

HOMEWORK CHOICE IN THE HIGH SCHOOL SCIENCE CLASSROOM

by

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DEDICATION

For my family, for their patience during my time writing this paper.
For my students, who went outside their comfort zone and tried new things.

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ABSTRACT

Homework is a critical part of the learning experience for high school students. Homework that is completed with fidelity helps students prepare for class, learn new skills, reinforce learned skills, and increases classroom participation. Students often do not complete all their homework on time and teachers are often looking for alternatives that make students more likely to finish. This study looks at how allowing students to choose their homework from a list rather than doing a specific, pre-assigned list affected their academic achievement as measured by summative assessments. The study also looked at whether homework choice improved homework completion rates. A class of students in a university-model homeschool program for 10th and 11th graders were followed during four units in an introductory chemistry class. The students were divided into two groups. For each unit, one group was assigned specific homework tasks, and the other group was given a list of assignments to choose from. The treatment and non-treatment groups were swapped at the end of every unit, giving each student two units where they were in the treatment group and two units where they were in the non-treatment group. Before the treatment, most students either did not like or hated science homework. After each unit the students were given a summative assessment. Overall, the homework compliance remained the same and the summative assessment scores were 10% higher for the treatment groups. In an end of project interview, students overwhelmingly expressed their enjoyment for homework choice and wanted it to continue beyond the project. The students preferred homework choice because they could opt for assignments that they felt more comfortable completing. Some preferred more traditional assignments, while others preferred more creative assignments. Looking at individual students, their summative assessment scores showed a statistically significant increase during the treatment. Homework choice seems to have for most students had a positive effect and should be considered in the future.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

Context of the Study

No matter the age of our students, teachers often rely on homework as a part of their overall instruction. Homework is given for a variety of reasons, but generally it can be thought of as either reviewing concepts that have been learned in class, preparing students to learn new material during the next class, or increasing classroom participation. There are many types of homework, ranging from informal, family-based activities (such as taking a nature walk with your parents) to long-term, written projects with a lot of complexity.

I teach science courses at a tutorial center for homeschooled students. My students come to class in person once a week for 32 weeks. Each class is 2 hour long. After each class, the students are sent home with a week's worth of homework to complete on their own. My classroom is a unique educational environment, but the problems that exist are the same as many classrooms around the United States.

Something that I have observed throughout my experience is that students who do best in the class are the ones who complete all the homework. However, as I am sure most teachers have observed, few students complete every assignment. I have also had some students who do not complete the homework at all. I have others who will only do the homework at the end of the quarter to increase their grade but have already taken and done poorly on the unit assessments (since they tried to do the assessments without completing the homework first.) I also have students who complete the work on time, but do not use any original thinking – they either copy answers directly from their textbook or search online for answers. None of these scenarios allow

the students to use homework in the way it is intended – as an additional source of learning materials for the students.

Studies have shown that the most effective homework is the homework that students actively complete with fidelity. While this should go without saying, it does raise the issue of why some students are more likely to complete homework than others. One way to increase homework compliance may be to give students a greater sense of ownership and pride in the assignments.

Focus Questions

My focus question was, What impact does allowing students a choice of homework assignments have on their academic achievement?

My sub-questions included the following:

1. How does homework choice affect students' sense of pride and ownership over their work?
2. What effect does homework choice have on homework compliance and timely completion?
3. How does homework choice affect the teacher's preparation and grading time and effort?

CHAPTER TWO

CONCEPTUAL FRAMEWORK

Introduction

Homework can be assigned for a variety of reasons. Although different researchers have some slight variation, consensus is that homework is primarily assigned for the purposes of practicing learned skills, preparing students to learn new skills, or to increase classroom participation (Batman et al., 2022). Additionally, homework can be used to increase personal development, parent-child relations, parent-teacher communications, peer interactions and for punishment (Epstein & Voorhis, 2001). I do not assign homework as punishment, but one example where it might be valid to assign homework in this way would be if a student didn't complete an in-class assignment because they were misbehaving in class, so they were asked to complete the classwork as homework. This type of misbehavior is not generally an issue in my classroom as my students are in class for a short period of time. For my study, most of the homework I given was to practice learned skills and to prepare students for new skills.

A study conducted by Miller et al. (2021) looked to improve the homework used in freshman physics courses in Harvard University using deliberate practice. They define deliberate practice as a breakdown of a skill into various subskills which are then practiced over and over to allow for the skill to be completed more efficiently. These subskills must be created by a skilled tutor or instructor who is familiar with common student errors and misconceptions.

The Miller et al. (2021) study was done over three years and found that by using deliberate practice the test scores improved significantly (between 5-10%) while the amount of

time students spent on homework stayed the same or decreased. Adding deliberate practice to traditional homework assignments made a positive impact on the students' learning.

Research is divided on how much time students should be working every day on homework. One study sampled 7,725 students in a mandatory university course and asked them to complete self-evaluation questions for each assignment where they noted how long they worked and the level of effort they put into it. Students also noted whether they needed help with the assignment (Fernández-Alonso, 2015). This information was compared to academic performance. Based on their statistically significant findings, there is an optimal amount of time for homework and anything over that time had a negative effect on student performance. By analyzing the data, they were able to directly compare time spent on homework with test scores and found that sixty minutes seemed to be the ideal amount of time for homework per day. However, they also argue that there should be less emphasis on time and more emphasis on designing effective assignments. Fernández-Alonso (2015) concluded when it comes to homework "how is more important than how much" (p. 1082). They also found that the amount of effort students reported seemed to be a better indicator of performance than the time on task. For my study, this research allows me to concentrate on generating assignments that meet my weekly goals rather than keeping track of my students' total time on homework tasks.

Teachers strive for theoretically effective homework assignments, but in practice tend to fall back to traditional homework assignments (Batman et al., 2022). This pitfall often happens because the teachers do not have the time or support to continue creating new and innovative assignments.

Research from Nicole Shrat Carr (2013) gives more detail on what makes effective homework assignments. Carr's research found that there are 5 elements of an effective

homework assignment (Figure 1). First, an effective homework assignment needs a specific purpose which should be communicated to the students. Since my AR will focus primarily on practice and preparation assignments, it should be easy to communicate the purpose to the students.

Second, an effective homework assignment is one that has what she calls “efficacy.” Efficacy means that the assignment doesn’t take too long to complete (matching Fernández-Alonso’s research) yet requires thinking. Assignments that are just “busy work” assigned to fill time logs are not considered to have efficacy.

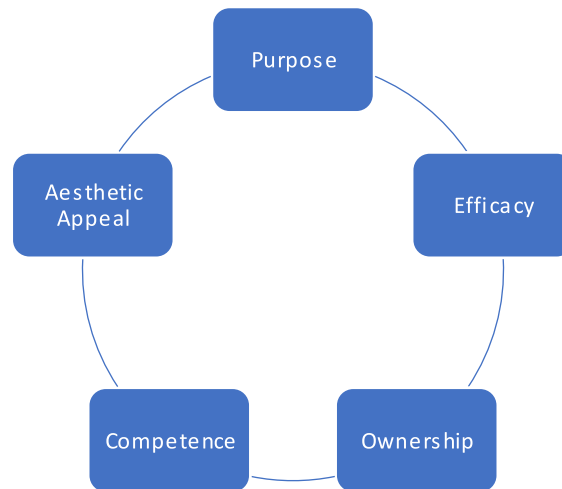


Figure 1. A graphic summary of Carr’s 5 Qualities of Effective Homework (Adapted from Carr, 2013).

Third, effective homework assignments require ownership by the students. Students need to feel a connection to the assignment, and this can be accomplished in a variety of ways. Students can be given a choice on which assignments to complete, the assignments can be connected to students’ personal interests, or the assignments should be able to be completed with “relatively high success rate” because the sense of pride for a job well done helps students to feel ownership (Carr, 2013, p.175). This bullet point is one I am most interested in pursuing as a part of my research project, specifically giving students a choice over which assignments they’d like

to complete. If students have some sense of control and ownership, they may be more likely to want to complete the homework and do it well.

The fourth quality of effective homework is competence. Homework should not be “one-size-fits-all” and should be differentiated based on students’ needs. This differentiation doesn’t necessarily mean creating different assignments, but it could be using different rubrics for some students, making the assignments shorter, or adding challenge questions for students who need more advanced work. Carr states that “homework that can’t be done without help isn’t good homework” (2013, p.175). If a student needs to be guided through an assignment, they are not getting the level of competence they should. Therefore, all the homework I assigned is meant for the student to complete successfully without needing to ask for help, either from their parents or me.

The final characteristic Carr assigns to effective homework is aesthetic appeal. Assignments that are attractive and visually uncluttered are more likely to get students to want to complete them.

Overall, research suggests that homework assignments prove most effective when students successfully complete them. As students age, they are less likely to complete all homework assignments (Epstein & Voorhis, 2001). Because of this, homework in secondary schools should be designed to allow for low-achieving students to have ample support and time to complete, while also providing the practice and preparation all the students require.

One way to increase student participation in homework is to involve parents and families (Carr, 2013; Epstein & Voorhis, 2001). Involving families in the homework process allows them to become more of a supporting role for the student. In high school, parents often do not monitor their child’s homework as much as they did when they were younger. This lack of parental

participation can cause students to feel that their parents do not value homework. Even though parents may not have knowledge in the content area, they are able to monitor homework and make sure it is completed. Epstein and Voorhis (2001) found that when parents were given specific instructions on how to interact with their student's homework there was significant increase in test scores.

Finally, the age of computers and digital resources means that many homework assignments can be done online. Traditional homework has been used for many years in, but research shows that student achievement improves the most with prompt individual feedback, something that the authors say is challenging for teachers because of time constraints. A systematic review of studies done by Magalhães et al. (2020) found that almost half (15 studies, $n=31$) showed no difference between online homework and traditional homework. When students were asked which type of homework they preferred, almost all said they preferred the online homework. Therefore, Magalhães et al. suggests that since the students prefer online assignments and online assignments appear to not have a negative impact, online assignments should be the preferred type of homework assignment. Most of these studies were done at the university level and they found that one major complication of online homework at the collegiate level is that students are susceptible to distraction and do not give their full attention to the assignment. There is not a lot of research at the high school level, but distraction is a problem for students of all ages.

Parker and Loudon (2012) studied the effectiveness of online homework for science classes. They examined online programs used in introductory college organic chemistry courses, which are “thought to function by promoting several of the key principles of good practice” (p. 37). They did find a moderate positive correlation between those students who used the online

systems and their test scores. This further indicates that using online systems may be a way for teachers to create homework assignments that students find effective.

Gerstle (2019) looked further into the various types of homework in a calculus class. He found that often math homework relies too much on the step-by-step process of doing mathematics and does not put “enough emphasis...on creative thinking, novel applications, and effective communications” (Gerstle, 2019, p. 71). Since math requires that type of thinking, Gerstle added a writing component to his assignments. Every two weeks the students were instructed to write a reflection designed to explore some of the concepts of creative thinking in problem solving. It was shown that students’ scores were higher after starting the reflection assignments, but also that “students reported feeling more confident in their performance” on in-class exams (Gerstle, 2019, p. 79). In my study, there were opportunities for students to perform writing exercises to stretch them to move beyond the mathematics of chemistry and explore the concepts of the subject.

Use of other forms of formative assessments was studied and found that “formative assessment improves student outcome” (Roschelle et al., 2016, p. 2). The outcomes are improved more if the results of the formative assessments are then used to inform instruction. Rather than assigning formative assessments in the classroom, Roschelle et al. (2016) assigned them for homework and then used their results to inform this lesson plans. The students who participated in the new type of homework had a higher achievement than that group that did not have that type of homework. This study further indicates that the type of homework assigned to students should not just include the formulaic type of work used for skill practice.

Direction for Action Research

Using Carr's (2013) guidelines, I developed a variety of homework options that matched content of the traditional homework. The students had the ability to choose from a list of assignments and complete the ones that meant the most to them. The focus was not on how much time the students spent working, but rather that they were working on the most effective assignments for them.

Every piece of homework was given for a specific reason and was adjusted to be the proper level of difficulty so students will not become frustrated or find the work too simple. The aim was to offer students a variety of assignments and let them self-identify which best suited them. The homework assignments also ranged from traditional assignments to more creative and reflective assignments.

CHAPTER THREE

METHODOLOGY

Demographics

This treatment was used in my high school introductory chemistry class at a homeschooling tutorial center. The courses at this center are comparable to the courses at the local public school, with the exception that the students only meet in person once per week. These in-person classes are 2 hours long. The students are sent home with assignments to complete that review the concepts studied in class and to prepare them to learn new concepts the following week. For the purposes of this study, the work that is sent home with the students to complete is what I have identified as homework.

This course has only six students, two boys and four girls. All are enrolled in at least one other course at the tutorial center, and five of them have been in at least one of my science classes before this one. All the students are homeschooled and are in middle to upper class families with at least one college educated parent. The students are in the 10th or 11th grades.

Treatment

Collecting useful data while performing Action Research can be challenging, especially because my classes are small, and my students do not have any standardized testing to judge achievement. To collect useful data, the class was divided into two groups. Half the class participated in the treatment (homework choice) while the other half served as the comparison group and was assigned specific homework assignments. Every-other unit, the student groups were swapped. This style of research removes any outliers that may occur because one student is

at a much different achievement level than another student. Each student is compared to themselves rather than one group against another (Miller et al., 2021). Each unit lasted approximately two weeks, so each group participated in the treatment for a total of four weeks, with two week breaks in between, while the other group participated in the treatment.

Before any treatment began, the students were asked to complete a Likert-type survey (with a few follow-up questions) on their opinions about homework and science class (Appendix A). This survey data was compared to a post-treatment interview to see how the students' attitudes changed because of the treatment.

The class was divided into two groups. Group A was the first group to undergo the treatment while Group B did not have any treatment for that unit. For the next unit, Group A used specific, teacher-chosen homework assignments and Group B used the homework choice treatment. Each unit lasted approximately two weeks. I used four units for this project, so each group had two opportunities to use the homework choice model.

The in-class instruction was the same for both groups. The in-class instruction included lectures, labs, and hands-on activities and was the same in-class instruction as in past years. Following the in-class instruction the students were sent home with homework that reviewed the current material and prepared them for the next in-class session. For the students in the treatment group, there was a choice of assignments (for example, choose 3 of the 5 assignments). The students not in the treatment group were assigned a specific homework assignment that had been given in past years. Both groups completed the same total number of assignments each week. The homework options for students in the treatment focused on similar skills, but offered options that are not usually presented, such as writing and drawing assignments.

At the end of each unit, students were given a summative assessment that was used to judge the students' understanding of the material in each unit.

Following the entire project, students participated in a short interview (Appendix B) where they provided feedback on the homework choice options. Since I've worked with these students before, they were honest and provided a good student perspective on homework choice.

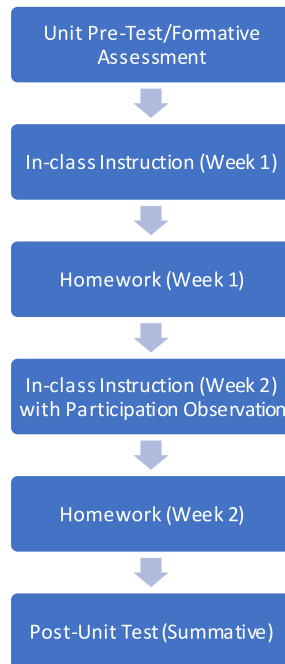


Figure 2. Classroom Treatment Flowchart. This treatment will be repeated three times, for a total of 8 weeks.

Data Collection and Analysis Strategies

My Action Research question and sub-questions had a variety of instruments to track their progress. The instruments ranged from summative assessments to student interviews and in-class evaluations. Table 1 shows which instruments were used for each question.

Table 1. Instrumentation used for each Action Research Question.

Research Questions	Data Collection					
	Survey of Homework Choices	Homework Completion Percentage	Homework Grades	In-class evaluation	Post-Unit Test	Student Interviews
What effect does homework choice have on student achievement?	X		X	X	X	
How does homework choice affect the students' sense of pride and ownership over their work?	X					X
What effect does homework choice have on homework compliance and timely completion?		X	X			X
What effect does homework choice have on classroom participation?				X		X

Each student was assigned a Homework Compliance Score indicating how much homework they completed fully and on time. A data table (Appendix C) was used to record the raw data. Each cell of the table was filled with the date of completion or a NC for Not Completed. After each unit the students were given a Compliance Score. For every assignment that is completed and on time, the student will earn 2 points. For every assignment that was completed late, the student earned 1 point. Students earned 0 points for any assignment that was not completed. The points were then be averaged for the entire unit. Students who completed all

assignments on time would have an average of 2 points, and students who don't complete any assignments would have an average of 0 points.

I will then be able to objectively show the impact of the treatment on compliance (whether the students completed their homework). I will also be able to correlate the student's compliance with their summative assessment scores. The validity of the summative assessments was determined through colleague feedback as well as studies on alternative assignment options.

The research methodology for this project received an exception by the Montana State University's Internal Review Board (IRB) prior to beginning any treatment. Compliance for work with human subjects was maintained (Appendix D).

CHAPTER FOUR

DATA ANALYSIS

Results

At the start of the treatment, all the students in my chemistry class were given a Likert-type survey with several follow-up questions regarding their science homework. The students were asked how long they spent doing their homework for science each week. Four of the six students said they spend 3-4 hours per week, while the remaining two said they spend only 1-2 hours per week. The student who is performing the worst in the class spends the least amount of time on homework, as would be expected. The students performing the best do spend more time doing their homework. None of the students said they spent more than four hours a week on their homework, keeping them well below the 60 minute per day limit Fernández-Alonso deemed as the ideal homework length (Fernández-Alonso, 2015).

Table 2. Time students spend on work and their current grade in the class, ($N=6$).

Student	Time Spent on Work	How Much Homework is Completed? (self-evaluation)	Current Grade in Course
A1	3-4 hours	Most (more than 3/4)	A+
A2	1-2 hours	Very Little (less than 1/2)	C+
A3	3-4 hours	Some (more than 1/2)	B-
B1	3-4 hours	Some (more than 1/2)	A+
B2	1-2 hours	All	A
B3	3-4 hours	Most (more than 3/4)	A-

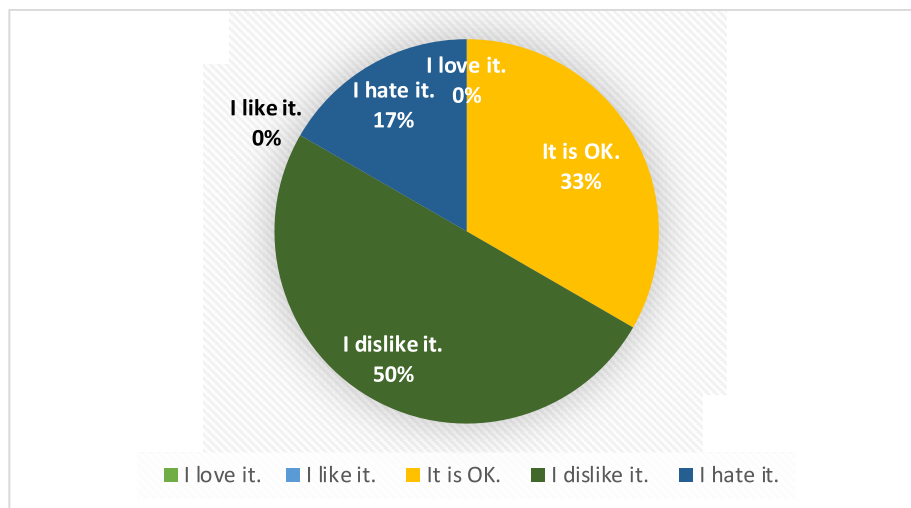


Figure 3. Evaluating how much students enjoy doing their current homework, ($N=6$).

The students were asked how much they enjoy their chemistry homework (Figure 3). I gave the answers a score of 1 (I love it) to 5 (I hate it). None of the students said they like or love the homework (which is what I expected to find). The mean score is 3.8 with a standard deviation of 0.7. When asked why they held those feelings for homework, they had a variety of answers. One student said, “Because chemistry is pointless. I’m not gonna [sic] use any of this in my day to day [sic] life as an adult.” Another said, simply, “I don’t enjoy doing homework.” And one was more realistic, saying, “It’s often hard and time consuming, but I understand why we have homework, and in the end it’s definitely beneficial to do it.” While I do not expect students to enjoy doing homework, I was surprised at how many dislike it.

Table 3. Homework Compliance Summary Score, (N=6).

					Average Score
Unit	1	2	3	4	
Student #					
A1	2.0	2.0	2.0	2.0	2.0
A2	1.7	1.2	1.8	0.5	1.3
A3	1.0	1.6	2.0	2.0	1.7
B1	1.7	1.2	2.0	2.0	1.7
B2	1.8	2.0	1.8	1.8	1.9
B3	1.8	2.0	1.3	0.8	1.5
Average Score	1.7	1.7	1.8	1.5	1.7

The first piece of data to evaluate academic achievement is their homework compliance. I completed a Homework Compliance Chart for each student for each week of the project. A score of 2 means they handed in their assignments on time, while a 1 means they handed in the assignment, but not on time. A 0 means they did not hand in an assignment at all. This data was put into a Summary Table (Table 3). The students ranged from a 2.0 average score to a 1.3 average score. This means that most students handed in their work, but only one student reliably handed in every assignment on time. Each individual unit had similar averages, with the last unit having the worst overall score of 1.5. I believe the homework for the last unit had the lowest compliance because of the time of year. It is, unfortunately, typical that students start handing in assignments late or not at all once the weather starts to get warmer.

Table 4. Homework Compliance During Treatment and No Treatment, (N=6).

					Average Score (Treatment)	Average Score (No Treatment)	Percent Change
Unit	1	2	3	4			
Student #							
A1	2.0	2.0	2.0	2.0	2.0	2.0	0 %
A2	1.7	1.2	1.8	0.5	1.8	0.9	50 %
A3	1.0	1.6	2.0	2.0	1.5	1.8	-20 %
B1	1.7	1.2	2.0	2.0	1.6	1.9	-19 %
B2	1.8	2.0	1.8	1.8	1.9	1.8	5 %
B3	1.8	2.0	1.3	0.8	1.4	1.6	-14 %
Average					1.7	1.7	0%

**Gold colored cells are for treatment. White cells are no treatment.*

Isolating the compliance scores only when the students were in the treatment (Table 4) showed that overall student homework compliance had a 0% change. However, looking at individuals reveals differences. Student A2 had a score of 1.8 during the treatment, but only a 0.9 when not in treatment. This student's scores therefore had an increase of 50% during treatment. However, three students (A3, B1, and B3) exhibited decreases in their compliance score during their treatment units (20%, 19%, and 14%, respectfully).

The second measure of student achievement is their unit test scores. At the end of each unit, the students were given a summative assessment. Their scores (Table 5) show that five of the six students scored higher during the treatment than nontreatment. It also shows that for three of the four units the class average was higher for those in the treatment than those who were not. These scores indicate that homework choice has a positive effect on student assessment scores.

Table 5. Summative Assessment Scores, (N=6).

					Average Score (Treatment)	Average Score (No Treatment)	Difference (%)
Unit	1	2	3	4			
Student #							
A1	85	65	95	95	90	80	10
A2	70	88	85	90	78	89	-11
A3	75	41	90	100	83	71	12
B1	-	76	73	100	88	73	15
B2	85	88	95	100	94	90	4
B3	90	88	80	95	92	85	7
Average	77	65	90	95	88	-	
	88	84	83	98	-	81	

**Gold colored cells are for treatment. White cells are no treatment.*

The null hypothesis for this study is that homework choice would have no impact on the students. Running an initial analysis of the data, the \bar{d} for the percent change ($\bar{d} = (\sum d)/n$) is 6.2. There is a large standard deviation of 9.2 with a Standard Error of Mean (SEM) of 3.8, largely because of student A2. If we remove that student from the data, we get a \bar{d} of 8 and a standard deviation of 4.3. Using all the students, we calculate a p-value of 0.1599. But if we remove student A2 we get a p-value of 0.005, which is statistically significant and rejects the null hypothesis.

Student A2 is known to have a learning disability and an erratic work ethic. He often takes tests without any preparation and before he completes the assigned homework. Because the results are so significant when we remove his data, and paired with his learning challenges, I think it makes sense to do that in this case.

Following the project, students were given an interview to discuss their feelings about homework choice. I was only able to interview five of the six students because of student

vacation schedules. The students were asked to rate how much they enjoyed homework choice on a scale from 1-5, with 5 being the best score. The students ($N=5$) had an average score of 4.2. However, this number is skewed by one very low score. Three of the students ranked homework choice as a 5, one a 4, and the final student gave it a 2. That last student, A1, continued to express their frustration with homework choice and did not like it at all.

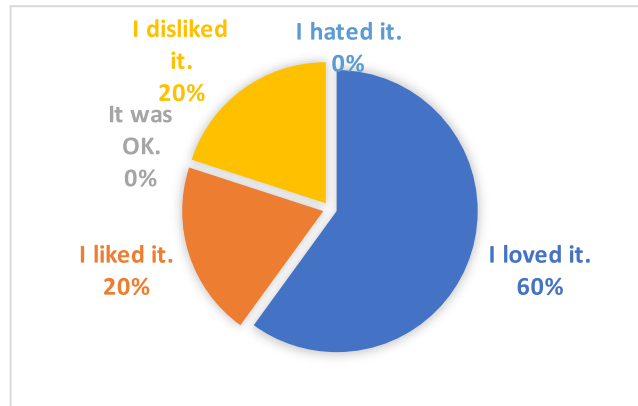


Figure 4. Student Attitudes about Homework Choice Treatment, ($N=5$).

The student who disliked homework choice said she did not like it because she spent more time choosing which assignments to do than it would have taken to do assignments that were assigned to her. She is the student who has completed every assignment and had a perfect compliance score (student A1). The overall sentiment is that homework choice is a good thing. One student said, “It’s so awesome. I get to choose the assignments. Sometimes I just can’t with the really long stuff like the worksheets...so it’s nice to be able to choose.”

Most students, (4 out of 5) preferred the assignments that use the computer or tablet to fill out, rather than pen or paper. One student said she preferred the pen and paper assignments because they were most like the work done in class. The students had very different preferences for their assignments. Two said favorite type of assignment was classic worksheets, while one said that worksheets were their least favorite. One student said her favorite was the more creative

type assignments (write a rap song, write a comic) while another said those exact assignments were her least favorite. Two students said their favorite assignments were online quiz games that give them instant feedback and have a competitive element to them (such as Quizizz activities). These results show that not only offering a choice of assignments, but a variety of assignments, is important to students.

Table 6. Student Homework Preference, ($N=5$).

Student	Favorite Type of Assignment	Least Favorite Type of Assignment
A1	Classic Worksheets	Coloring Sheets
A2	Online Quiz Games	Textbook Assignments
A3	Online Quiz Games	Long Worksheets
B2	Creative (Write a Comic Strip, Write a Rap Song)	Creating Worksheets
B3	Paper Worksheets	Coloring Sheets or Making Songs

All the students said that they would like to see homework choice in other subjects, though most said they could not imagine how that would work or what the assignments would look like. Most of the students said they did not feel more or less prepared for unit tests, but one did say she felt better prepared because “I felt better about the stuff I was studying.”

CLAIM, EVIDENCE, AND REASONING

Claims From the Study

The students overwhelmingly (80%) liked homework choice. The one student who did not like the treatment did not like it because it took her too long to choose which assignments to complete. I believe that she was too worried about picking the wrong ones. However, had this treatment begun at the beginning of the year I suspect she may have had more confidence that none of the choices were bad choices, and she may have been better able to enjoy choosing a bit more.

The work by Carr (2013) shows that effective homework assignments are those that the students have ownership of. Since most of the students preferred homework choice and some wanted it to expand beyond the science classroom, it is clear that ownership was a key factor to the success of the project.

There was a slight decline in student homework compliance during their treatment units, except for one student who generally had poor compliance. The change in the amount of work they handed in on time did not seem to impact their assessment scores very much. I believe that the ability to choose their own assignments made them retain the material better, even if they didn't complete the full number of assignments they were supposed to do. Since students were able to have more ownership of their work, it was likely more effective than just following a set checklist of assignments. It also shows that homework assignments that were chosen all had an equal educational value, since their scores were not affected by the type of assignments they chose from the list of options.

Time spent on work would have been the same for students in the treatment and not in the treatment for each unit (Fernández-Alonso, 2015). Since the students reported they were

spending 1-4 hours per week on homework, the total amount of time spent on assignments is in line with what Fernández-Alonso say is ideal.

Most students (5 out of 6) experienced an increase in their unit test scores during the treatment. The student who did not experience an increase is also the one with the most dramatic change in his homework compliance. I believe his test scores do not accurately reflect the treatment as his unit test scores and homework compliance because of his undiagnosed learning disability mentioned earlier. The other students experienced an increase in their unit test scores.

Three of the four units had higher test scores amongst the students who were in the treatment group. This data strongly suggests that students who were part of the treatment had more understanding of the material and were better prepared for the unit tests.

Value of the Study and Consideration for Future Research

This study illustrates that students benefit from having homework choice options. The students completed fewer assignments on time and still had more success at their summative assessments. It also shows that students have a wide variety of preferred homework assignments. Teachers who may not want to implement student choice should consider offering a variety of assignments to their students. The students were split between liking the traditional worksheet type lessons, computer-based assignments, and the creative type of assignment. Future work could focus more on student variety without student choice to see if a similar impact to unit test scores can be seen.

There will always be some barriers to having homework choice in particular units. They may not lend themselves to a variety of assignments, and some weeks the students must do a particular assignment to prepare for class (such as watching an online lecture or doing a take-home exam). Teachers will also struggle with the time required to find new assignments of equal

rigor, especially those that are more artistic in nature. However, once selected, the teacher would be able to reuse those assignments in upcoming years, so working through just one unit at a time may be a way for teachers to overcome this hurdle.

Impact of Action Research on the Author

The data was so positive that I believe that I will consider implementing homework choice in my classroom for the entire school year. The most challenging part of homework choice is keeping track of it in the Learning Management System used for grading, but Google Classroom (the one I use) has recently added features that make it even easier to excuse students from assignments which makes homework choice easier for both students and teachers to track what they need to hand in each week and any grades.

I am also interested in sharing this research with instructors in other subjects. Since the students were interested in trying the treatment in other subjects, it would be interesting to see what my colleagues who teach other subjects think they can do to implement homework choice in their own classrooms.

Overall, I am very pleased with this study. I saw positive interactions between the students and their work. They felt more ownership of their assignments, and it had a positive impact on their overall academic achievement.

REFERENCES CITED

- Batman, K. A., Beidoğlu, M., & Köklü, S. (2022). Homework assignments for the science and technology course in 5th grade in Northern Cyprus. *Cogent Education*, 9(1). <https://doi.org/10.1080/2331186X.2022.2149227>
- Carr, N. S. (2013). Increasing the effectiveness of homework for all learners in the inclusive classroom. *School Community Journal*, 23(1), 169–182.
- Epstein, J. L., & Van Voorhis F.L. (2001). More than minutes: Teachers' roles in designing homework. *Educational Psychologist*, 36(3), 181–193. https://doi.org/10.1207/s15326985ep3603_4.
- Fernández-Alonso, R., Suárez-Álvarez, J., & Muñiz, J. (2015). Adolescents' homework performance in mathematics and science: Personal factors and teaching practices. *Journal of Educational Psychology*, 107(4), 1075–1085. <https://doi.org/10.1037/edu0000032>.
- Gerstle, K. (2019). Incorporating meaningful reflection into calculus assignments. *PRIMUS*, 29(1), 71–81. <https://doi.org/10.1080/10511970.2018.1472155>.
- Magalhães, P., Ferreira, D., Cunha, J., & Rosario, P. (2020). Online vs traditional homework: A systematic review on the benefits to students' performance. *Computers & Education*, 152, 103869. <https://doi.org/10.1016/j.compedu.2020.103869>.
- Miller, K., Callaghan, K., McCarty, L. S., & Deslauriers, L. (2021). Increasing the effectiveness of active learning using deliberate practice: A homework transformation. *Physical Review Physics Education Research*, 17(1). <https://doi.org/10.1103/physrevphyseducres.17.010129>.
- Parker, L. L., & Loudon G.M. (2012). Case study using online homework in undergraduate organic chemistry: Results and student attitudes. *Journal of Chemical Education*, 90(1), 37–44. <https://doi.org/10.1021/ed300270t>.
- Roschelle, J., Feng, M., & Mason, C. A. (2016). Online mathematics homework increases student achievement. *AERA Open*, 2(4). <https://doi.org/10.1177/2332858416673968>.

APPENDICES

APPENDIX A

HOMEWORK ATTITUDE SURVEY

For the purposes of this survey, homework means any work completed outside of class.

Name:

What grade do you currently have in class? _____

How much time do you spend each week on chemistry homework?

- Less than 1 hour
- 1-2 hours
- 3-4 hours
- 5-6 hours
- More than 6 hours

What is your preferred way of doing chemistry homework?

You probably use more than one of these methods. Choose the one you like the most.

- Phone
- Computer
- Paper/Book
- Tablet/iPad
- Other. Please list: _____

How much do you enjoy Chemistry homework?

- I love it. It's the best part of my week.
- I like it. It's still homework, but it isn't too bad.
- It is OK. I don't mind doing it.
- I dislike it. I don't enjoy doing it, but it could be worse.
- I hate it. It's the worst part of my week.

Why did you choose the answer you did for the previous question? _____

How much of your Chemistry homework do you hand in on time each week?

- I always finish all of my homework.
- I usually finish most (more than 3/4) of my homework.
- I finish some (more than 1/2) of my homework.
- I finish very little (less than 1/2) of my homework.

What, if anything, keeps you from doing all of your chemistry homework on time? _____

What is your favorite school subject this year? _____

For the following questions, choose how much you agree with the given statement.

I like school.

- Strongly Agree
- Agree

- Disagree
- Strongly Disagree

I enjoy science.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Why did you choose the answer you did in the previous question? _____

My chemistry homework helps me understand the subject.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

My chemistry homework helps me prepare me for class.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

When I do my chemistry homework, my grade improves.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

APPENDIX B

POST-STUDY INTERVIEW QUESTIONS

Student Name: _____

The following questions will be asked in a one-on-one setting with each student, either in person or over a Zoom session. Students can opt out of answering any question or end the interview at any time. Other questions may rise as the conversation continues and will be recorded on this document as well.

1. On a scale of 1-5, 1 being the worst and 5 being the best, how would you rank your current opinion of homework choice.
2. Why did you choose that rank?
3. Would you want to have homework choice options in the future?
4. What assignments did you like the best?
5. What assignments did you like the least?
6. What types of assignments did you not see, but would like to in the future?
7. Did homework choice make you more likely or less likely to do your science homework?
8. Would you be open to homework choice in other subject areas, like math?
9. Which assignments were you more likely to choose – those requiring a paper and pen or those requiring a smart phone/computer?
10. Did using homework choice make you feel more prepared for the test?
11. Anything else you'd like to say about homework choice?

APPENDIX C

HOMEWORK COMPLIANCE CHART

APPENDIX D

IRB EXEMPTION

Hello Lamb, Melissa,

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

PI: Lamb, Melissa

Approval Date: 1/26/2024

Title: MSSE What Affect Does Homework Choice Have on Academic Achievement?

Protocol #: 2024-1160-EXEMPT

Review Type: Exemption

Expiration Date: 1/26/2029

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