THE EFFECTS OF HOMEWORK STYLE ON COMPLETION AND TEST SCORES IN HIGH SCHOOL BIOLOGY

by

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ABSTRACT

Students doing poorly on summative assessments have long been a concern for teachers. I, and many fellow teachers, believe that homework has a direct effect on student test scores. We tend to believe that if students do their homework, they will be prepared and do well on their tests. This got me thinking about ways to improve student test scores using different styles of homework assignments. The purpose of this study is to determine if the style of homework; paper or digital, have an impact on student homework completion and summative test scores. Students experienced altering styles of homework during four biology units, these included: all paper, all digital, and half paper and half digital, and student choice. Data was collected using post-unit surveys, interviews, unit assessments, and homework checks. The results suggest that simply completing homework itself remains the most important factor of success. Homework style did not significantly influence homework completion or student performance on assessments for all students, but did impact select individuals. Data also shows that student choice had a positive impact on motivation overall.

INTRODUCTION AND BACKGROUND

Teaching Experience and School Demographic

For the past six years, I have been teaching at Naperville Central High School in Naperville, IL. Naperville Central is one of two high schools in the city and offers 20 science courses for grade 9-12. I have switched between several content areas; biology, chemistry, earth science, and anatomy & physiology. I seemed to have settled on biology and anatomy & physiology for the past two years, which really is my calling. I am absolutely thrilled and honored to be teaching these classes at such an extraordinary school. For my research, I focused on the biology class that I teach to collect data. The majority of sophomores take biology. They are usually trying to get the second science credit they need to graduate, though many of them take additional courses in science.

Naperville Central High School is a suburban school that ranks in the top three percent of the nation according to US News and World Report. There are 2815 students enrolled in the school, of which 67.1% are Caucasian, 16% are Asian/Pacific Islander, 4.9% are African American, 7.9% are Hispanic, 0.1% are Native American, and 3.9% are two or more races. The school has a culture of achievement and the students are academically successful. The graduation rate is 97% and the average SAT Math score is a 603 and the average SAT ELA is a 588. About 90% of the Class of 2018 enrolled in a four-year college (Illinois Report Card, 2018).

Purpose

One of our biggest challenges as educators is trying to figure out how to improve test scores. A factor that plays into test scores, is homework, and whether or not it is

being completed by students. This is another one of our challenges: improving homework completion. I became curious to see if the style of homework students complete plays a factor in homework completion, especially since we live in a technologically-savvy world. The purpose of this research was to determine if the style of homework; digital or paper, had an impact on homework completion and test scores.

As I went through this project, relaying the information to the students was imperative. If students figure out that they tend to do better when they complete a specific style of homework; if given the option, will they choose that style? Students believe that they know what works best for them, but do they really? It was helpful for me to determine what works best for my students individually but also overall, so I can use the results of this research for future classes. It was interesting to see which style of homework worked for each individual student, based on what I already knew about them, and how they did in this study. I also wanted to get a general idea of the style of homework that works for the majority of my students.

We are in such a push nowadays for technology, students tend to think that digital assignments are best for them, but this may not be the case. This leads to another question I had: do distractions online play a part in homework completion? My school is a one-to-one district meaning all students have a Chromebook. Now that we are in year five of Chromebook implementation, I have noticed students becoming more and more distracted online. This research determined students homework completion is not being affected by distractions online.

Finally, I wanted students to identify the positive correlation between completing homework and improved test scores. Homework has such a negative connotation in the minds of students, and I hoped through this project, student could realize the importance of homework and how well it could prepare them for the upcoming assessment. I believed this research will also benefit my fellow teachers. Based on the results, teachers may need to make some changes to how they give out homework. Teachers may feel that they need to convert every assignment to digital form, due to our one-to-one devices, but this may not be what works best for our students. I hope my research will give my fellow teachers and I a better idea of what works best for our students when it comes to homework assignments.

Research Questions

For my action research project, my primary research question was: which style of homework; digital or paper, correlates with higher levels of completion and assessment scores? My first sub questions was: how does choice in style of homework assignment affect completion and test scores? My second sub question was: will students' completion of online homework assignments be affected by potential online distractions?

CONCEPTUAL FRAMEWORK

Since my project's focus is on homework style, I needed to locate prior research about varying types of homework and its effect on student performance. I found several articles that conducted the same research I plan to conduct and a number of articles that took another route. Each resource shared results that were informative and helpful to my research.

In my first article, Hallat, Huss, Unsbee, Al-Bataineh, & Chumpavan (2017) address a very similar research question to my own. The authors researched the following questions: 1) how the rate of homework completion is affected by the use of digital submission versus traditional paper turn-in in 6-12th grade classrooms? 2) What is the teacher perception of effectiveness on submission rate of digital versus paper submission of homework? 3) What is the students' perception of digital versus paper submission of homework? Two key pieces of data in this research were; the completion rate significantly decreased when the assignment was in digital form and students tended to choose digital submission over traditional even though the rate of completion was still lower (Hallat et al., 2017).

This article was by far the most informative for me because it is essentially what my action research project was be about. I found it very interesting to read the results and the author's ideas of why the results occurred. I thought that if given a choice students would choose digital submission over traditional paper submission; which according to this research was true. But I also thought that digital homework assignments would have a far greater completion rate than traditional, which was not true. A couple things to think about when it comes to the results are the fact that this was conducted 4 years ago and this occurred in a rural area of central Illinois. Technology has advanced in the past four years and each student at my school have a Chromebook, compared to the students in this research who do not. In my own research, I found that students were more likely to choose the paper assignments over digital, which was surprising to me.

Gascoigne examined what students are doing, as well as not doing, in terms of written and online homework in beginning postsecondary foreign language courses. The results are examined through the lens of self-efficacy theory, which basically states that if you believe in yourself you can do it. One suggestion from the research includes, allowing for student choice in homework options, particularly for those students with high levels of self-efficacy (Gascoigne, 2015). The idea of self-efficacy never really crossed my mind when it came to homework. I have always looked at homework necessary for good practice.

This article shows that students prefer the choice of homework style and the choice in whether or not they need to complete it. To me, this makes a lot of sense but makes me think; it is an accurate representation of what actually works for them? Students are always going to argue that they don't need to do their homework, but is it true? This article is evaluating students after high school, so they have had time to identify what does and does not work for them, with my students that may still be up in the air. Unfortunately, this article does not address homework completion or lack thereof with test scores. What this article does show which I can use in my research is this idea of the power of choice. I incorporated a treatment where the students have the choice of style of their homework. Based on Gascoigne's research, students who chose not to do the homework still studied for their assessments and did well without the assignment. I think this would be a valuable secondary question that I could explore in my own research.

Brender (1996) investigates the relationship between homework completion and student achievement on five Spanish exams. Based on his results, it does suggest that students who complete more homework do achieve better scores on tests than those who do not. This article relates very closely with my action research project. What I liked about this article was the detail in the data collection. His research focused heavily on quantitative data collection; comparing homework assignments that were completed to the student's test scores. This data was very analytical in terms of statistical significance. The author made sure to explain when the data was significant but also when it was not (Brender, 1996).

I plan to use these methods that the author used. I want to make sure I am relaying both statistically significant data but also when it is not significant. I think it is important to show both sides, even though the data isn't significant in terms of numbers, it is significant in terms of the conclusions that will be drawn from the data. The author made it very clear what the results were and even though the data was "insignificant," he still drew conclusions from that data, which was very valuable in his overall research. I need to make sure I do this as well.

Walk and Lassak (2017) used several different styles of data collection; both qualitative and quantitative. The purpose of their research was to determine which style of homework problems lead to more completion and greater level of effort. What I found very interesting with their data was the combination of qualitative and quantitative. They would ask the students to solve a problem but then explain what they did and why they did it, afterwards. I really liked this idea for data collection because they are not only

quickly analyzing, “are the students doing the problem, correctly?” (quantitative) but also, “do the students know why it is correct?” (qualitative). It was very interesting to see that when students got a problem wrong, they were not able to explain why it was correct. This is where things got interesting, their explanations were almost leading them to the correct answer. This was really informative qualitative data; students may have gotten the problem wrong but they learned from their mistakes. The following problem they did correctly based on what they figured out from the previous question. This seemed to be the most valuable data for the authors; they realized that when students were asked to do a couple questions like this, it provided them with the results they were hoping for.

The author wanted to know if less homework was assigned but with more detail and greater cognitive skills required, would it lead to a greater rate of completion with a greater rate of effort put forth. Based on their data, it appears that less but more detailed homework did have these desired results. I hope to use this idea of a mixture of qualitative and quantitative in one activity, specifically this idea of explaining yourself within the homework assignment (Walk & Lassak, 2017).

Fernández-Alonso, Suárez-Álvarez, & Muñiz’s focus was to investigate the effect of homework on performance of students in mathematics and science. It was interesting to see the author’s treatment methodology. They analyzed two main factors: the individual level which examined time spent, effort made, and the way homework was; and the class level which considered frequency of assignment and quantity of homework. The results were somewhat predictable; they found that prior knowledge was the most important predictor of achievement in the study. They found that it had a greater effect

than all the other variable's effect combined. Also interesting was that the study found that autonomy and frequency of homework assignments made large impacts on test scores. Autonomy had the greatest impact on an individual-level but effort and time spent did not (Fernandez-Alonso et al., 2015).

This article had a message to teachers that I thought was very informative and I planned to use while developing my homework assignments during my project, Fernandez-Alonso (2015) said:

> Our data indicated that it is not necessary to assign huge quantities of homework, but it is important that the assignment is systematic and regular, with the aim of instilling work habits and promoting autonomous, self-directed learning. Homework should not exclusively aim for repetition or revision of content, as this type of task is associated with less effort and lower results. On the contrary, homework should present a certain level of challenge or difficulty, without being so challenging that it discourages effort (p. 1083).

I believe that I already try to assign homework that won't take very long but will challenge the students, but that is not all of my assignments. I need to find a good mixture between challenging but possible and short.

Cooper, Lindsay, Nye, and Greathouse (1998) wrote the last article I read. This article was insightful because it incorporated the attitudes and thoughts of homework from three different perspectives; students, parents and teachers. The purpose of this study was to determine if there was a correlation between students, parents and teachers perspective on homework in relation to student achievement. From this research, the authors found that student, parent and teacher opinion on homework varies, which makes sense. This could be due to the different expectations teachers, parents and students hold toward homework or the fact that each respondent sees a different side of the homework

process. This is something I will need to be sure to incorporate into my research; everyone needs to be on the same page. I can do this with online announcements on our school's portal.

Other results found there to be no relation between the amount of homework assigned and student achievement, but there was a positive relationship between rigor of homework completed and student achievement (which has been true with the other articles I have read) (Cooper et al,. 1998). This tells me that I need not to worry about the length and amount of homework assigned, I need to make sure the homework is valuable to the student to ensure that it is completed. Also the results stated that when it comes to student attitudes, the more positive the student attitude toward homework the more homework was completed. This one is a little trickier as I need to look into how I can turn the attitude of homework around. This is usually a stigma they bring in from previous years of schooling and the homework they were assigned, I need to ensure that my student's homework activities are not long and arduous, but challenging and short.

These articles have provided me with a lot of helpful research to use in my Action Research Project. Some examples of concepts I will incorporate into my project are: homework assignments need to be ready for students at all math and reading levels, homework assignments may need to be reduced in length but enhanced in rigor, students need options in homework, students, parents and teachers all need to be on the same page when it comes to homework assignments, and increased amount of homework has a negative effect on completion, therefore, keep amount of homework to a minimum.

METHODOLOGY

Treatment Methods

I implemented four different types of treatment for my project. Since my project hinged on the idea of homework, my treatments changed the style of homework given within each unit. The homework assignments given did not change from previous years in terms of content, they only changed in terms of style; digital vs traditional paper.

I wanted students to become somewhat familiar with the classroom before starting research, which is why I did not start research until the second unit. This served as baseline data. Treatments were given in each unit that followed the first. Units ranged between three to five weeks long and each unit had around six to ten homework assignments. The homework assignments were quick practice from the day's activities. For example, one of the units covered was over genetics, one of the homework assignments was five Punnett square problems. In terms of digital versus paper assignments, the assignments were the same, the difference came in when they go to turn it in. They would either have to physically give it to me or turn it in online.

The first treatment was given in the second unit of the year: Energy; this treatment was 50% digital assignments and 50% traditional paper assignments. The second treatment was given in the third unit of the year: DNA & Mitosis; this treatment was 100% traditional paper assignments. The third treatment was given in the fourth unit of the year; Protein Synthesis and was 100% digital assignments. The fourth treatment was given in the fifth unit of the year: Meiosis & Genetics and it was student choice. I provided students the option of digital or traditional for all of the homework assignments

in that fifth unit. For each of the four types of treatment, I collected what type of homework assignment it is and whether or not students completed the homework.

Data Collection Methods

Table 1 illustrates how I collected data for each research question. It shows each question I researched, then breaks down one by one the data I collected and how that data was collected.

Table 1
Research Matrix

Research Questions	Homework Completion	Test Scores	Pre and Post Unit Surveys	Individual Student Interviews
How does the style of homework, online vs paper, affect homework completion and test scores?	X	X		
How does choice in style of homework assignment affect completion and test scores?	X	X	X	X
Will student's completion of online homework assignments be affected by potential online distractors?	X		X	X

I administered the surveys to every student in my biology class. Please refer to Appendix A for a copy of the survey. I wanted to ensure that I got a wide range of responses from all my students. I conducted my research in my only biology class that occurs during the first period of the day (*N*=23). This class has a large variety of student ability which was important to my data collection. I gave a survey at the completion of every unit, this way students can reflect on the homework given during that particular

unit for every unit. I physically gave the students the survey at the beginning of the next unit or right after the test (if time allows). The class demographic for data collection was as follows: 11 males and 12 females, 22 sophomores and 1 junior, 2 IEPs and 2 504 plans, and 2 ELL students. All of the students have a plethora of extra support opportunities available to them. Our school provides biology-specific help every morning and science help every day during lunch periods, run by science teachers. The National Honor Society students also provide a tutoring session twice a week after school.

I had the students complete the surveys through Google Forms. This helped alleviate data collection and analysis headaches. Google Forms compiled the responses to all of the questions into a spreadsheet, which made analysis a breeze. I was able to compare the number of students responding to each question. I looked at the number of students that liked the assignments versus the ones that found it easy to do. This was a valuable correlation to determine; just because students found it easy doesn't mean they like it. I repeated a couple questions in the survey to ensure students are reading and understanding the questions fully. An example would be questions two and four in the survey, they both assess if the students found it easy to complete the assignment. If I get two different answers for those questions, I know that the student rushed through or didn't understand the question. This also helped with validity and reliability in my instruments which I also addressed through triangulation, and peer and professor input on instruments. I also looked for patterns within the questions, are there any questions that received the same answers? I saw trends between liking homework style and completion rates but not trends between homework style and completion.

I administered interviews to six of my first hour biology students. Please refer to Appendix B for interview questions. I wanted to ensure that I got a wide range of responses from a handful of my students. I conducted my research in my only biology class that occurs during the first period of the day. This class has a large variety of student ability which was important my data collection. I conducted an interview at the completion of every unit, this way students could reflect on the homework given during that particular unit for every unit. This occurred after the students completed the survey, so there would be points of discussion to go off of. All of the six students selected for the interviews, share the same lunch hour as myself, which is when the interviews were conducted. I kept notes during the interviews, but I also recorded the interviews. Table 2 shows the students that I conducted interviews with, under the following demographics:

Table 2
Interview Demographics

	Student Number					
Characteristics	2	9	18	22	3	13
Intelligence (based on previous tests)	Above Average	Below Average	Above Average	Average	Below Average	Average
Social Interactions	Above Average	Above Average	Below Average	Below Average	Average	Average
Learning Disabilities	None	IEP	IEP	None	None	None
Average Homework Completion	Above Average	Below Average	Above Average	Below Average	Above Average	Below Average

For my data analysis, I looked for trends and patterns during these discussions with the students. Since all of my interviewed students have the same lunch period, I thought I would interview the students as one large group of six as a focus group interview. I was sure to ask and hear for all voices as I know some can be louder than others. I looked for similar comments and trends coming from the students such as: completing homework became easier when I enjoyed the style or I didn't want to complete homework because of the style. This is was a common trend during the conversations. I listened back through the recorded version to catch any comments I missed and drew conclusions with a second look. The research methodology for this project received an exemption by Montana State University's Institutional Review Board, and compliance for working with human subjects was maintained (Appendix C).

DATA AND ANALYSIS

The first set of data that I analyzed was the overall average homework completion per treatment/unit. As you can see in Figure 1, the average homework completion rate differed about 7.4%, between the highest and lowest averages. Treatment 1, 50% paper and 50% digital, had the lowest average of 76.7%. Treatment 4, student choice in assignment type, had the highest average of 84.1%. As you can see, there isn't a significant difference between the style of homework and the overall rate of completion.

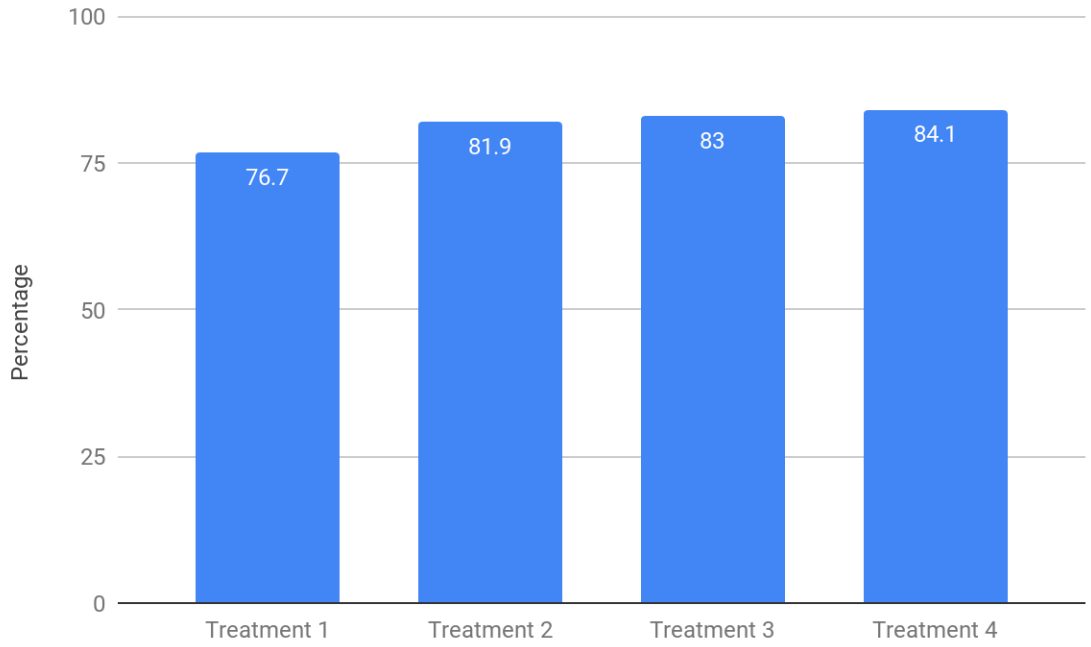


Figure 1. Homework completion average per treatment, (*N*=23).

To further elaborate on homework completion rate for each treatment, Figure 2 illustrates the average homework completion rate per student for each treatment. As you can see, there is a similar pattern to all of the treatments with minimal differences. No matter the style of homework, the majority of students had a similar trend in their homework completion rate. Students such as 4 and 5 tended to complete their homework, regardless of the style. Both of these students are females that have a positive attitude toward school. They are concerned about their grades and are willing to put the effort in to do well. Students such as 9 and 16 were always below average when it came to completing their homework, regardless of style. These two students are both males who aren't nearly as concerned about school as their female counterparts mentioned above. They are more concerned will being "cool" then completing their homework. Then there were students like 21 and 22, who varied slightly in their homework completion rate

depending on the style of homework. The average completion rate for treatment 1 was 76%. Student 4 was 100%, student 9 was 67%, and student 21 was 75%. You can see in this situation student 4 was above average, student 9 was below and student 21 was below in this case. For treatment 2, the class average was 81.9. Student 4 was 100%, student 9 was 0%, and student 21 was 100%. For this treatment, student 4 was above average, student 9 was below and student 21 was above average. For treatment 3, the class average was 83. Student 4 was 100%, student 9 was 33%, and student 21 was 67%. For this treatment, student 4 was above average, student 9 was below and student 21 was below average. Finally for treatment 4, the class average was 84.1. Student 4 was 100%, student 9 was 33%, and student 21 was 92%. For this treatment, student 4 was above average, student 9 was below and student 21 was above average. As you can see, this appears to be a case by case scenario. Each student has a particular style of homework that works for them, there is no overall trend that one style of homework is superior to the others.

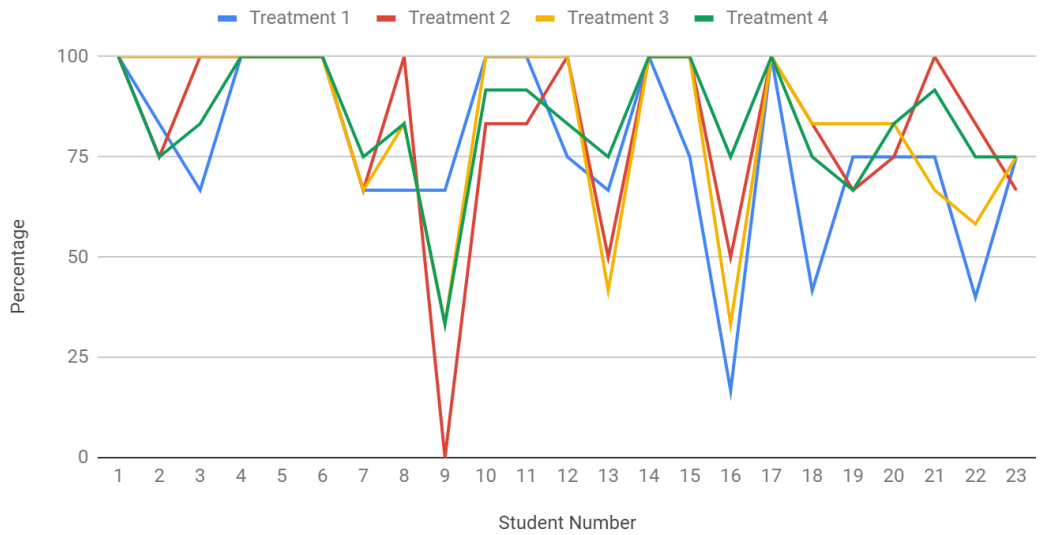


Figure 2. Average student homework completion per treatment, (*N*=23).

In order to determine if this data was significant, I ran a t-test comparing the homework completion averages for each treatment to one another. In Figure 3, the values demonstrate that the data is not significant, none of the values exceed 0.05. The debatably most "significant" value is between treatment 1 and 4, 50/50 and student choice, at 0.07. The most insignificant value was between treatment 3 and 4, digital and student choice, at 0.74. Referring back to Figure 2, even though there were students like 21 and 22 who did have a difference in completion dependent upon homework style, the t-test tells a different story. Figure 3 demonstrates that there is no significance in style of homework on homework completion when looking at the data as a whole (N=23, df=n-1=22).

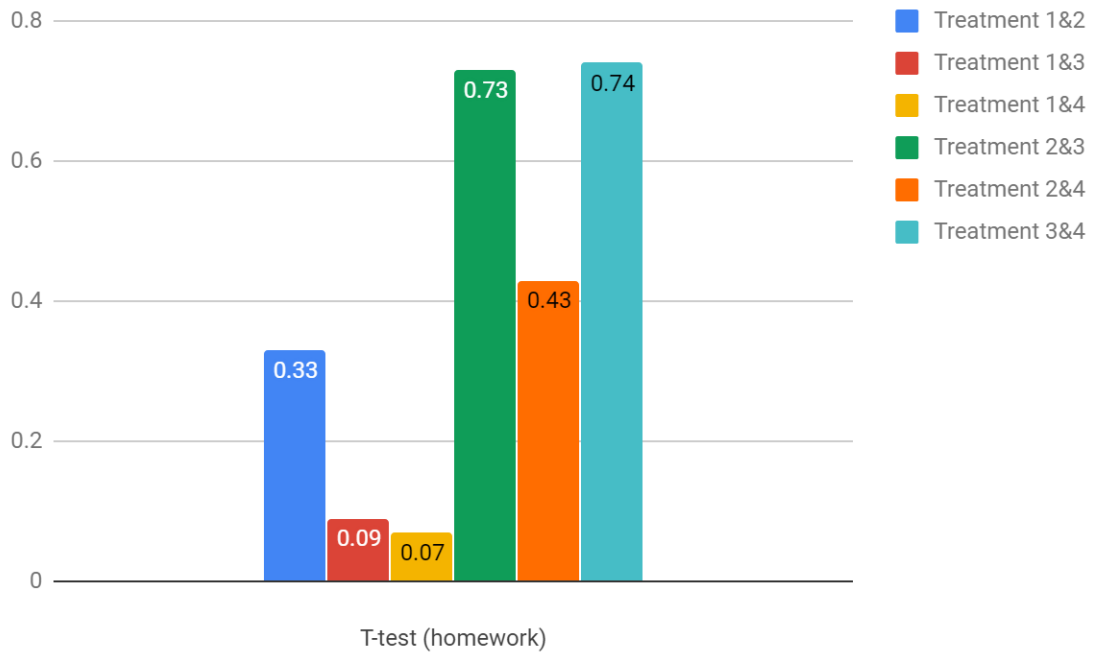


Figure 3. T-test comparing homework completion averages per treatment, (N=23).

The next set of data that I analyzed was the average test score per treatment/unit. In Figure 4, the average test score only varied 7.6% between the highest and lowest

scores. Looking back at Figure 1, the test score data appears to be following a similar trend as the homework completion data. Treatment one and two had the lowest test scores, with one being the lowest, same as homework completion. The difference between homework completion and test scores averages sits in this highest averages; homework completion was highest during treatment 4 (student choice), while test scores were highest during treatment 3 (all digital). This leads me to believe that the style of homework does not have an impact on test scores either, as a whole. Yet again, this seems to come down to a case by case situation.

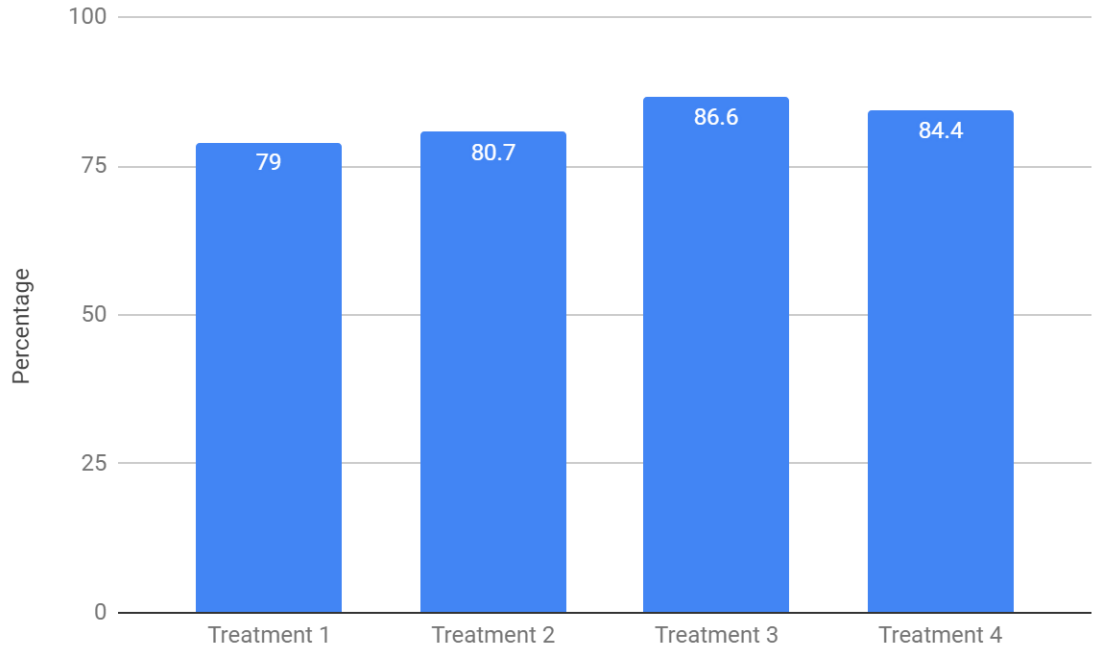


Figure 4. Average test score per unit, (*N*=23).

Next, I wanted to analyze the test scores for each student per treatment, Figure 5 illustrates this. Similar to Figure 2, the results seem to be dependent on each student. Looking at students like 5 and 11, they tend to do above average on tests, regardless of style. These students are high achievers, both students were recommended for Honors

Biology but decided to opt out because of their school work load. Looking at students like 3 and 9, you can see that they tend to do below average on test, regardless of homework style. Both of these students have 504 plans for their ADHD. Where the data becomes interesting to analyze is when you look at students like 13 and 20, they scores vary depending on the treatment. The average completion rate for treatment 1 was 79%. Student 5 was 88%, student 3 was 58%, and student 13 was 88%. You can see in this situation student 5 was above average, student 3 was below and student 13 was above average. For treatment 2, the class average was 80.7%. Student 5 was 95%, student 3 was 55%, and student 13 was 55%. For this treatment, student 5 was above average, student 3 was below and student 13 was below average. For treatment 3, the class average was 86.6%. Student 5 was 96%, student 3 was 74%, and student 13 was 74%. For this treatment, student 5 was above average, student 3 was below and student 13 was below average. Finally for treatment 4, the class average was 84.4%. Student 5 was 96%, student 3 was 64%, and student 13 was 87%. For this treatment, student 5 was above average, student 3 was below and student 13 was above average. As you can see, this appears to be a case by case scenario. Each student has a particular style of homework that works for them, there is no overall trend style of homework that works for all students.

There were a couple outliers that caught my eye. There were two students in particular that usually performed below the average of the class that in separate treatments did above average. Student 12 was the first student that stuck out to me, overall this student usually hovers around that 75% test score, again, typically below the

class average. You can see this student follows this trend for treatments one, two, and three, with test scores of 73%, 55%, and 77%. For treatment 4, student 12 exceeded the average with a 90%. Student 16 was also in this same case, this student typically scores below the class average, with scores in treatment one, three and four like; 43%, 66%, and 59%. For treatment 2, this student exceeded the class average with a test score of 90%. Unfortunately, these outliers did not have much in common, other than their typical below average test scores. The tests that they did much better on were two different tests. The question is; why? Why did they do better on these tests? Was it just a fluke? Did they study differently, that was more effective for them? Honestly, I am not 100% sure. My best hypothesis is that it was just a fluke. These students studied better for these two tests than any others, or maybe they were grounded that weekend and were forced to study more. Maybe these student decided to take advantage of the biology help in the morning before these tests. I am not sure and the data does not point me in one particular direction to a means of why.

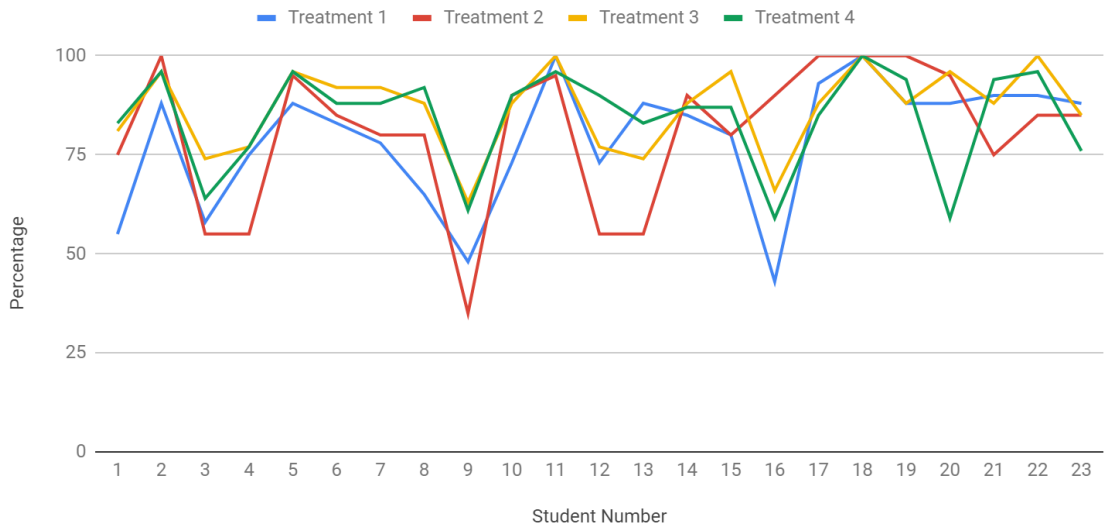


Figure 5. Student test score per treatment, (*N*=23).

The next set of data that I analyzed was student choice survey. As stated before, the overall trend of which style of homework impacts completion and test scores, seems to be a case by case situation. Data that I found interesting were the results of the survey I gave the students after the last treatment, which was student choice. Figure 6 is a graph demonstrating this data. The post unit survey questions can be reviewed in Appendix A. Questions 1-6 and 10 are positively phrased questions about student choice; such as, "I like this style of homework" or "I would like to do all my homework this way." Questions 7-9 and 11 are negatively phrase questions; such as, "I do not like this style of homework" or "I do not want to do my homework when it is in this style." In the other three treatments, the results were more split down the middle. But for treatment four, this was not the case. As you can see in Figure 6, the results were more telling. In all of the positively phrased questions, the majority (more than 60%) of students agreed with the statements. In all of the negatively phrased questions, the majority (above 60%) of students disagreed with the statements. This is a clear sign from the students saying they like the choice in which the style of homework they would like to complete. Table 3 is a list of similar answers from student interviews and post unit survey answering the question, "why do you like or dislike this style of homework (student choice)?"

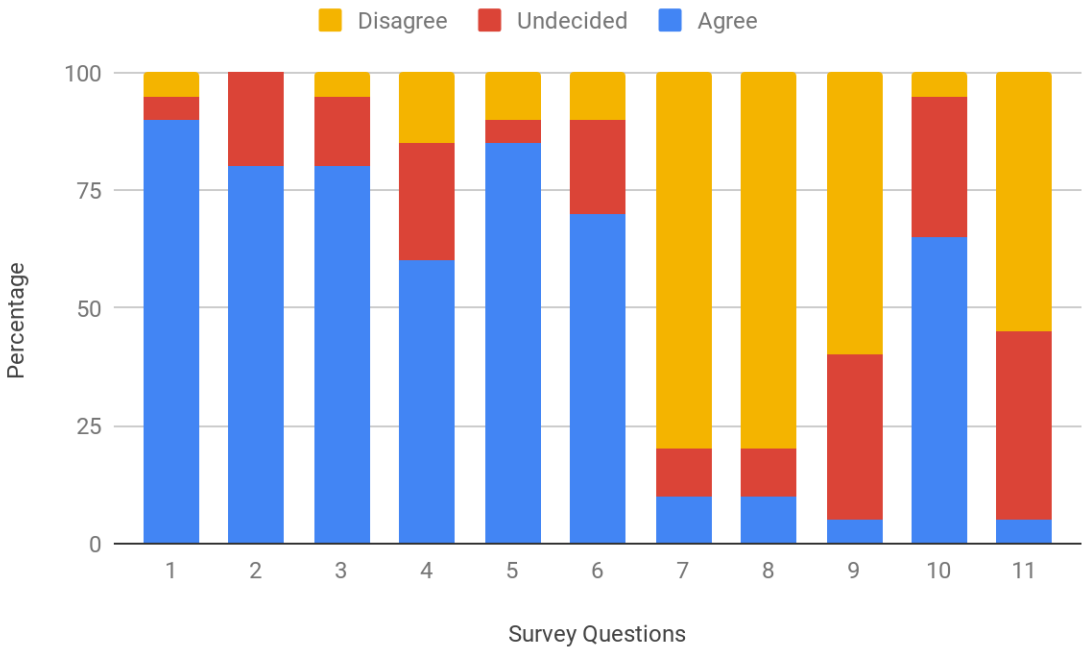


Figure 6. Treatment four Likert survey results, (*N*=23).

Linking this information back to Figure 1, student choice did have the best overall average in completion rate. Analyzing the data closer in Figure 2, we see that is not an end all be all to which style of homework is the best for all students. When it came to student choice and its effect on test scores, Figure 4 shows us that it did not have the highest average. Conversely, student choice is not negatively impacting their homework completion or test scores, so there may be a lesson to be learned from this data. Students like having the option of completing their homework in whatever style they prefer. This leads me to believe that student choice helps increase student motivation to do homework. Perhaps if we continue to give them the option, completion rates may improve over time. Table 3 shows student responses to the question "Why do you like or dislike homework this way (student choice)?"

Table 3
Student Interview & Survey Responses

Student #	Response the question: Why do you like or dislike homework this way (student choice)?
2	I like this because you can do a choice in which is the better option
3	I like homework this way because it allows me to choose what style of homework would be more effective for me depending on what we are learning and what the homework has us doing.
9	I like to choose
13	I like it because it gives us more of a choice as to how we want to express our knowledge
18	It's nice to have a choice between two different forms of homework, both with their own pros and cons. Paper doesn't need electricity, but it can easily get disorganized and confusing. Digital is much less ambiguous and more organized, but you need a charged battery for it.
22	It's nice to be able to choose what we are able to do, because it allows us to work at our own pace and jump around as much as we want
Other students responses from survey	- Its best for all students - I like this way because it gives students a chance to use a platform that will most improve their learning. - Because when it's something like filling out a chart paper would be better. But long assignments would be easier on the computer but it should be up to the students - It's my choice, I can choose what days I feel like typing or writing or what's more convenient - Because the kids who like digital can use digital but for the kids that like paper, they can just do it on paper

As you can see in Table 3, there is an overall trend of admiration when it comes to student choice in homework assignment. Students like the idea of student choice because, "[it's] a better option", or "it allows me to choose…depending on what we are doing", or "it's best for all students". Student seem to like the choice because it is in their hands, they can make the decision themselves. I believe students feel more appreciated and

heard when they get to be put in the driver's seat of their learning. Students like to know that they are part of the planning and decision-making, because it is their learning experience. We are consistently telling these students to grow-up and prepare for the real world, but then we take away their voices for things as simple as a homework assignments. I believe these responses were a view into the teenage mind. They want choice and they want to be a part of the decision –making when it comes to their education.

The last set of data that I wanted to analyze was distractions and how they affect students completing their homework. Table 4 shows student interview responses to the question. "If you become distracted during completion of these assignments, please explain what distracts you?" As you can see, students seem to become distracted regardless of homework style. It does appear that when students complete digital assignments they tend to have more issues with becoming distracted online, which makes sense. Referring back to Figure 1, there was not a drastic difference in average completion rates between each style of homework. This leads me to believe that distractions did not play a role in homework completion when comparing it to the style of homework. Student responses in table 4, do lead me to believe that distractions, specifically online, do play a role in how long it takes a student to finish a homework. Based on their responses, it appears that it will take them longer to complete online assignments because of those distractions. Specifically, student 18 states "This style [online] is quite distracting, because I have this urge to go on other websites (although it's improved), and also because I have so many homework tabs open and it's hard to manage

all that work." Even though this may take them longer because of those distractions, it does not impact whether or not they finish the assignment.

Table 4

Student Interview Responses to Distractions during Homework Completion

Student #	Treatment 1 – 50/50	Treatment 2 - Paper	Treatment 3 - Online	Treatment 4 – Student Choice
2	While completing homework online, I can sometimes get distracted by doing other things on my computer besides the homework like working on stuff for other classes.	Nothing really	Other assignment can distract me.	Usually other assignments can distract me
3	I think the fact that when I do homework online, I am able to access social media and Netflix, shopping, etc! It motivates me less to do my homework because there are other things online I would prefer to do.	I do not get distracted because when I just do my homework on paper, there is no other media to distract me	Other websites and games and shopping; distractions I don't have with paper copies	Other stuff outside of school, like social media, shopping, Netflix. Stuff like that is distracting
9	My phone distracts me.	Just getting bored and wanting to do something else	My phone.	My phone
13	The only thing that may distract me is my phone but I don't have much of a problem with that	The only thing that may distract me is my phone but I don't have problems with that	If I'm on a computer, I may find myself on a website unrelated to my homework. My phone sometimes distracts me too.	My phone may be a distraction sometimes
18	I easily become distracted by other things in the room and by other websites, and this is a thing that I have struggled with and me and my supporters are currently working on. It's getting better, though.	Nothing distracts me other than exterior factors (Noises)	This style is quite distracting, because I have this urge to go on other websites (although it's improved), and also because I have so many homework tabs open and it's hard to manage all that work.	I would be less distracted because I made the conscious decision to do my homework this way. I know what needs to be done and I will do it. Sometimes I do get distracted but it is less likely.
22	The thing that distracts me the most is the transition between the digital and paper assignments, because my mind tends to wander when I do something mundane.	Nothing really	Other homework online	I would not be distracted because I would choose a platform that will keep me on task

When it comes to distractions, being on the computer seems to have the biggest impact. As you can see in Table 4, when students needed to do their homework online; treatment 1, 3, and 4, they tended to say that they were distracted by the internet. When students were not completing an assignment online, they didn't claim they were as distracted as the former. For example, student 2 said for treatment 1 that is half online, "While completing homework online, I can sometimes get distracted by doing other things on my computer besides the homework like working on stuff for other classes." But for treatment 2 that is paper assignments, she said "Nothing really." Student 22 had a similar response. When asked about distractions during treatment three, they said "Other online homework." When asked about distractions during treatment 2, they said "nothing really." It seems pretty clear that when students have to complete assignments online, using their Chromebooks, they tend to become more distracted. This makes sense because it is easy just to open up a new browser window and start online shopping, or look up sports scores, or watch a show. Compared to completing a paper assignment, students would have to take the extra step to get out their Chromebook, that wasn't out before, and log on to these sites.

Another trend I did see with distractions was the distraction from their phones. Student 13 mentioned during treatment 2, which is paper assignments, is "The only thing that may distract me is my phone but I don't have problems with that." Student 9 also mentioned phones in his response to each one of the treatments. This brings up a valuable point that no matter the style of assignment, phones will always be a distraction to students while completing their homework and in the end could be the reason it does not

get finished. This is a whole new avenue that teachers need to go down with students; putting phones away during class, staying off phones, learning when it is time to use the phone. We live in a world now that has students centered on their phone. We as teachers need to come up with new tricks to get kids off their phones to better their education.

INTERPRETATION AND CONCLUSION

Ever since I started teaching, I have always been looking for ways to help my students succeed in the classroom and possibly improve overall understanding of the material. When I began this research I was hoping to learn more about the style of homework and if it had an effect on students. I was hoping to learn if there was one style of homework that would impact completion rates and test scores. My hope was that by implementing different styles of homework, I could determine if one style of homework was better than the others. In order to achieve this goal, I implemented four different styles of homework during different units; unit 3 was 50% paper assignments and 50% digital assignments, unit 4 was all paper assignments, unit 5 was all digital assignments, and unit 6 was student choice. During these 4 units I collected a variety of quantitative and qualitative data, such as; homework checks, test scores, surveys and interviews. This data collection helped me answer my three research questions;

1. Primary Question: Which style of homework; digital or paper, correlates with higher levels of completion and assessment scores?
2. Sub-question 1: How does choice in style of homework assignment affect completion and test scores?

3. Sub-question 2: Will students' completion of online homework assignments be affected by potential online distractions?

In order to answer my primary question, I used mainly the quantitative data in the form of homework checks and test scores. When I started this project, I believed that there would be one definitive style of homework that worked: digital. I thought that in this day and age, the technology-savvy students would want to complete their homework online and therefore do it more often in that style. The data showed that I was sadly mistaken. The data showed that this is a case by case situation, each student is different. There is not one style of homework that works or all students. Looking at the data now, it does make perfect sense. Some students have an easier time using their Chromebooks and would prefer having all their homework on it. Some students find it difficult to complete homework assignments online, they prefer having a piece of paper in front of them. Some students claim it depends on the assignment. One of the homework assignments was during our genetics unit. The assignment was solving Punnett squares (Appendix D). Student two mentioned during an interview, "it was too difficult to complete that homework assignment online, it would have been easier to do it on paper because we had to draw in the Punnett Square boxes".

What I also found interesting about these results were that they contradicted the results of one of the first articles I read for my conceptual framework. Hallat, Huss, Unsbee, Al-Bataineh, & Chumpavan's (2017) results were very indicative that digital assignments had a significantly lower completion rate than paper. My results were not like this at all. They also included that even though digital submission of assignments

was significantly lower, students still chose to complete their homework like this. Again, much different from my results.

Based on my data, it is clear that the style of homework does not impact completion rate nor test scores. The data clearly illustrates that every student is different, some like paper, some like digital, and some like a mix. This leads me to believe that as teachers we need to read our students, they are very telling of what works and does not work for them. It also leads me to believe that our best judgement on what style of homework would work best here. Assignments that require drawing, diagraming, illustrating may need to be submitted on paper. Assignments that require lots of writing or production of graphs and charts would be better suited in digital form. For all the in between assignments, student choice may be the way to go. Let the students decide what works best for them and allow them the choice.

This leads me to my first sub-question: how does choice in style of homework assignment affect completion and test scores? The results on this were also pretty clear. There were two major findings; 1) student choice did not significantly improve completion nor test scores, and 2) students really like having the choice in style of homework.

Starting with the first major finding in student choice, it does not play significant enough effect on completion and test scores. This was pretty disappointing, I truly thought that student choice was going to make a great impact on their completion rates. Unfortunately, it did not. The reasoning behind these results is a bit lost to me. My initial thoughts would be that there was just not enough data. Maybe if there were more

assignments and more students, I would see the results I expected. I also believe that my students were not used to the idea of choice. Some students would just pick up the paper copy because it was right in front of them. They weren't used to this idea of options and I should choose what works best for me, or what I like best. Some students were acting shear out of laziness. I think if I had done this before any of the treatments, they would have been more familiar and more likely to tap into the idea of choice.

As far as the second major finding in student choice, I was not surprised at all. Students like having the option to choose for themselves. Figure 6 was very clear to illustrate that students enjoy choice. Table 3 gave an excellent view into the student's minds. These results have multiple reasoning behind them as well. I believe that 1) students don't like to be told what to do, 2) students know what they like and don't like, and 3) some assignments only work to them in a certain format. I was working with high school students, sophomores specifically, and this group of students especially do not like to be told what to do. When they have the opportunity to flex their personal choice, they love it. I think this is a great representation of that. Students would clearly prefer to make their own decisions about a task they need to complete than have a teacher tell them what to do. A quote from one of my students during an interview was, "you guys [teachers] tell us what to do every day all day, every once in a while, it is nice to make our own decisions and choices, it may seem silly but I like it". Students also know what they like and don't like, if they know completing an assignment online is going to be a pain for them, they won't want to do it. Giving student's choice could eliminate that from

happening. Again the data did not show it, but if we gave students more choice, I think over time we would see a difference in completion.

Interestingly enough, Gascoigne's (2015) results were very similar to mine. He found that students like and appreciate when they get to choose the style of homework. His research went farther to discuss whether giving them an option to do the homework in general plays a factor in their test scores. This was interesting but I did not include in my research; I actually wish I had. Brender's research also looked into this perspective of homework completion as a choice and found similar results to Gascoignes.

As stated before, some of the assignments are easier to complete in one specific format. Giving the students a choice on how they complete the assignment, would allow them to figure this out for themselves. Again, it is giving them a say in their lives and I believe it helps decision-making skills. They are looking at an assignment and trying to determine the best avenue to take. They are taking a problem and solving it, in a way that best suits themselves. This is an important skill to have and build upon.

My final research question was; will students' completion of online homework assignments be affected by potential online distractions? The results that came from this question were interesting. I absolutely thought that completing online assignments would be greatly affected by distractions. Based on the results I gathered from student interviews and surveys, students claimed that they seem to always get distracted, regardless of style of homework. While some of the bigger distractions come from the internet; games, Netflix, and social media, the biggest distraction yet was their phones. The majority of students claimed to get distracted by their phones. It didn't matter if they

were completing an assignment online or on paper, they said their phones will usually distract them.

I believe that I did not collect enough data to have a solid set of findings for this question. I believe if I had students somehow keep track of how many times they became distracted by their phones or the internet, I would have a better explanation of my findings. I think if I were to do this research over again, I would somehow incorporate that tracking system. But in all the results make sense, especially nowadays. Kids in this generation are growing up with technology in their face since they were babies. I myself have nieces who are younger than five, "owning" their own iPad. These kids constantly have some type of screen in front of them at all times during the day, whether it be their phone, a TV, a Chromebook, a project in class, etc. They are constantly being stimulated by some type of technology, it makes sense that they get distracted no matter what they are doing. Completing homework is a monotonous and tedious task, it is clearly easy to get distracted by something else.

VALUE

There are many aspects of this research that I plan to take away for myself, my students, and my colleagues. The first being to give students a mix of styles of homework. The data is clear in that always giving one style of homework is not beneficial to anyone. It is important to mix it up, but also be mindful of which style of homework works best with the specific assignment. I plan to put more thought into the style of homework when assigning it. I will assign digital assignments when students need to do a lot of writing or need to make a graph. I will assign paper assignments when

students needs to illustrate or draw. I plan to pass this information off to my colleagues. I think this valuable information that may be overlooked in our day to day work.

Another implication from my research is that students like having a choice in the style of homework that is provided to them. The data was very definitive when it came to student choice, the students want choice. Aside from what was mentioned above, if there are assignments that are not as pointed in terms of style that would be best, I plan to give the students a choice. As stated in my conclusions, I strongly believe that over time student choice will have an impact on completion. I plan to share this information with my colleagues as well, I will be honest to say that the data did not support student choice yet, but I believe over time it will. I think this will be eye-opening to some of my coworkers. I personally didn't think that student choice would matter to the students and that they would only want online assignments. I was casually asking fellow teachers what they thought, and I received much of the same thoughts as myself. Many teachers believe that digital assignments are what students want. Some of my colleagues didn't really think of student choice as a viable option either, primarily because of the extra work behind it. I will share this information with them and I will change how often I give students a choice in how they would like to complete their homework.

This research also provided me with interesting aspect I would like to share. Online distractions do not just impact digital assignments. Some teachers may like to give paper assignments to avoid online distractors. The sad news is that regardless of how assignments are being done, distractions are always going to be there, especially phones. Perhaps if teachers really want to avoid distractions, something they can do in class is

have students put phones away somehow. This way as students begin their homework in class, they could get a lot done if the phone is away for the time being. Unfortunately, there is nothing teachers can do when students are at home. This is a piece of information that could be communicated to parents, but there is no way of reinforcing it. I think sharing this information with parents would be important and could help students. Telling parents to limit their child's access to their phone, in order for them to complete their homework, is a brave thing to do. Risky may be a better way to describe it. There is always a fine line teachers have to aware of when it comes to making suggestions to parents for how home life should look when it comes to homework. Again, there is no way of knowing whether or not the parent is receptive and willing to make changes at home to help homework completion. I would believe that most parents are already aware but not always.

Finally, I think being an open book is the most important thing I can do with this research. Sharing what I have discovered is probably the most valuable thing I can do. It is challenging when your research is not significant one way or another, but that does not mean that it is not relevant. I plan to not only share with my colleagues but also with students and parents. Fellow teachers need to know that one style of homework is not beneficial for students, mixing it up is important and choice is key. Students need to know that I hear them and value their voice. If they think they know what suits them best, then I will let them make that decision. But I will also let them know, when I see their decisions are not doing them any favors, then I will make those decisions for them. I want parents to know that online distractions are real and can impact homework completion,

no matter the style. Keeping an eye on student's screen time is important, especially nowadays. We are in a technology-heavy world, and it is only going to get more technology-heavy, so we need to find ways to help students stay focused and limit those online distractors.

While all these implications stem from the research I have done, there is always room for future research I plan to do throughout my teaching career. Based on these results, I would like to look into skill versus will when it comes to homework completion. Did I get the results because students just didn't want to do the homework, or was it really from the style of homework? Or was it because the assignments were too difficult? I didn't factor this into my research this time, but this could be a future investigation. I also thought that I could do a similar type of research but try to link the questions from the assignments to test questions. This way when I assign a specific style of homework, I can track the specific questions they would impact on the tests to see if there is a relationship to them. This would be much more time consuming but the results would be undeniable.

The last thought I have on future investigations is tracking online distractors. This would be challenging to do and I would need to get the students on board and super honest with me. But it would be interesting to see how often and when students get distracted. Is it related to the time an assignment takes, the style of assignment, or the content of the assignment? Clearly, my action research days are not over, and I will continue researching what helps students be better learners. I will be forever grateful to the MSSE program and Montana State University for giving me the opportunity to

complete and share my first action research project. I will definitely take with me the skills and knowledge that I have learned throughout my teaching career.

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APPENDICES

APPENDIX A

POST-UNIT SURVEY

Post-Unit __ Survey

Participation in this research is voluntary and participation or non-participation will not affect your grade or class standing in any way.

1 = strongly disagree 2 = disagree 3 = undecided 4 = agree 5 = strongly agree

1. I like this style of homework (*insert style of homework here*).
   1 2 3 4 5

2. I find it easy to complete all my homework this way (*insert style of homework here*). 1 2 3 4 5

3. I would like all my homework to be this style (*insert style of homework here*).
   1 2 3 4 5

4. It was less work to complete my homework when it was in this style. (*insert style of homework here*) 1 2 3 4 5

5. I like completing my homework when it is this style (*insert style of homework here*). 1 2 3 4 5

6. I find myself wanting to finish my homework when it is this style (*insert style of homework here*). 1 2 3 4 5

7. I do not want to do my homework when it is in this style (*insert style of homework here*). 1 2 3 4 5

8. I don't like this style of homework given (*insert style of homework here*).
   1 2 3 4 5

9. I felt distracted while trying to complete my homework when it is this style (*insert style of homework here*). 1 2 3 4 5

10. I want to complete my homework in this style (*insert style of homework here*) all the time. 1 2 3 4 5

11. I want to do something else instead of completing my homework when it is in this style (*insert style of homework here*). 1 2 3 4 5

12. Please explain why you like or dislike homework this way (*insert style of homework here*).

13. If you become distracted during completion of these assignments, please explain what distracts you.

APPENDIX B

POST-UNIT INTERVIEW QUESTIONS

Post-Treatment Interview Questions

Participation in this research is voluntary and participation or non-participation will not affect your grade or class standing in any way.

1. How are we all doing today? Have we had a good day? Good week?
    a. Why or why not?
    b. Anything to look forward to coming up?
2. What did you think about the style of homework given this unit?
    a. Did you like it? Did you not like it? Why?
3. Did you feel like you wanted to complete your homework more often?
    a. Why or why not?
4. Do you think you would have completed your homework more often or less often if the homework was another style? Elaborate.
5. What style of homework do you tend to like more?
    a. Why?
    b. Is this the homework you completed more often or less often?
    c. Are you surprised by those results?
6. Did you find yourself getting distracted online?
    a. What did you do when this happened?
    b. How much time do you think you wasted?
    c. Did you think this slowed done the time it took you to complete your homework?
    d. Did you ever not complete your homework because of distractions?
7. Based on what we discussed here, have your thoughts on homework style changed?
8. Is there anything else you would like to add?

APPENDIX C

IRB EXEMPTION

MONTANA STATE UNIVERSITY

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MEMORANDUM

TO: Chelsea Gibson and Walter Woolbaugh

FROM: Mark Quinn, Chair Mark Quinn CQ

DATE: November 25, 2018

RE: *"The Effects of Homework Style on Completion and Test Scores" [CG112518-EX]*

The above research, described in your submission of November 19, 2018, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

_X_ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

_X_ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX D

SAMPLE ASSIGNMENT FROM TREATMENT 3

Worksheet #1 - Basic Punnett Squares

Complete Dominance

1) A male hamster that is homozygous for brown fur mates with a female hamster that is homozygous for black fur. Black fur is dominant over brown. Create a Punnett square showing the possible phenotypic outcomes for their offspring.

What is the **male's** genotype?____ **female's** genotype?____

What is the probability the offspring will have a phenotype like mom?

What is the probability of the offspring will have a genotype like dad?

2) A female walrus is heterozygous for long whiskers and mates with a male with the same genotype. Create a Punnett square showing the possible phenotypic outcomes for their offspring.

What is the **male and female's** genotype?_____ _____

What is dominant? How do you know?

What is the probability the offspring will have a phenotype like mom and dad?

3) A green flower is crossed with a yellow flower. Green is dominant over yellow. Fifty percent of the offspring are green and 50% of the offspring are yellow. Create a Punnett square that illustrates this cross. (Hint: you may have to work backwards…)

What is the green genotype?_____

What the yellow genotype?__

4) A pure-bred, true breeding red flower is crossed with a pure-bred, true breeding white flower. Create a Punnett square that illustrates this cross. Red is dominant over white.

What are the phenotypes of the offspring?

What is the probability that the offspring will have the same genotypes as the parents?

What is the probability that the offspring will have the same phenotypes as the parents?

Now, cross two of the offspring from above together for the F2 generation.

What are the phenotypic ratios of the offspring?

What is the probability that the offspring will share the same genotype as the F1 generation?

5) A male llama that is heterozygous for long hair mates with a llama that is homozygous recessive for short hair. Fill in the Punnett square that illustrates this cross.

What is the **male's** genotype?_____**female's** genotype?_____
What probability the offspring will be:

Homozygous recessive? _____

Homozygous dominant? _____

Heterozygous?_____