DF	F Ratio	p-value
M-1	42.1%	41.3%	38.8%	118	0.10	0.9034
M-2	56.1%	50.0%	51.7%	118	0.13	0.8755
M-3	63.4%	65.0%	55.0%	118	0.50	0.608
M-4	90.2%	90.0%	85.0%	118	0.36	0.6951

Table 4-20: PRT Q's on Forces Test

Questions	No PRT n=41	PRT n = 20	TRT n = 60	DF	F Ratio	p-value
F-1	98.8%	95.0%	90.8%	118	1.86	0.161
F-2	63.4%	55.0%	59.2%	118	0.59	0.5566
F-3	87.0%	86.7%	87.2%	118	0.003	0.997
F-4	82.9%	77.5%	77.5%	118	0.32	0.7273
F-5	70.7%	75.0%	73.3%	118	0.71	0.9315

The questions C2 and W2 were the only two questions with statistical significance ( $p = .026$ ,  $p < .001$ ). These questions were two questions in which the test question and the PRT assignments question were virtually identical; however, they were also moderately difficult concepts. It seems that for this physics class, the PRT assignments do outperform both the non-participants and the TRT participants on retaining information, but the PRT assignments did not increase a student's ability to apply the knowledge to new scenarios.

### ■ Question 3 & 4, The Survey Data

At the end of the study a survey was sent out to parents of both treatments groups. The purpose of this survey was to gain some insight about the parent's and student's perspectives of the PRT assignments. A survey was also sent to the parents of the students who did the TRT assignments. This allowed for a direct comparison of responses from parents participating in the PRT assignments.

The two treatment groups received slightly different surveys except for four questions. The questions asked parents to respond to how well they agreed with a statement on a seven-point scale: Strongly agree (7), Agree (6), Somewhat agree (5), neither agree or disagree (4), Somewhat disagree (3), disagree (2), Strongly disagree (1). The parents of the PRT treatment group also had a question about how many of the four PRT assignments they participated in. Of the parents who responded to the survey, all but one participated in three or four PRT assignments. The researcher decided that the best analysis would result from comparing the TRT treatment results with those who experienced the PRT assignments. In the data for the survey responses, the PRT treatment group is represented by parents and students who completed a minimum of three PRT assignments.



#### 4.5.1 Level 1 – Direct Comparison

The first four questions of the surveys for both treatment groups were identical. Of these questions, the first focused on parental involvement, and the other three on the parent’s awareness of various aspects of their child’s education. These four questions are listed below.

Survey questions sent to the parents of both the TRT and PRT treatment groups:

Q1.For Mr. Welling’s class, I feel involved in my child’s education.

Q2.My child tells me about what he/she is learning about in Mr. Smith’s class (Not including the PRT assignments).

Q3.I know how well my child understands the physics principles being taught in Mr. Smith’s physics class.

Q4.I feel aware of the struggles my child faces at school.

Table 4-21: Mean Parent Survey Results, Q1-Q4

Question	PRT parents	TRT Parents	DF	t-Ratio	p-value
Q1	6.18	5.50	33	-2.13	.040
Q2	5.94	5.22	33	-1.84	.075
Q3	5.71	5.11	33	-2.77	0.009
Q4	5.82	5.77	33	-.176	0.861

Table 4-21 displays the parent results for these four questions. By analyzing the data, it appears that the parents participating in the PRT assignments feel more involved ( $p = .040$ ), hear more from their child about what their child is learning ( $p = .075$ ), and feel more aware of how

well their child is understanding what is being taught ( $p = .009$ ). There is no evidence that the PRT assignments affect a parent’s awareness of their child’s struggles at school.

The same 4 questions were also asked to both student treatment groups. The questions were slightly different in that rather than saying “I feel involved in my child’s education,” it said “I feel my parents are involved in my education.” The data from an analysis of variance test for each question is displayed in Table 4-22.

Table 4-22: Mean Student Survey Results, Q1-Q4

Question	PRT Students	TRT Students	DF	t-Ratio	p-value
Q1	5.84	5.26	87	-2.05	0.044
Q2	5.55	4.57	87	-2.73	0.008
Q3	5.58	4.98	87	-1.71	0.091
Q4	5.74	5.53	87	-0.59	0.55

There is evidence that the PRT assignments correlate with students feeling that their parents are more involved in their education ( $p = .044$ ). The results also show that even beyond the PRT assignments, students reported telling their parents more about what they were learning in school ( $p = .008$ ). This suggests that the PRT assignments may have facilitated an increase in parent-child dialogue even outside the PRT assignments. There is also a correlation between the PRT assignments and students feeling their parents know how well they understand the physics principles they are learning ( $p = .091$ ).

#### 4.5.2 Level 2 - Deeper Look at the PRT Experience

The parents and students of the PRT treatment group were asked five additional questions specific to their participation in the PRT assignments. Again, the student questions were slightly modified for their audience. The survey questions given to the parents participating in the PRT assignments are listed below.

Q6.I enjoy participating in the PRT assignments with my child.

Q7.I feel the PRT assignments are helping my child learn the class content.

Q8.I feel the PRT assignments are allowing me to participate more in my child's education.

Q9.The PRT assignments have helped initiate other conversations which have increased my awareness of the struggles my child faces at school.

Q10. I would like more teachers do something like the PRT assignments.

Table 4-23: Mean PRT Parent Survey Results, Q6-Q10

Question	PRT Parents	PRT Students	DF	t-Ratio	p-value
Q6	6.41	5.51	46	3.36	0.002
Q7	6.35	5.71	46	-1.83	0.073
Q8	6.35	5.84	46	-1.44	0.156
Q9	5.64	5.13	46	-1.34	0.187
Q10	5.82	5.39	46	-1.23	0.226

In Table 4-23, an ANOVA Test, compares the results between the parent responses and the student responses for those who participated in three or more PRT assignments. Based on the

analysis it appears that the parents enjoyed participating in the PRT assignments - having an average score of 6.4, meaning between “Agree” and “Strongly agree.” This finding was not true for the students, who reported that they didn’t enjoy the PRT as much as their parents ( $p = .002$ ), answering on average between “Somewhat agree and Agree.” The same pattern occurred in regards to how much the participants felt the PRT assignments were helping the students learn ( $p = .073$ ). For the other three questions, there were not significant differences between what the parents responded and what the students responded. However, it should be noted that all the questions received an average response between “Somewhat agree” and “Strongly Agree.”

### **4.5.3 Open Survey Responses**

#### Students

The survey’s sent out to students and parents included one open-response. The question asked what benefits (if any) the students/parents noticed as they participated in the PRT assignments. Again, the data below only represents students and parents who completed three or more PRT assignments. Not all the students answered this question so the student responses were limited (25), and the parent responses were also small (11). For each category, a general description will be presented with supporting quotes.

Four themes emerged from their responses:

1. Deeper comprehension (9 responses)
2. Retention of knowledge (7 responses)
3. Family connection (6 responses)
4. Test preparation (3 responses)

Deeper comprehension: Most of the student recognized that through teaching their parents they came to understand the physics concepts at a deeper level.

- “Sometimes I realize that I don’t fully understand and it helps me know what I still need to learn.”
- “When you are explaining it to your guardians, you are also explaining it to yourself in a way, so it helps.”
- “It is definitely a big eye opener; it totally shows you what you do and don’t know.”

Retention of knowledge: The responses in this theme all suggested the ideas of remembering and retaining the concepts learned in class.

- “It helps me retain the information because of what I share with them.”
- “I remember things better”
- “It has helped me solidify my understanding of the topics learned in class.”
- “It helps me refresh my memory about the topics”

Family connection: A quarter of the responses didn’t focus on the academic benefits but on its effect on the connection it created with their parents.

- My dad knows a lot about physics so when questions arise I’m able to talk about them with him.”
- “My parents understand whats going on and how I am doing in class.”
- “I have noticed that my parents like doing them a lot more that i do but there still good.”

Test preparation: A few students looked at the assignments as purely study helps.

- “I’ve done better on the tests.”
- “Helps prepare me for what’s on the test.”

## Parents

The themes that emerged from the parent's open responses revealed that the parents focused on slightly different benefits than the students: Child's excitement to teach (5 responses), Deeper comprehension (5 responses).

Child's excitement to teach: Many parents commented about how they enjoyed seeing their child excited to teach them about what they learned in class.

- "My child gets excited about sharing the concepts."
- "It's been fun to have intellectual discussions on things that normally wouldn't come up."

Deeper comprehension: Like many of the students, parents also recognized the educational benefit of learning by teaching.

- My child has to articulate what she is learning, and the effort it takes increases her level of understanding.
- They help him recognize which concepts he might not actually understand very well.
- "It's been good for her because as she tries to explain concepts to me, she either realizes that she doesn't know/understand it well enough or that she does understand"

### **4.5.4 Level 3 - Second Survey Group**

At the end of the study, the twenty parents who had participated the most in the PRT assignments were given the option of filling out an open-ended survey. This survey asked specific questions about the logistics of the assignments as well as their opinions about its value. 11 parents completed the survey.

1. Time Commitment: What is your opinion about the time commitment for the PRT assignments?

The average submission time for the PRT assignments for the first two units was 7 minutes with a standard deviation of 4 minutes. The parent's opinion about this time commitment was that it was very reasonable. None of the respondents complained; several parents expressed that they would prefer if the assignments required a little more time.

2. Assignment Style: What are your thoughts about the access code email and doing it on your child's computer? Did this method work for you?

All the parents felt like the access code method was very effective.

3. Due Date: Students were provided 3-5 nights to complete the assignment with their parents. Did you feel this was sufficient time for your schedule?

All the participants felt the timeframe was sufficient to complete the assignment.

4. PRT Questions: How did you feel about the questions asked in the PRT assignments? What type of questions worked well for these assignments? Do you have any suggestions for how to make the questions better?

The parents felt the questions were at a level that the students could explain the principles well enough that the parents understood. Some felt the questions didn't allow for enough depth on the topic. Some parents mentioned the idea of them receiving a key so they could verify that their child explained the topics correctly or with enough detail.

5. Educational Value: What is your honest opinion about the educational value of these assignments?

All the respondents felt the assignments were educationally valuable. A common response from the parents was the understanding that teaching a concept is the best way to learn it. One parent

observed that their child's interest in the topics varied, and when interest was low, the quality of the teaching was lower.

Beyond Educational Value:

6. Do you feel the PRT assignments resulted in any benefits beyond academic learning?
7. Did the PRT assignments ever lead to valuable discussions beyond the physics principles? If so, what else was talked about?

The parents felt that the PRT assignments provided benefits beyond just learning physics.

Common responses centered on improving communication skills, and having deeper conversations about their school day, and simply spending more time together.

8. Parent-Teacher Relationship: Sometimes teachers will talk about a parent-teacher relationship. This may refer to how well the parents feel connected or comfortable with the teacher. How has participating in the PRT assignments affected your parent-teacher relationship with Mr. Smith?

Parents didn't feel more connected with the teacher, but they expressed that his extra effort in trying something new to help the students increased their opinion of him. Parents also felt more connected with what was going on in class.

9. Parent Involvement: Do you feel activities, like the PRT assignments, that involve both the parent and child, should be more common in education? Would you appreciate something like this for your child's other classes (English, Math, History, etc.)?

The general consensus was that parents would appreciate more opportunities like the PRT assignments for other subjects; however, with multiple kids each with multiple classes, it could become overwhelming if too many teachers started doing it.



## 5 CONCLUSION, DELIMITATIONS AND RECOMMENDATIONS

### **Problem Statement**

Current research shows that parents involvement is at its lowest for teenage children (Hornby & Lafaele, 2011; Simon, 2000). There are many benefits which result from parent involvement in student education. These benefits include: stronger academic achievement, improved school attendance and behavior, more positive perceptions of school and self, and higher educational aspirations (Hoover-Dempsey, Walker, Jones, Reed, 2001; Mellon and Moutavelis, 2009). Notwithstanding, parent involvement decreases dramatically during a child's teenage years (Hornby & Lafaele, 2011; Simon, 2000). This study is part of an ongoing effort as researchers investigate new strategies for how parents can be more involved in the education of their children (Epstein, 2001).

This study investigated Parent Reciprocal Teaching (PRT) as an effective strategy to increase parent involvement. It also aimed to determine if PRT was an effective strategy for teachers to use to help students master class content and increase performance on unit tests. To determine its effectiveness on student performance, test scores from student PRT participants were compared with non-participants, and with students who participated in a traditional reciprocal teaching (TRT) practice - which required students to reteach class content to a classmate rather than a parent/guardian.

## ■ Conclusions on Academic Benefit

### 5.2.1 PRT Participants vs. Non-Participants

The results from this study were not able to conclude any statistical relationship between the students who participated in the PRT assignments and higher test scores. In looking at just the questions correlated with the PRT assignments, only the circuits test produced a p-value close to statistical significance ( $p = .053$ ).

Additionally, this study revealed that for the first two units, a correlation exists between the students who chose to complete the PRT assignments with higher SAGE scores ( $p = .002$ ,  $p = .014$ ). This means that sometimes, the students with higher SAGE scores are the same students who chose to complete the PRT. It is also possible then, that because these students were higher academically performing students prior to the PRT, that the PRT did not have as significant an impact as perceived – additionally testing is necessary to properly evaluate this finding.

Though SAGE proficiency did not significantly correlate across all the units with who participated in the PRT assignments, gender did. There is convincing evidence that females are more likely to complete the PRT assignments than males ( $p < .03$  for the circuits, waves, and forces units). Ethnicity was also tested and no significant correlation was found between Hispanic and White/Caucasian ethnic groups and those who chose to complete the PRT assignments.

### 5.2.2 PRT vs. TRT

In comparing the PRT participants with the TRT participants, there is evidence that those who completed the PRT assignment correlated with better test scores on the circuits test and

forces test. For the circuits test, the PRT students averaged 25% higher [8%, 44%] than those who only taught their peers ( $p = .005$ ). For the forces test, PRT participants averaged 10% higher [3.3% to 16.6%] than the TRT participants ( $p = .004$ ). It should be noted that this pattern was not significant across all the unit tests. An analysis on the specific test questions revealed why some units correlated stronger than others.

### **5.2.3 Deeper Look at the PRT Questions**

An analysis of variance test was performed for each question to determine if there were any correlations with participation in the different methods of reciprocal teaching. The results revealed that when the test questions were identical to what was on the PRT/TRT assignments, statistical significance was present. However, when the test questions used a different scenario to test the same principle, there was no significant correlation.

The two unit tests with the most identical questions were the circuits and waves unit tests. This explains why the student performance on these unit tests, especially the specific questions related to the PRT assignment correlated stronger with PRT participation than the other units when the scores were compared against TRT participants and non-participants. For the motion and forces unit, there were weak correlations between the unit test questions related to the PRT assignments.

### **5.2.4 General Academic Conclusions**

PRT participants did only did statistically better than the TRT participants on the forces test ( $p = .004$ ). For the circuits unit, the PRT participants also did better than the non-participant group ( $p = .019$ ); however, for this question, the SAGE score (a confounding variable) favored

the PRT. Notwithstanding, with the SAGE advantage taken into account (using a covariance test), the PRT participants still did significantly better than the TRT group ( $p = .005$ ) on the circuits test.

Overall, no statistically significant pattern was found across all four units favoring PRT participation over the TRT methods or with the non-participants. However, there is enough significant correlations in some of the units and the individual questions to suggest that participating in the PRT assignment had some academic benefit. The analysis done on the specific PRT question suggest significant correlations in helping the PRT participants perform on similar questions between the PRT assignments and unit tests.

## ■ The Effect on Parent Involvement

### 5.3.1 Survey Data, PRT vs TRT

The results suggest that the parents participating in the PRT assignments feel more involved ( $p = .040$ ), hear more from their child about what their child is learning not including the PRT assignments ( $p = .075$ ), and feel more aware of how well they understand what is being taught ( $p = .009$ ) than the parents of the students who participated in the TRT assignments. There is however, no evidence that the PRT assignments effect a parent's awareness of their child's struggles at school.

There is convincing evidence that the PRT assignments correlate with students feeling like their parents are more involved in their education ( $p = .044$ ) and with the students telling their parents more about what they are learning in school ( $p = .008$ ). There is also a suggestive

correlation between the PRT assignments and students feeling their parents know how well they understand the physics principles they should be learning ( $p = .091$ ).

### **5.3.2 PRT Students vs. PRT Parents**

The analysis shows that the parents enjoyed participating in the PRT assignments with an average score of 6.4, meaning between “Agree” and “Strongly agree.” The students still didn’t agree as much with the statement, the difference being significantly less ( $p = .002$ ), answering on average between “Somewhat agree and Agree.” The same pattern occurred again with how much the participants felt the PRT assignments were helping the students learn ( $p = .073$ ).

For the other three questions, there were not significant differences between what the parents responded and what the students responded. However, both parents and students reported an average response between “Somewhat agree” and “Strongly Agree.” These questions addressed issues regarding parental involvement in the child’s education, that the assignments help initiated other conversations about what the child struggles with at school, and that they would appreciate more PRT assignments from other teachers.

### **5.3.3 Noted Benefits from PRT Parents and Students**

The surveys sent out to students and parents included one open-response question asking what benefits the students/parents noticed as they participated in the PRT assignments. The students and parents responded to this question differently. The themes that emerged from the parent’s open responses revealed that the parents focused on slightly different benefits than the students. They are: child’s excitement to teach and deeper comprehension. The student

responses fit four themes: deeper comprehension, retention of knowledge, family connection, and test preparation.

Both parents and students recognized the value of the reciprocal teaching aspect of the assignments, stating they believe PRT helped increase the student's comprehension of the content. However, a higher majority of parents commented that what was most beneficial for them was witnessing the excitement of their child as they taught their parents what they had been learning. This may suggest that many of the students want to celebrate what they are learning by sharing it and parents recognize this through the child's excitement.

#### **5.3.4 Second Survey Group Data**

At the end of the study, 11 parents who had actively participated in the PRT assignments completed an open-ended survey regarding their experiences. This survey asked specific questions about the logistics of the assignments as well as their opinions about its value.

The parents found the time commitment of the PRT assignments to be very reasonable. The average submission time for the PRT assignments for the first two units was 7 minutes with a standard deviation of 4 minutes. None of the respondents complained about the time commitment; some even expressed that they would be fine if the assignments required a little more time.

The parents felt the quiz style of the assignments, retrieving the access code from their email, and completing the assignment on their child's computer were all effective methods for the PRT experience. The allotted time to complete the assignment, 3 to 5 nights, was unanimously agreed as sufficient.

The parents felt the questions were at a level that the students could explain the principles well enough that the parents understood. Some parents felt the questions didn't allow for enough depth on the topic. However, all the respondents felt like the assignments were educationally valuable. A common response from the parents was that they believed teaching a concept is the best way to learn it. Parents also felt more connected with what was going on in class by participating in the PRT assignments.

The parents also believed the PRT assignments provided benefits beyond just helping their child learn physics. The common responses were communication skills, deeper conversations about their school day, and allowing the parent and child to spend more time together. Parents expressed that they would appreciate more opportunities like the PRT assignments from other subjects – as long as it doesn't become too overwhelming.

### ■ A Note from the Teacher

The PRT assignments had a significant impact on how the teacher taught his classes. For Jonathan Welling, the physics teacher, exposing his class content to the parents through the PRT assignments did cause some feelings of vulnerability. For a teacher, students are a comfortable audience. Inviting the parents to participate, though only by listening to their child reteach class content, resulted in some angst about how parents would perceive the content being taught.

This anxiety was not a bad thing, as it forced the teacher to look at his content from the perspective of a parent. As a result, he often asked himself the following question, "If I were a parent, would I view the content being taught in this PRT assignment as relevant to the child's learning?" The consequence of this reflection, changed the focus of some of the class content for the better. The teacher sought new examples to reinforce the principles being taught. These

examples focused on familiar phenomenon and modern technologies which appeared to increase student interest of the principles being taught. The teacher felt this was a positive result of implementing the PRT assignments.

## ■ Conclusions

In regards to the academic benefit of the PRT assignments in comparison to the traditional reciprocal teaching methods, no conclusive statements can be made because of some confounding variables. There was enough evidence to suggest the students participating in the PRT assignments outperformed those participating in the TRT, but this was mainly discovered in situations where the questions on the PRT assignments were identical to those on the unit tests.

Much of the benefits of the PRT assignments are found in their influence on parent involvement. To help communicate the parent-involvement benefits of the PRT assignments, excerpts from the responses from the second survey group participants are included below.

- “Honestly, they were great. Two different times the questions asked clarified and differentiated between 2 similar concepts and she discovered that. I loved that teaching moment.”
- “If the students take them seriously I think it is great. My student did all of them but her interest level varied depending on the topic.”
- “Yes, it was nice to spend time with him doing homework, and to see what he was learning. He would often share some experiences from class.”
- “It gave my son and I an opportunity to discuss his schoolwork, rather than the "how was your day?" "Fine" conversation as per the usual.”



- “Yes. They provide the opportunity to open communication between me and my child and make me aware of what they are learning at school. This has strengthened my relationship with my child.”

These quotes taken from parent surveys show that parents perceived the PRT assignments as a positive experience. One parent even felt they helped strengthen their relationship with child. The analysis of the survey data shows that as parents participated in the assignment with their child, they felt more involved in their child’s education, more aware of what their child was learning and more mindful of how well their child understood the course content. Parents and students enjoyed the assignments and felt they were valuable; they even recommended more teachers implement a similar process.

Overall, the PRT assignments produced many positive benefits for both students and parents. The researchers of this study feel confident in recommending to other teachers that PRT assignments can have a positive impact on student learning and parental involvement in learning. Dr. Epstein (2001) has conducted many studies on the benefits of parent involvement, and has suggested that “teachers need new approaches, organized strategies, and specific tools to help parents become productively involved at home” (pp. 186). The PRT assignments are an answer to this petition. They are an effective tool to help parent become productively involved in the home in their child’s education.

## **Delimitation of the Study**

### **5.6.1 Focus of the PRT Assignments**

Towards the end of the study, while analyzing the questions in the PRT assignments, it was realized that the topics addressed in the questions determined the focus of the PRT assignments. It became apparent that the PRT questions had the potential to take two different focuses; an academic focus, or a focus parent-child connection. Though this study analyzed the questions as if they were focused on academics, it later became apparent that the questions focused more on parent-child connection.

Had the questions focused solely on increasing a child's academic performance, the topics of the PRT questions would center on common misconceptions and difficult physics concepts. This approach would expose the child to more practice with the difficult concepts and therefore likely increase the student's competence in physics resulting in higher test scores. However, the most difficult concepts in physics are typically mathematical and likely less engaging conversation topics for students to discuss with their parents.

A focus on parent-child connection happens when the questions focus on creating engaging dialoged between parent and child. This is the focus used in this study. The PRT questions were created from the most interesting concepts in the course with the intent that they would generate engaging conversation between the student and their parent. It is therefore recommended that to deeper understand the academic benefit of PRT assignments, further studies should investigate the PRT methods with questions focused on the most difficult concepts of the course.

I should also be noted that not only does the focus of the PRT assignments affect the student's learning, but also the quality of the questions. In the open survey responses from parents, some parents commented how certain questions created rich dialogue between them and their child, while other questions were answered by the students with quick vague responses. This means that the benefits a teacher might find from implementing the practice of PRT depends not only on students doing the PRT assignments, but also on the focus and quality of the questions the students discussed with their parents. It is recommended that further research be done to create guidelines and rubrics to help teachers write high quality discussion questions that will be effective for PRT assignments.

### **5.6.2 The Low PRT Participation**

It should be noted that in this study the teacher was not very effective at motivating the students to complete the PRT assignments. The first PRT assignments had the greatest participation of 48%. The participation decreased for the following three units to 38%, 33%, and 33%. This is likely because the assignments were not worth enough points to notably effect student grades.

High school students are often busy after school with extracurricular activities and their social life. Parents are also busy, so the intersection of the two schedules is a small window of time. Though the PRT assignments only required about five minutes, many students were not effective at remembering, scheduling and prioritizing the assignment before its due date. The researchers had hoped that the emails home to parents before each PRT assignments would motivate parents to initiate the PRT conversations with their child. Though some parents did take initiative, the more part of those who completed the PRT assignments were because the

students took the initiative to talk to their parents. Thus it is recommended for future studies that the PRT assignments be worth more points in increase the student initiative to complete the assignments.

### **5.6.3 Ineffective Reciprocal Teaching Methods**

Reciprocal teaching has been well documented as one of the best practices for students to learn content (Hattie, 2017). As such, it would have been expected that a larger correlation existed between the students who participated in the PRT/TRT assignments with those who did not. The fact that this correlation was not statistically significant across all four units, suggests that the methods the teacher used for the PRT/TRT assignments could be improved.

It was observed that when students participated in the TRT assignments, not all the students knew how to teach the content. Since they were confused, they had no ability to teach a peer correctly. For the TRT students, the teacher was a valuable resource in the classroom. The PRT students, however, did not have the teacher accessible to them while they taught their parents at home. This means that though some students completed the PRT/TRT assignments, they may not have actually taught the principles effectively. It would be better if the students knew well in advance the questions they would be required to teach their parents/peers, and had study resources (besides in-class notes, labs and experiences) to help them prepare.

### **5.6.4 TRT Assignments & Trading Off Every Other Question**

Having the students teach a peer in the class resulted in some differences between the TRT and PRT assignments. When students participated in the TRT assignments, the responsibility of what was taught was shared every other question rather than one student

teaching all the content and then allowing their partner to repeat what had been said. This meant that the students participating in the PRT assignments had an advantage over the TRT participants because they taught all the questions every time.

However, the TRT students also had an advantage of teaching a partner who was familiar with the content being taught. If the student teaching became confused, the listener had the capability of stepping in and helping the student teaching work through his confusion. This advantage was not accessible to the PRT participants.

These advantages were not accounted for in this study. It is therefore possible that the PRT students did better because they were able to teach more questions. However, they may have done worse at times because they didn't have a knowledgeable peer for help when needed. The study recognizes that this difference in reciprocal teaching methods effects the comparison between the PRT and TRT practices.

#### **5.6.5 The Class Schedule**

The classes selected for the PRT and TRT assignments were different in their meeting times. The TRT treatment classes (n=3) met during the first part of the school day (starting at 8am), and then immediately following lunch (noon), and the PRT classes met at the end of the day (2pm). The time a class is taught effects the dynamics of the class. For example, morning classes are often quieter than classes after lunch. Also, for much the study, the teacher taught the TRT class periods first. This means that his instruction could have slightly improved through repetitive teaching and benefited the PRT classes. These variables were not accounted for in this study.

## ■ Recommendations

PRT is not limited to high school physics. The ideas behind PRT assignments could be adapted to any subject or grade level. This study only focused on one style of reciprocal teaching – a five question quiz displayed on student laptops. Teachers could try paper sign-off, phone notifications, or an app that connects parents to the teacher. Teachers could also have parents and students watch short videos together and discuss its content. There are a wide variety of methods that could be used to conduct a PRT assignment, and each of these could add to the understanding of this approach to learning. Additional research should be conducted analyzing and investigating the impact of these other PRT methods.

## REFERENCES

- Acock, A. C., & Demo, D. H. (1994). *Family Diversity and Eellbeing*. Thousand Oaks, CA: Sage.
- Binns, K., A. Steinberg, and S. Amorosi. (1997). *The Metropolitan Life Survey of the American Teacher: Building Family–School Partnerships: Views of teachers and students*. New York: Lewis Harris and Associates.
- Cooper, C. E., & Crosnoe, R. (2007). The Engagement in Schooling of Economically Disadvantaged Parents and Children. *Youth & Society*, 38, 372-391.
- Colombo, M. W. (2006). Building School Partnerships with Culturally and Linguistically Diverse Families. *Phi Delta Kappan*, 2, 314–318.
- Desforges, C., & Abouchaar, A. (2003). *The Impact of Parental Involvement, Parental Support and Family Education on Pupil Achievement and Adjustment: a Review of Literature*. Nottingham: DfES Publications.
- Deslandes, R., & Cloutier, R. (2002). Adolescents' Perception of Parental Involvement in Schooling. *School Psychology International*, 23(2), 220-232.
- Eccles, J.S., & Harold, R.D. (1993). Parent–School Involvement During the Early Adolescent Years. *Teachers College Record* 94, no. 3: 568–87.
- Epstein, J.L. (2017, February 20). TIPS: Teachers Involve Parents in Schoolwork. Retrieved February 24, 2018, from <http://nnps.jhucosos.com/tips/>
- Epstein, J. L. (2001). *School, Family, and Community Partnerships: Preparing Educators and Improving Schools*. Boulder, CO: Westview.
- Epstein, J. L., & Van Voorhis, F. L. (2001). More than Minutes: Teachers' Roles in Designing Homework. *Educational Psychologist*, 36(3), 181-193.
- Fan, X., & Chen, M. (2001). *Parental Involvement and Students' Academic Achievement: A Meta-Analysis*. Kluwer Academic -Plenum .  
doi:<https://doi.org/10.1023/A:1009048817385>
- Farkas, S., Johnson, J. M., & Duffett, A. (1999). *Playing their Parts: Parents and Teachers Talk about Parental Involvement in Public Schools*. New York: Public Agenda.

- Green, C.L., Walker, J.M.T., Hoover-Dempsey, K.V., & Sandler, H.M. (2007). Parents' motivations for involvement in children's education: An empirical test of a theoretical model of parental involvement. *Journal of Educational Psychology* 99, no. 3: 532–44.
- Harris, A. and Goodall, J. (2008) Do Parents Know They Matter? Engaging All Parents in Learning. *Educational Research*, Vol.50 (No.3). pp. 277-289. ISSN 0013-1881
- Harris, A., & Chrispeels, J.H., (2006). *Improving Schools and Educational Systems: International Perspectives*. London: Routledge. 315.
- Hattie, J. (2017). *VISIBLE LEARNING FOR TEACHERS: Maximizing Impact on Learning*. S.I.: Garland Science.
- Ho. E. S., & Willms. J. D. (1996). Effects of Parental Involvement on Eighth-Grade Achievement. *Sociology of Education*, 69. 126-141.
- Hoover-Dempsey, Battiato, K.V., A.C., Walker, J.M., Reed, R.P., Dejong, J.M., & Jones, K.P., (2001). Parental Involvement in Homework. *Educational Psychologist* 36, no. 3: 195–209.
- Hoover-Dempsey, K.V., & Sandler, H.M., (1997). Why do Parents Become Involved in their Children's Education? *Review of Educational Research* 67, no. 1: 3–42.
- Hoover-Dempsey, K. V., Walker, J. M., Jones, K. P., & Reed, R. P. (2002). Teachers Involving Parents (TIP): Results of an In-Service Teacher Education Program for Enhancing Parental Involvement. *Teaching and Teacher Education*, 18(7), 843-867.
- Henderson, A., & Berla, N. (1997). *A New Generation of Evidence: The Family is Critical to Student Achievement*. Washington, DC: Center for Law and Education.
- Hornby G. & Lafaele R. (2011): Barriers to parental involvement in education: an explanatory model, *Educational Review*, 63:1, 37-52
- Karibayeva, A., & Boğar, Y. (2014). To what Extent does Parents' Involvement in Middle School Influence Children's Educational Progress? *Procedia - Social and Behavioral Sciences*, 152, 529-533.
- Mellon, R. C, & Moutavelis, A. G. (2009). Parental Educational Involvement Conceived as the Arrangement of Contingency Operations. *Educational Psychology*, 29, 621–643.
- Moawad, G., & Ebrahim, G. (2016). The Relationship between Use of Technology and Parent-adolescent Social Relationship. *Journal of Education and Practice*, 7 (14), 168-178
- Newman, K. S., & Chin, M. M. (2003). High stakes: Time poverty, Testing, and the Children of the Working Poor. *Qualitative Sociology*, 26, 3-34.
- Portier, C. A., Peterson, S. S., Capitaio-Tavares, Z., Rambaran, Z., (2013). Parent Perceptions and Recommendations about Homework Involving Wikis and Blogs. *Middle School Journal*, 44.5, 6-14.



- Sad, S. N., Konca, A. S., Özer, N., Acar, F. (2016). Parental E-nvolvement: a Phenomenological Research on Electronic Parental Involvement. *International Journal of Pedagogies and Learning* . Vol. 11, Iss. 2.
- Sanders, M. G., Epstein, J. L., & Connors-Tadros, L. (1999). Family partnerships with high schools: The parents' perspective. (Report 32). Baltimore, MD: Johns Hopkins University, Center for Research on the Education of Students Placed At Risk (CRESPAR).
- Shumow, L., Lyutykh, E., Schmidt, J. (2011) Predictors and Outcomes of Parental Involvement with High School Students in Science. *School Community Journal*, 21:2, 81-98.
- Simon, B. (2000). Predictors of high school and family partnerships and the influence of partnerships and student success. Unpublished doctoral dissertation, Johns Hopkins University, Baltimore. MD.
- U.S. Bureau of Labor Statistics. (n.d.). Retrieved February 03, 2018, from <https://www.bls.gov/news.release/famee.t02.htm>
- Van Voorhis, F. L. (2001). Interactive Science Homework: An Experiment in Home and School Connections. *NASSP Bulletin*, 85 (627), 20-32.
- Van Voorhis, F. L. (2000). The effects of interactive (TIPS) and non-interactive homework assignments on science achievement and family involvement of middle grade students. Unpublished doctoral dissertation, University of Florida, Gainesville.
- Van Voorhis, F. L. (2003). Interactive Homework in middle school: effect on Family involvement and science achievement. *The Journal of Educational Research*, 96 (3), 323-338.
- Van Voorhis, F. L. (2004). Reflecting on the Homework Ritual: Assignments and Designs. *Theory Into Practice*, 43 (3), 205-212.
- Walker, J. M. T., Hoover-Dempsey, K. V., Whetsel, D. R., & Green, C. L. (2004). Parental Involvement in Homework: A review of Current Research and its Implications for Teachers, after School Program Staff, and Parent Leaders. Cambridge, MA: Harvard Family Research Project; Harvard Graduate School of Education.
- Williams, B., Williams, J., & Ullman, A. (2002). *Parental Involvement in Education*. London: Dept. for Education and Skills.

## APPENDICES

## **Appendix A – PRT Assignments**

### **PRT 1 - Parent Reciprocal Teaching on Circuits**

#### Instructions

The best way to learn something is to teach it. This assignment is aimed to give students a chance to briefly teach parents/guardians a few core concepts they learned in their physics class. This will also be a helpful study activity for their coming test.

Students: I have provided pictures for you to help with your explanations. This means you should be showing your computer screen to your parents while you teach them.

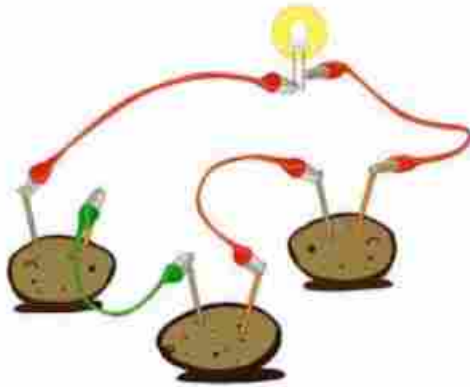
Question 1

1 pts

How does a battery work?



In class we made batteries out of potatoes. How were these similar?



My child explained how a battery works

Question 2

1 pts

Why do some plugs have 3 prongs while others only have 2?



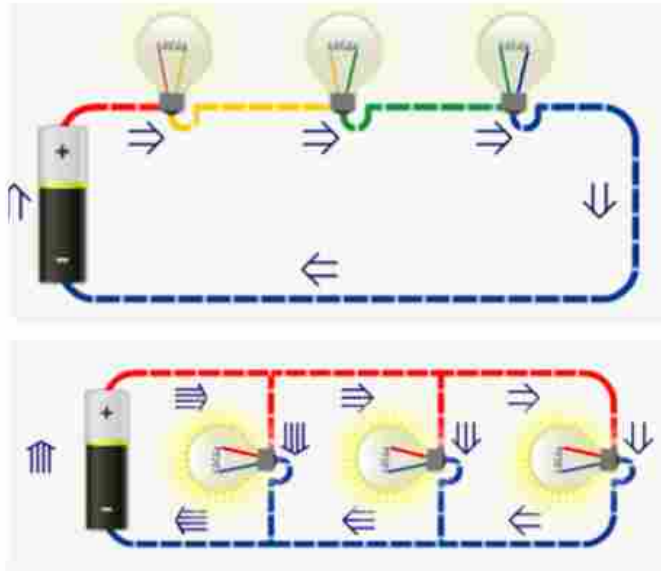
Explained

Question 3

1 pts

Explain why some Christmas lights (series) don't work when one bulb breaks. However, other brands will still work even if one bulb breaks.

Here are some pictures of series and parallel circuits



Ⓞ Explained

Question 4

1 pts

Why do you need the power adapter box in the middle of your phone charging cable when it's plugged into the wall, but not when plugged into your computer?



Ⓞ Explained

Question 5

1 pts

Extra Credit Question

Let's say your TV remote batteries die and the only batteries you can find in your house are the large D batteries.

Could you use the D batteries for your TV remote?

What would be different?



## PRT 2 - Parent Reciprocal Teach for Waves


The access code for this assignment was sent in an email to parents.

The best way to learn something is to teach it. This assignment is aimed to give students a chance to briefly teach parents/guardians a few core concepts they learned in their physics class. This will also be a helpful study activity for their test next week.


There are 5 questions and a bonus extra credit question for students to explain to their parent/guardian/older sibling.

Question 1 1 pts

How does WiFi work?



How is it similar to Morse Code?

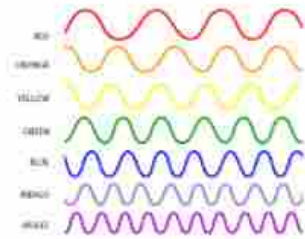


Explained

In 2006, the Blue ray player was released to the public market.



What is the big difference between the blue ray players and old DVD players?



Why does changing the color of laser increase the quality?

Ⓐ Explained!



In class we did a Kazoo lab and built a large variety of different sounding kazoos.

Explain how the kazoo created sound and how you could modify that sound to play different "notes."



Almost all instruments follow a similar structural pattern that allows for different notes. What is that pattern?

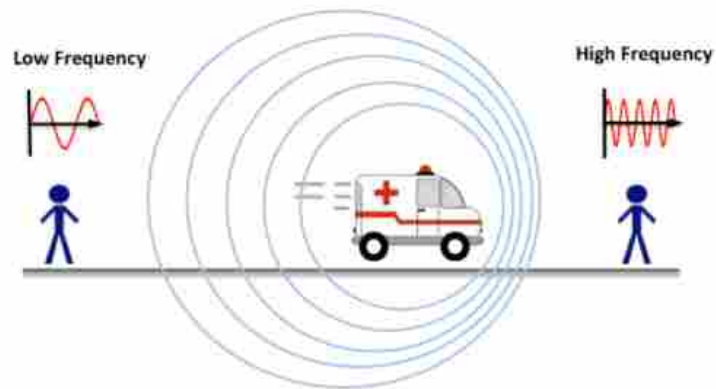


Ⓜ Explained

### The Doppler effect

When standing on the side of the road and a car drives by, why does the sound coming from the car change pitch as it passes you?

## Doppler Effect



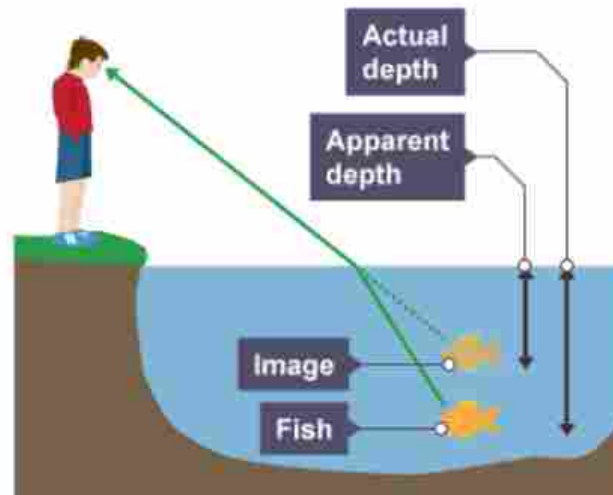
📖 Explained

### Refraction

When light travels through different materials (like water) it can cause some strange effects.



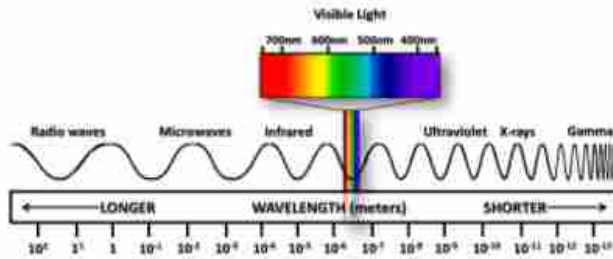
Explain why objects in water always look closer to the surface than they actually are?



Ⓞ Explained

**Extra Credit Question**

The physics of light tells us that some colors of light have more energy than others.



If we apply this to Star Wars, than some light-sabers would technically be more powerful than others.

If we assume that the light with the greatest energy is the most power, which of the following Jedi's would have the most powerful light-saber?

Who has the weakest light-saber?



### PRT 3 - Motion

The access code for this assignment was sent in an email to parents.

The best way to learn something is to teach it. This assignment is aimed to give students a chance to briefly teach parents/guardians a few core concepts they learned in their physics class. This will also be a helpful study activity for their test next week.

Question 1 1 pts

**Falling penny**

If a penny is dropped from a building, even the tallest skyscraper, it will never reach deadly speeds? Why?



Explained

The image shows a low-angle shot of several tall skyscrapers reaching towards a blue sky with light clouds. In the center of the frame, a single penny is captured in mid-air, appearing to fall from the top of one of the buildings. The perspective makes the buildings converge towards the top of the image, emphasizing their height.

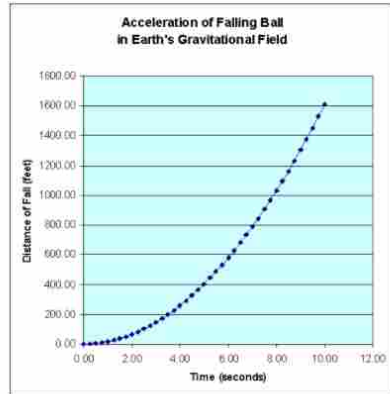
Question 2

1 pts

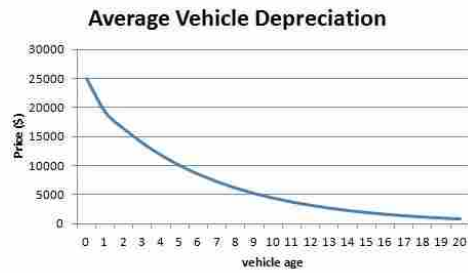
Examples of acceleration

Below are three graphs. Explain how acceleration (a changing rate) is represented in each example.

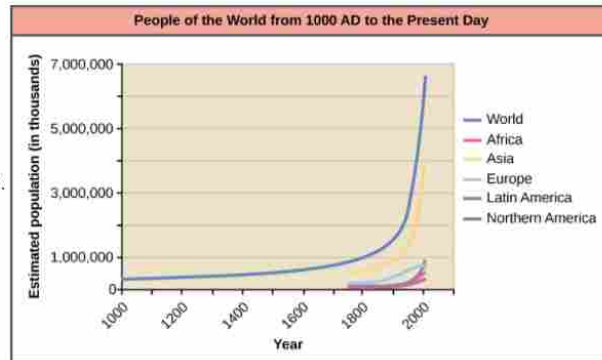
1. The distance of a falling object.



2. The value of a new car after purchase.



3. The world's population.



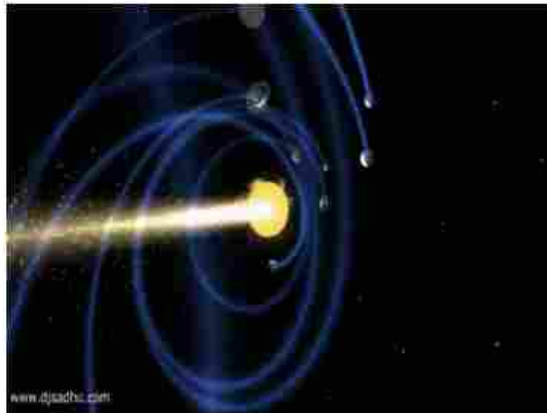
Explained

Question 3

1 pts

Relative motion

Motion is relative. Right now you may appear stationary, but in fact, we are on a spinning planet orbiting a moving star. How can we be both stationary and moving?



Ⓜ Explained

Question 4

1 pts

Bowling Ball Lab

Explain how you were able to predict the exact collision location of two bowling balls rolling towards each other.



Ⓜ Explained

## PRT 4 - Forces


The access code for this assignment was sent in an email to parents.

The best way to learn something is to teach it. This assignment is aimed to give students a chance to briefly teach parents/guardians a few core concepts they learned in their physics class. This will also be a helpful study activity for their coming test.

Question 1 1 pts

**Pulling out the tablecloth**

In class we demonstrated that you can actually pull a tablecloth out from a set table?  
How does Newton's First Law explain why this is possible?



ⓘ Explained



Question 2

1 pts

### Grocery Cart Science

A heavy grocery cart (or cart full of students) is a great demonstration of the relationship between mass and acceleration.

How does the mass of an object affect its ability to accelerate?



Explained

Question 3

1 pts

### The science of walking

During a class lab students were given a simple challenge. They started standing on a Scooter pad (wide skateboard) and were asked to simply step off the scooter and land two feet forward.

Using your understanding of forces, explain why the challenge was almost impossible.



Explained

Question 4

1 pts

### The fastest diet possible

If you put your bathroom scale on top of a folded towel it will display a weight much less than your actual weight. Why?



Explained

Question 5

1 pts

### Hammer Your Hand

A fun demo we did in class asked students to place their hand underneath a forty pound metal plate and then pounded on the top of it with a hammer. Surprisingly, it didn't hurt.


What is the physics behind why it didn't hurt?



Explained

## Appendix B – Surveys

### Survey sent to parents of TRT treatment classes.



Please indicate how well you agree or disagree with the following statements

	Strongly agree	Agree	Somewhat agree	Neither agree or disagree	Disagree	Somewhat disagree	Strongly disagree
For Mr. Welling's class, I feel I am involved in my child's education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child often tells me about what he/she is learning in Mr. Welling class.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know how well my child understands the physics concepts taught in Mr. Welling's class.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel aware of the struggles my child faces at school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would appreciate more opportunities to be involved in my child's education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[>>](#)

Survey Sent to parents of PRT treatment classes

**BYU**  
BRIGHAM YOUNG  
UNIVERSITY

So far there have been Four PRT (Parent reciprocal teaching) assignments (Circuits, Waves, Motion, and Forces).  
Of these, how many have you participated in with your child?

One

Two

Three

All four

None

	Strongly agree	Agree	Somewhat agree	Neither agree or disagree	Disagree	Somewhat disagree	Strongly disagree
For Mr. Welling's class, I feel I am involved in my child's education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My child often tells me about what he/she is learning in Mr. Welling class (not including the PRT assignments).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know how well my child understands the physics concepts taught in Mr. Welling's class.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel aware of the struggles my child faces at school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please indicate how well you agree or disagree with the following statements


	Strongly Agree	Agree	Somewhat agree	Neither agree or disagree	Somewhat disagree	Disagree	Strongly Disagree
I enjoy participating in the PRT assignments with my child.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel the PRT assignments are helping my child learn the class content.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel the PRT assignments are allowing me to participate more in my child's education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The PRT assignments have helped initiate other conversations which have increased my awareness of the struggles my child faces at school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would like more teachers do something like the PRT assignments:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

As you have participated in the PRT assignments with your child, what benefits have you noticed?

Do you have any suggestions for how the experience of the PRT assignments could be improved?



## Second survey group survey



**BYU**  
BRIGHAM YOUNG  
UNIVERSITY

This survey will ask 10 questions about your experiences with the Parent Reciprocal Teaching (PRT) assignments you did with your child. This survey is anonymous, so if you have any negative opinions, please tell me.

---

1. TIME COMMITMENT - What is your opinion about the time commitment for the PRT assignments?

---

2. ASSIGNMENT STYLE - What are your thoughts about the access code email and doing it on your child's computer? Did this method work OK for you?

---

3. DUE DATE - I tried to give students 3-5 nights to complete the assignment with their parents. Did you feel this was sufficient time for your schedule?

---

4. PRT QUESTIONS - How did you feel about the questions asked in the PRT assignments? What type of questions worked well for these assignments? Do you have any suggestions for how to make the questions better?



5. What is your honest opinion about the educational value of these assignments?

6. Do you feel the PRT assignments resulted in any benefits beyond academic learning?

7. Did the PRT assignments ever lead to valuable discussions beyond the physics principles? If so, what else was talked about?

8. Sometimes teachers will talk about a parent-teacher relationship. This may refer to how well the parents feel connected or comfortable with the teacher. How has participating in the PRT assignments affected your parent-teacher relationship with Mr. Welling?

9. Do you feel activities, like the PRT assignments, that involve both the parent and child, should be more common in education? Would you appreciate something like for your child's other classes (English, Math, History, etc.)?

10. Do you have any last suggestions or comments about the PRT assignments that you feel Mr. Welling should know about?





## Appendix C – Consent Forms

### Consent to be a Research Subject and participate in student surveys (PRT Group)

#### **Introduction**

This research study is being conducted by Jonathan Welling as part of his graduate program at Brigham Young University with Dr. Geoff Wright as his committee chair (research advisor). The study is on a homework method for students called Parent Reciprocal Teaching (PRT) to determine its influence on parent involvement and the learning process of students. Parent involvement can be defined by how well you feel your parents are aware of what you are learning and your proficiency with the class content. You were invited to participate because as a student in Mr. Welling's physics class, you will be participating in the homework method being studied. The researcher would appreciate your consent to use your feedback as data for his study.

#### **Procedures**

If you agree to participate in this research study, the following will occur:

- You will receive a four short online surveys about your experience with the PRT assignments and the involvement of your parents in your education (approximately in October, November, January, and February).
- The surveys will be designed to take 5 minutes or less and will be taken during class time.
- You will be allowed to opt out of the surveys without it effecting your grade.
- Further in the study, a few students will receive an invitation to participate in small second survey groups or group meetings. At that point a different consent form will be distributed asking if the selected participant would be willing to participate in additional procedures.

#### **Risks/Discomforts**

The survey questions will ask about your participation in the PRT homework assignments. The risks for this study include emotional discomfort especially if you did not have time to participate in the PRT assignments with your parent. The surveys questions are optional, you may choose not to respond to any question that makes you uncomfortable. You will also have the option to remain anonymous.

#### **Benefits**

There will be no direct benefits to you. It is hoped, however, that through your participation other teachers may learn about this PRT homework method from a student's perspective and how you felt it influenced your learning.

**Confidentiality**

All survey responses will be kept in password protected files and only the research will have access to the data. You will have the option to remain anonymous for all your responses to survey questions. At the conclusion of the study, all identifying information will be removed and the data will be kept in the researcher's locked cabinet.

**Compensation**

There will be no compensation for your participation in this study.

**Participation**

Participation in this research study is voluntary. The homework assignments are part of the class and you are expected to do them and they will affect your grade. However, the surveys are optional and will not affect your grade or standing in Mr. Welling’s class.

**Questions about the Research**

If you have questions regarding this study, you may contact Jonathan Welling at [jonathan.welling@wasatch.edu](mailto:jonathan.welling@wasatch.edu) or Geoff Wright at [geoffwright@byu.edu](mailto:geoffwright@byu.edu) for further information.

**Questions about Your Rights as Research Participants**

If you have questions regarding your rights as a research participant contact IRB Administrator at (801) 422-1461; A-285 ASB, Brigham Young University, Provo, UT 84602; [irb@byu.edu](mailto:irb@byu.edu).

**Statement of Consent**

I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

Student’s Name (Printed): \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

# Parental Permission for a Minor - participate in Student surveys (PRT Group)

## **Introduction**

This research study is being conducted by Jonathan Welling as part of his graduate program at Brigham Young University with Dr. Geoff Wright as his committee chair (research advisor). The study is on a homework method for students called Parent Reciprocal Teaching (PRT) to determine its influence on parent involvement and the learning process of students. Parent involvement can be defined by how well your child feels his/her parents are aware of what he/she is learning and his/her proficiency with the class content. Your child was invited to participate because as a student in Mr. Welling's physics class, he/she will be participating in the homework method being studied. The researcher would appreciate your consent to use your child's feedback as data for his study.

## **Procedures**

If you agree to allow your child to participate in this research study, the following will occur:

- Your child will receive a four short online surveys about their experience with the PRT assignments (approximately in October, November, January, and February).
- The surveys will be designed to take 5 minutes or less and will be taken during class time.
- Your child will be allowed to opt out of the surveys without it effecting your child's grade.
- Further in the study, a few students will receive an invitation to participate in small second survey groups or group meetings. At that point a different consent form will be distributed asking if the selected participant would be willing to participate in additional procedures.

## **Risks/Discomforts**

The survey questions will ask about your child's participation in the PRT homework assignments. The risks for this study include emotional discomfort especially if your child did not have time to participate in the PRT assignments with their parent. The surveys questions are optional, your child may choose not to respond to any question that makes him/her uncomfortable. Your child will also have the option to remain anonymous.

## **Benefits**

There will be no direct benefits to your child. It is hoped, however, that through your child's participation other teachers may learn about this PRT homework method from a student's perspective and how your child felt it influenced their learning.

## **Confidentiality**

All survey responses will be kept in password protected files and only the research will have access to the data. Your child will have the option to remain anonymous for all his/her responses to survey questions. At the conclusion of the study, all identifying information will be removed and the data will be kept in the researcher's locked cabinet.

## **Compensation**

There will be no compensation for your participation in this study.

**Participation**

Participation in this research study is voluntary. The homework assignments are part of the class and are expected to do them and they will affect your child’s grade. However, the surveys are optional and will not affect your child’s grade or standing in Mr. Welling’s class.

**Questions about the Research**

If you have questions regarding this study, you may contact Jonathan Welling at [jonathan.welling@wasatch.edu](mailto:jonathan.welling@wasatch.edu) or Geoff Wright at [geoffwright@byu.edu](mailto:geoffwright@byu.edu) for further information.

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**Statement of Consent**

I have read, understood, and received a copy of the above consent and desire of my own free will to allow my child to participate in this study.

Student’s Name (Printed): \_\_\_\_\_

Parent’s Name (Printed): \_\_\_\_\_

Parent’s Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## Consent to be a Research Subject and participate in Parent surveys (PRT Group)

### **Introduction**

This research study is being conducted by Jonathan Welling as part of his graduate program at Brigham Young University with Dr. Geoff Wright as the advisor. The study is on a homework method for students called Parent Reciprocal Teaching (PRT) to determine its influence on parent involvement and the learning process of students. Your involvement can be defined by how well you feel you are aware of what your child is learning and their proficiency with the class content. You were invited to participate because as a parent of one of the students in Mr. Welling's physics class, your child will be participating in the homework method being studied. The researcher would appreciate your consent to use your feedback as data for his study.

### **Procedures**

If you agree to participate in this research study, the following will occur:

- You will receive a four short online surveys sent to your email about your experience with the PRT assignments and you involvement with your child's education (approximately in October, November, January, and February).
- The surveys will be designed to take 5 minutes or less.
- You will be allowed to opt out of the survey email list at any time.
- Further in the study, a few parents will receive an invitation to participate in small second survey groups or group meetings. At that point a different consent form will be distributed asking if the selected participant would be willing to participate in additional procedures.

### **Risks/Discomforts**

The survey questions will ask about your participation with your child in the PRT homework assignments. The risks for this study include emotional discomfort especially if you did not have time to participate in the PRT assignments with your child/student you care for. The surveys questions are optional, you may choose not to respond to any question that makes you uncomfortable. You will also have the option to remain anonymous.

### **Benefits**

There will be no direct benefits to you. It is hoped, however, that through your participation researchers and teachers may learn about this PRT homework method from a parent's perspective and how they perceived its influence on the learning of their child.

### **Confidentiality**

All survey responses will be kept in password protected files and only the research will have access to the data. You will have the option to remain anonymous for all your responses to

survey questions. At the conclusion of the study, all identifying information will be removed and the data will be kept in the researcher's locked cabinet.

**Compensation**

There will be no compensation for your participation in this study.

**Participation**

Participation in this research study is voluntary. You have the right to withdraw at any time or refuse to participate entirely without jeopardy to your child's grade or standing in Mr. Welling's class.

**Questions about the Research**

If you have questions regarding this study, you may contact Jonathan Welling at [jonathan.welling@wasatch.edu](mailto:jonathan.welling@wasatch.edu) or Geoff Wright at [geoffwright@byu.edu](mailto:geoffwright@byu.edu) for further information.

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**Statement of Consent**

I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

Name (Printed): \_\_\_\_\_

Email: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## Consent to be a Research Subject and participate in student surveys (TRT Group)

### **Introduction**

This research study is being conducted by Jonathan Welling as part of his graduate program at Brigham Young University with Dr. Geoff Wright as the advisor. The study examines the difference in parent involvement between two instructional practices: Parent Reciprocal Teaching (PRT) and Reciprocal teaching (RT). You are part of the class assigned the RT assignments. You were invited to participate in this study because as a students in Mr. Welling's physics class, your parent's involvement in your education is of interest for this study. Your parent's involvement can be defined by how well you feel they are aware of what you are learning and your proficiency with the class content. The researcher would appreciate your consent to use your feedback as data for his study.

### **Procedures**

If you agree to participate in this research study, the following will occur:

- You will receive a four short online surveys about your parent's involvement in your education (approximately in October, November, January, and February).
- The surveys will be designed to take 5 minutes or less.
- You will be allowed to opt out of the survey email list at any time.

### **Risks/Discomforts**

The survey questions will ask about your parent's involvement in your education. The risks for this study include emotional discomfort especially if your parents did not have time to be as involved in your education. The surveys questions are optional, you may choose not to respond to any question that makes you uncomfortable. You will also have the option to remain anonymous.

### **Benefits**

There will be no direct benefits to you. It is hoped, however, that through your participation researchers and teachers may learn about parent involvement.

### **Confidentiality**

All survey responses will be kept in password protected files and only the research will have access to the data. You will have the option to remain anonymous for all your responses to survey questions. At the conclusion of the study, all identifying information will be removed and the data will be kept in the researcher's locked cabinet.

### **Compensation**

There will be no compensation for your participation in this study.

### **Participation**

Participation in this research study is voluntary. You have the right to withdraw at any time or refuse to participate entirely without jeopardy to your grade or standing in Mr. Welling's class.

**Questions about the Research**

If you have questions regarding this study, you may contact Jonathan Welling at [jonathan.welling@wasatch.edu](mailto:jonathan.welling@wasatch.edu) or Geoff Wright at [geoffwright@byu.edu](mailto:geoffwright@byu.edu) for further information.

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**Statement of Consent**

I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

Student's Name (Printed): \_\_\_\_\_

Signature: \_\_\_\_\_



# Parental Permission for a Minor - participate in Student surveys (TRT Group)

## **Introduction**

This research study is being conducted by Jonathan Welling as part of his graduate program at Brigham Young University with Dr. Geoff Wright as the advisor. The study examines the difference in parent involvement between two instructional practices: Parent Reciprocal Teaching (PRT) and Reciprocal teaching (RT). Your child are part of the class assigned the RT assignments. Your child was invited to participate in this study because as a students in Mr. Welling's physics class, your involvement in your child's education is of interest for this study. Parent involvement can be defined by how well you feel you are aware of what your child is learning and his/her proficiency with the class content. The researcher would appreciate your consent to use your child's feedback as data for his study.

## **Procedures**

If you agree to participate in this research study, the following will occur:

- Your child will receive a four short online surveys about your involvement in his/her education (approximately in October, November, January, and February).
- The surveys will be designed to take 5 minutes or less.
- Your child will be allowed to opt out of the survey email list at any time.

## **Risks/Discomforts**

The survey questions will ask about your involvement in your child's education. The risks for this study include emotional discomfort especially if a child feels their parents do not have time to be as involved in their education. The surveys questions are optional, you child may choose not to respond to any question that makes you uncomfortable. You will also have the option to remain anonymous.

## **Benefits**

There will be no direct benefits to you or your child. It is hoped, however, that through your child's participation researchers and teachers may learn about parent involvement.

## **Confidentiality**

All survey responses will be kept in password protected files and only the research will have access to the data. You will have the option to remain anonymous for all your responses to survey questions. At the conclusion of the study, all identifying information will be removed and the data will be kept in the researcher's locked cabinet.

## **Compensation**

There will be no compensation for your participation in this study.

## **Participation**

Participation in this research study is voluntary. Your child has the right to withdraw at any time or refuse to participate entirely without jeopardy to your grade or standing in Mr. Welling's class.

**Questions about the Research**

If you have questions regarding this study, you may contact Jonathan Welling at [jonathan.welling@wasatch.edu](mailto:jonathan.welling@wasatch.edu) or Geoff Wright at [geoffwright@byu.edu](mailto:geoffwright@byu.edu) for further information.

**Questions about Your Rights as Research Participants**

If you have questions regarding your rights as a research participant contact IRB Administrator at (801) 422-1461; A-285 ASB, Brigham Young University, Provo, UT 84602; [irb@byu.edu](mailto:irb@byu.edu).

**Statement of Consent**

I have read, understood, and received a copy of the above consent and desire of my own free will give consent for my child to participate in this study.

Student's Name (Printed): \_\_\_\_\_

Parent's Name (Printed): \_\_\_\_\_

Parent's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

# Consent to be a Research Subject and participate in Parent surveys (TRT Group)

## **Introduction**.....

This research study is being conducted by Jonathan Welling as part of his graduate program at Brigham Young University with Dr. Geoff Wright as the advisor. The study examines the difference in parent involvement between two instructional practices: Parent Reciprocal Teaching (PRT) and Reciprocal teaching (RT). Your child is part of the class assigned the RT assignments. You were invited to participate in this study because as a parent of one of the students in Mr. Welling's physics class, your involvement in your child's education is of interest for this study. Your involvement can be defined by how well you feel you are aware of what your child is learning and their proficiency with the class content. The researcher would appreciate your consent to use your feedback as data for his study.

## **Procedures**

If you agree to participate in this research study, the following will occur:

- You will receive a four short online surveys sent to your email about your involvement as a parent in your child's education (approximately in October, November, January, and February).
- The surveys will be designed to take 5 minutes or less.
- You will be allowed to opt out of the survey email list at any time.

## **Risks/Discomforts**

The survey questions will ask about your involvement in your child's education. The risks for this study include emotional discomfort especially if you did not have time to be involved in the education of your child. The surveys questions are optional, you may choose not to respond to any question that makes you uncomfortable. You will also have the option to remain anonymous.

## **Benefits**

There will be no direct benefits to you. It is hoped, however, that through your participation researchers and teachers may learn about parent involvement.

## **Confidentiality**

All survey responses will be kept in password protected files and only the research will have access to the data. You will have the option to remain anonymous for all your responses to survey questions. At the conclusion of the study, all identifying information will be removed and the data will be kept in the researcher's locked cabinet.

## **Compensation**

There will be no compensation for your participation in this study.

## **Participation**

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**Questions about the Research**

If you have questions regarding this study, you may contact Jonathan Welling at [jonathan.welling@wasatch.edu](mailto:jonathan.welling@wasatch.edu) or Geoff Wright at [geoffwright@byu.edu](mailto:geoffwright@byu.edu) for further information.

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**Statement of Consent**

I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

Parent's Name (Printed): \_\_\_\_\_

Email: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## Appendix D - Data

Student ID	Gender	Ethnicity	PR T/ TR T	C - PRT, No PRT, RT	W - PRT, NO PRT, RT	M - PRT, NO PRT, RT	F - PRT, NO PRT, RT	PRT 1 - Circuits	PRT 2 - Waves	PRT 3 - Motion	PRT 4 - Forces	TRT 1 Circuits	TRT 2 waves	TRT 3 - Motion	TRT 4 - Forces
9150	f	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
9769	f	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
10303	f	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
10389	f	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
10694	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
10730	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
15160	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
16532	m	h	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
18738	m	h	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
20266	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
9458	f	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
10217	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
10278	m	h	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
10576	f	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
10698	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
11144	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
20088	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
20398	m	h	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
10650	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
10709	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
17424	f	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
20569	m	h	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
20394	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	0	0	0	0	N/A	N/A	N/A	N/A
9015	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	1	0	0	0	N/A	N/A	N/A	N/A
17579	m	w	PR T	NO PRT, RT	NO PRT, RT	NO PRT, RT	NO PRT, RT	1	0	0	0	N/A	N/A	N/A	N/A

102			PR		NO	NO	NO										
43	f	w	T	PRT	PRT	PRT	PRT	1	0	0	0	N/A	N/A	N/A	N/A		
104			PR		NO	NO	NO										
67	f	w	T	PRT	PRT	PRT	PRT	1	0	0	0	N/A	N/A	N/A	N/A		
106			PR		NO	NO	NO										
31	f	w	T	PRT	PRT	PRT	PRT	1	0	0	0	N/A	N/A	N/A	N/A		
106			PR		NO	NO	NO										
61	m	w	T	PRT	PRT	PRT	PRT	1	0	0	0	N/A	N/A	N/A	N/A		
202			PR		NO	NO	NO										
56	f	w	T	PRT	PRT	PRT	PRT	1	0	0	0	N/A	N/A	N/A	N/A		
203			PR		NO	NO	NO										
81	f	w	T	PRT	PRT	PRT	PRT	1	0	0	0	N/A	N/A	N/A	N/A		
175			PR		NO	NO	NO										
15	f	w	T	PRT	PRT	PRT	PRT	0	1	0	0	N/A	N/A	N/A	N/A		
194			PR		NO	NO	NO										
31	f	w	T	PRT	PRT	PRT	PRT	1	1	0	0	N/A	N/A	N/A	N/A		
108			PR		NO	NO	NO										
52	f	w	T	PRT	PRT	PRT	PRT	1	1	0	0	N/A	N/A	N/A	N/A		
173			PR		NO	NO	NO										
74	f	w	T	PRT	PRT	No PRT	PRT	1	1	0	0	N/A	N/A	N/A	N/A		
144			PR		NO	NO	NO										
38	m	w	T	PRT	PRT	PRT	PRT	1	0	1	0	N/A	N/A	N/A	N/A		
118			PR		NO	NO	NO										
58	m	w	T	PRT	PRT	PRT	PRT	0	1	1	0	N/A	N/A	N/A	N/A		
161			PR		NO	NO	NO										
27	m	w	T	PRT	PRT	PRT	PRT	0	1	1	0	N/A	N/A	N/A	N/A		
105			PR		NO	NO	NO										
97	f	w	T	PRT	PRT	PRT	PRT	1	1	1	0	N/A	N/A	N/A	N/A		
106			PR		NO	NO	NO										
99	m	w	T	PRT	PRT	PRT	PRT	1	1	1	0	N/A	N/A	N/A	N/A		
103			PR		NO	NO	NO										
87	f	w	T	PRT	PRT	PRT	PRT	1	1	1	0	N/A	N/A	N/A	N/A		
965			PR		NO	NO	NO										
2	m	w	T	PRT	PRT	PRT	PRT	0	0	0	1	N/A	N/A	N/A	N/A		
105			PR		NO	NO	NO										
63	f	w	T	PRT	PRT	PRT	PRT	0	0	0	1	N/A	N/A	N/A	N/A		
105			PR		NO	NO	NO										
91	f	w	T	PRT	PRT	PRT	PRT	0	0	0	1	N/A	N/A	N/A	N/A		
104			PR		NO	NO	NO										
24	f	w	T	PRT	PRT	PRT	PRT	0	0	0	1	N/A	N/A	N/A	N/A		
106			PR		NO	NO	NO										
41	f	w	T	PRT	PRT	PRT	PRT	0	0	0	1	N/A	N/A	N/A	N/A		
144			PR		NO	NO	NO										
55	f	h	T	PRT	PRT	PRT	PRT	0	1	0	1	N/A	N/A	N/A	N/A		
112			PR		NO	NO	NO										
05	f	w	T	PRT	PRT	PRT	PRT	1	0	1	1	N/A	N/A	N/A	N/A		
963			PR		NO	NO	NO										
7	f	h	T	PRT	PRT	PRT	PRT	0	1	1	1	N/A	N/A	N/A	N/A		
126			PR		NO	NO	NO										
61	m	w	T	PRT	PRT	PRT	PRT	0	1	1	1	N/A	N/A	N/A	N/A		
939			PR		NO	NO	NO										
2	f	w	T	PRT	PRT	PRT	PRT	0	1	1	1	N/A	N/A	N/A	N/A		
101			PR		NO	NO	NO										
56	f	w	T	PRT	PRT	PRT	PRT	1	1	1	1	N/A	N/A	N/A	N/A		
101			PR		NO	NO	NO										
85	f	w	T	PRT	PRT	PRT	PRT	1	1	1	1	N/A	N/A	N/A	N/A		
106			PR		NO	NO	NO										
38	f	w	T	PRT	PRT	PRT	PRT	1	1	1	1	N/A	N/A	N/A	N/A		
123			PR		NO	NO	NO										
66	f	h	T	PRT	PRT	PRT	PRT	1	1	1	1	N/A	N/A	N/A	N/A		
207			PR		NO	NO	NO										
11	f	w	T	PRT	PRT	PRT	PRT	1	1	1	1	N/A	N/A	N/A	N/A		
104			PR		NO	NO	NO										
54	m	w	T	PRT	PRT	PRT	PRT	1	1	1	1	N/A	N/A	N/A	N/A		
105			PR		NO	NO	NO										
70	f	w	T	PRT	PRT	PRT	PRT	1	1	1	1	N/A	N/A	N/A	N/A		
106			PR		NO	NO	NO										
74	f	w	T	PRT	PRT	PRT	PRT	1	1	1	1	N/A	N/A	N/A	N/A		

107			PR													
10	f	w	T	PRT	PRT	PRT	PRT	1	1	1	1	N/A	N/A	N/A	N/A	
152			PR													
86	m	w	T	PRT	PRT	PRT	PRT	1	1	1	1	N/A	N/A	N/A	N/A	
101			TR													
51	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
101			TR													
55	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
101			TR													
83	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
102			TR													
36	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	0	
102			TR													
40	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
103			TR													
29	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	0	
103			TR													
54	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
103			TR													
59	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	0	1	1	
103			TR													
78	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	0	
103			TR													
80	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	0	
103			TR													
81	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
105			TR													
47	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
105			TR													
56	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
105			TR													
60	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	0	1	
106			TR													
35	f	h	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
106			TR													
39	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
106			TR													
45	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
106			TR													
51	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
106			TR													
69	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
106			TR													
75	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	0	1	1	
107			TR													
37	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
109			TR													
42	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
130			TR													
93	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
132			TR													
38	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
133			TR													
27	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
149			TR													
96	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
150			TR													
96	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
174			TR													
04	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
186			TR													
57	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
189			TR													
56	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
198			TR													
94	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1	
101			TR													
48	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	0	1	1	1	

101			TR												
54	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
101			TR												
60	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
101			TR												
68	m	h	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
102			TR												
19	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
103			TR												
22	f	h	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
103			TR												
24	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
103			TR												
27	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
105			TR												
31	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
105			TR												
36	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	0	1	0	1
105			TR												
58	f	h	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
105			TR												
86	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
105			TR												
90	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
107			TR												
04	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
107			TR												
05	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
107			TR												
20	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
107			TR												
52	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
112			TR												
31	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
119			TR												
09	f	h	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
122			TR												
80	m	h	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
127			TR												
53	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
145			TR												
04	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
166			TR												
12	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
175			TR												
16	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
194			TR												
98	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
195			TR												
72	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
195			TR												
74	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	1
201			TR												
16	m	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	1	1	0
212			TR												
17	f	w	T	TRT	TRT	TRT	TRT	N/A	N/A	N/A	N/A	1	0	1	1



## Performance Data

Student ID	C - PRT		W - PRT		M - PRT		F - PRT	
	%	C - % Test	%	W - % Test	%	M - % Test	%	F - % Test
9150	75%	0.8375	85%	0.861111	73%	0.847619	57%	0.623333
9769	0%	0	100%	0.837963	64%	0.542857	70%	0.616667
10303	81%	0.9375	100%	0.888889	100%	0.825397	90%	0.91
10389	31%	0.575	60%	0.722222	73%	0.815873	80%	0.786667
10694	56%	0.525	70%	0.717593	36%	0.269841	80%	0.643333
10730	81%	0.7625	70%	0.708333	73%	0.88254	67%	0.763333
15160	100%	0.975	90%	0.972222	73%	0.942857	100%	0.88
16532	38%	0.35	20%	0.263889	64%	0.244444	47%	0.506667
18738	38%	0.4625	40%	0.375	0%	0.577778	100%	0.606667
20266	88%	0.75	70%	0.763889	100%	0.885714	100%	0.93
9458	63%	0.475	95%	0.847222	64%	0.819048	47%	0.683333
10217	88%	0.6625	90%	0.814815	18%	0.574603	90%	0.746667
10278	31%	0.6625	70%	0.481481	27%	0.609524	90%	0.56
10576	50%	0.45	100%	0.958333	18%	0.663492	90%	0.706667
10698	75%	0.7625	100%	0.972222	100%	0.873016	100%	0.9
11144	88%	0.9375	100%	0.902778	73%	1	90%	0.83
20088	75%	0.8625	100%	0.986111	73%	0.990476	100%	0.89
20398	0%	0	70%	0.62037	45%	0.342857	60%	0.35
10650	88%	0.775	85%	0.791667	73%	0.84127	90%	0.853333
10709	56%	0.45	60%	0.791667	64%	0.695238	90%	0.726667
17424	100%	0.925	100%	0.884259	64%	0.815873	90%	0.886667
20569	63%	0.675	40%	0.583333	0%	0	37%	0.283333
20394	88%	0.9	100%	0.958333	64%	0.879365	80%	0.796667
9015	88%	0.8375	85%	0.861111	73%	0.733333	100%	0.9
17579	38%	0.7875	95%	0.87037	18%	0.701587	37%	0.673333
10243	56%	0.4	90%	0.773148	18%	0.590476	90%	0.836667
10467	56%	0.625	90%	0.930556	100%	0.930159	70%	0.796667
10631	75%	0.7875	100%	0.972222	55%	0.790476	80%	0.706667
10661	56%	0.675	85%	0.75	82%	0.730159	90%	0.693333
20256	50%	0.5	90%	0.888889	64%	0.803175	80%	0.763333
20381	63%	0.85	100%	0.986111	100%	0.822222	77%	0.823333
17515	44%	0.7125	100%	0.782407	82%	0.930159	77%	0.893333
19431	88%	0.875	100%	1	100%	1.028571	100%	0.96
10852	94%	0.8125	100%	0.944444	100%	0.907937	80%	0.92
17374	38%	0.775	90%	0.875	100%	0.946032	70%	0.87
14438	81%	0.6625	100%	0.703704	73%	0.730159	90%	0.87
11858	63%	0.8125	100%	0.944444	73%	0.866667	100%	0.93
16127	100%	0.825	100%	0.930556	64%	0.828571	90%	0.84
10597	88%	0.8125	90%	0.75	73%	0.777778	80%	0.693333
10699	56%	0.6625	100%	0.787037	18%	0.666667	80%	0.75
10387	75%	0.825	90%	0.875	73%	0.87619	70%	0.776667
9652	13%	0.275	80%	0.75	36%	0.71746	70%	0.833333
10563	0%	0	60%	0.564815	45%	0.501587	47%	0.503333
10591	69%	0.4875	100%	0.828704	55%	0.669841	100%	0.83
10424	25%	0.5625	95%	0.907407	82%	0.914286	90%	0.876667
10641	75%	0.725	100%	0.925926	100%	0.980952	90%	0.87
14455	19%	0.3375	40%	0.472222	64%	0.828571	90%	0.61
11205	81%	0.875	95%	0.902778	55%	0.971429	60%	0.8
9637	50%	0.425	80%	0.685185	27%	0.714286	70%	0.6
12661	69%	0.8375	100%	0.847222	45%	0.844444	90%	0.823333
9392	31%	0.3625	75%	0.819444	27%	0.68254	77%	0.74
10156	69%	0.8	95%	0.800926	100%	0.933333	57%	0.753333
10185	100%	0.7875	100%	1	64%	0.88254	90%	0.95
10638	88%	0.875	95%	0.986111	100%	1.019048	90%	0.94
12366	88%	0.875	100%	0.986111	100%	0.914286	90%	0.866667

20711	100%	0.975	80%	0.916667	100%	0.996825	100%	1
10454	100%	0.7375	100%	0.930556	82%	0.898413	70%	0.71
10570	44%	0.7125	90%	0.74537	64%	0.873016	77%	0.763333
10674	63%	0.85	75%	0.791667	18%	0.838095	40%	0.73
10710	100%	0.85	100%	0.972222	36%	0.857143	90%	0.98
15286	75%	0.7875	90%	0.87037	36%	0.809524	70%	0.81
10151	75%	0.85	100%	0.958333	100%	0.8	100%	0.92
10155	75%	0.7625	75%	0.902778	73%	0.780952	90%	0.856667
10183	94%	0.825	80%	0.791667	73%	0.87619	100%	0.92
10236	31%	0.5625	70%	0.643519	36%	0.571429	47%	0.51
10240	81%	0.7875	95%	0.944444	45%	0.8	90%	0.74
10329	75%	0.7125	75%	0.796296	45%	0.692063	0%	0
10354	63%	0.775	100%	0.958333	100%	0.815873	90%	0.9
10359	19%	0.4375	95%	0.865741	36%	0.657143	57%	0.633333
10378	63%	0.75	80%	0.902778	18%	0.828571	90%	0.956667
10380	69%	0.5875	70%	0.74537	100%	0.787302	90%	0.586667
10381	88%	0.775	95%	0.856481	73%	0.847619	100%	0.886667
10547	100%	0.925	80%	0.828704	100%	0.952381	90%	0.773333
10556	56%	0.4625	70%	0.444444	0%	0.479365	100%	0.65
10560	88%	0.9125	100%	0.972222	45%	0.920635	0%	0.433333
10635	56%	0.575	60%	0.634259	55%	0.739683	37%	0.406667
10639	75%	0.95	100%	0.944444	55%	0.971429	80%	0.93
10645	56%	0.45	100%	0.685185	45%	0.711111	90%	0.59
10651	69%	0.725	100%	0.888889	100%	0.885714	90%	0.826667
10669	69%	0.6875	70%	0.722222	18%	0.561905	100%	0.723333
10675	88%	0.9125	90%	0.930556	55%	0.885714	100%	0.873333
10737	69%	0.625	100%	0.986111	82%	0.647619	90%	0.926667
10942	19%	0.3	60%	0.462963	45%	0.257143	70%	0.446667
13093	63%	0.6875	90%	0.884259	55%	0.733333	100%	0.87
13238	75%	0.825	100%	1	100%	1.025397	90%	0.836667
13327	56%	0.3875	80%	0.615741	18%	0.492063	60%	0.6
14996	56%	0.6875	100%	0.824074	100%	0.761905	90%	0.89
15096	88%	0.8	95%	0.972222	73%	0.72381	90%	0.713333
17404	63%	0.6625	80%	0.768519	45%	0.742857	70%	0.733333
18657	50%	0.625	100%	0.851852	64%	0.653968	90%	0.8
18956	81%	0.6	100%	0.796296	100%	0.67619	57%	0.67
19894	69%	0.6375	90%	0.694444	55%	0.695238	77%	0.71
10148	31%	0.5125	80%	0.652778	100%	0.771429	60%	0.686667
10154	63%	0.6875	65%	0.657407	73%	0.6	100%	0.67
10160	88%	0.9375	90%	0.972222	82%	0.914286	100%	0.95
10168	44%	0.575	75%	0.671296	0%	0.447619	80%	0.766667
10219	44%	0.7625	100%	0.902778	82%	0.761905	90%	0.793333
10322	50%	0.55	80%	0.625	55%	0.796825	70%	0.79
10324	81%	0.575	90%	0.916667	18%	0.361905	80%	0.733333
10327	25%	0.7375	100%	0.87963	18%	0.704762	100%	0.83
10531	75%	0.9	100%	0.902778	82%	0.980952	90%	0.766667
10536	0%	0	95%	0.861111	0%	0	0%	0
10558	75%	0.775	100%	0.875	100%	0.809524	57%	0.726667
10586	38%	0.3875	90%	0.703704	100%	0.619048	70%	0.686667
10590	25%	0.425	95%	0.856528	64%	0.834921	67%	0.766667
10704	25%	0.75	90%	0.893519	36%	0.885714	80%	0.886667
10705	63%	0.65	75%	0.888889	100%	0.898413	70%	0.78
10720	31%	0.4	75%	0.662037	18%	0.419048	50%	0.523333
10752	75%	0.575	75%	0.740741	18%	0.701587	80%	0.786667
11231	63%	0.8875	90%	0.944444	64%	0.949206	90%	0.9
11909	50%	0.6625	75%	0.736111	0%	0	60%	0.623333
12280	31%	0.4875	95%	0.87963	64%	0.657143	80%	0.793333
12753	56%	0.725	100%	0.680556	27%	0.634921	100%	0.9
14504	75%	0.6875	100%	0.930556	100%	0.857143	70%	0.77
16612	75%	0.725	65%	0.773148	73%	0.803175	50%	0.786667
17516	75%	0.7875	100%	0.981481	36%	0.844444	90%	0.79

19498	88%	0.3875	60%	0.606481	0%	0.447619	100%	0.756667
19572	88%	0.6375	75%	0.74537	100%	0.768254	90%	0.663333
19574	63%	0.8125	80%	0.810185	82%	0.834921	90%	0.86
20116	88%	0.7125	100%	0.912037	36%	0.790476	70%	0.85
21217	81%	0.5	65%	0.555556	64%	0.596825	100%	0.626667