Which Method of Flipped Learning (Traditional Flip or Explore-Flip-Apply) Will Strengthen Student Inquiry Skills the Most?

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Abstract

The flipped classroom teaching method allows for a restructuring of classroom time. It reduces the amount of teacher-directed instruction during a class period. Some methods of flipped classroom front-load the students with curricular information. In a science classroom, it is important to encourage inquiry skills like questioning, curiosity, and exploration. This study examined different methods of implementing flipped learning into a middle school classroom to see its ability to strengthen student inquiry skills. The methods of flipped learning compared in this study are a traditional flipped classroom and an explore-flip-apply, a method designed to encourage inquiry. It was predicted the explore-flip-apply group would show more growth because they would be more motivated by their curiosity. Students in this study self-assessed their inquiry skills before the two-month study began, which were compared to their self-assessments at the end of the study. Both test groups showed growth in inquiry skills. Overall, explore-flip-apply group had more students show growth than the traditional flip classroom group.

Introduction

"If you look around the room and notice a class full of glazed over faces, it's time to rethink your approach," states Jennifer Powell-Lunder, a clinical psychologist and adjunct professor at Pace University in New York (Sheehy, 2013.) As students' interests have shifted to incorporate new, cool technology into their everyday life, a divide has been created between the way students learn outside of school, and the way they learn in school. This divide has often resulted in partial engagement from students, and educators are struggling to overcome this divide. Schools are not tapping into student engagement through mediums common for many students' way of life. "It has been noticeable over the last several years that the way students interact with technology, the way students interact with each other, and the way students interact with their teachers is changing. It seems that in many ways the education system is not keeping pace with these changes" states Graham Johnson, secondary math teacher in Kelowna, British Columbia (Johnson 2013).

To address this divide, some educators are implementing a new model of learning called the flipped classroom. The idea of the flipped classroom takes the teacher-directed lecture portion of normal class time and turns the lecture into a video tutorial the student can watch outside of class, and at their own pace. With this, students make their own decisions in determining the speed of their learning, whether they will go faster because they understand the content, or if they need to go slower or rewatch the content to help break it down (Goodwin & Miller, 2013). The structure of the flipped classroom allows for students to engage in learning methods different from the traditional classroom environment. These methods compliment the technology-based learning methods students are naturally practicing outside of the classroom, as many students are naturally gathering information from sources on the web and social media in their daily lives (Bergmann & Sams, 2012).

This alternative structure begins to shift the roles of learning inside the classroom, and gives students the opportunity to begin to engage in self-regulated learning. Classroom time is no longer a passive process or a sit-and-get lecture format. While at school, students engage in higher-level processing activities. Students practice problems, discuss issues, explore case studies or work on specific projects. The classroom becomes an interactive space, which encourages students to become more directly involved in their education (Horn, 2013.) With this shift, students will engage in self-regulated learning practices tapping into cognition (the ability to recall information), metacognition (the ability to understand what they recalled), and motivation (the confidence and ability to engage in challenging tasks) (Schraw, G., Crippen, K. J., & Hartley, K. 2006). These attributes create a different type of learner who is empowered to tackle more challenging, interactive, and social problems within the context of the classroom. The teacher's role in learning shifts to a role of support and guidance to assist students when they have reached their learning limits.

One benefit the flipped classroom offers is the elimination of classroom distractions while important information is being covered. Many teachers who use a flipped classroom have students watch a video covering new content before coming to class and then in class participate in a variety of engaging activities to apply the concepts from the video (Ashe 2012). While this can bring many positives to a classroom, it can take away from the curiosity which is such an important part of learning. Ramsey Musallam, a chemistry teacher at Sacred Heart Cathedral Prep in San Francisco, has been a big advocate in modifying the traditional flipped classroom. Musallam takes a back-flip approach, which he calls explore-flip-apply. Students in Musallam's classroom engage in inquiry activities first (Musallam, 2012). Then, students work to construct knowledge, and when Musallam feels as though they have reached a roadblock and can no longer form ideas on their own, he creates a video to address misconceptions, and provide further instructions to advance his students deeper in learning (Ashe, 2012).

The addition of Musallam's step to the flipped classroom model is critically important in fostering student curiosity. When you examine inquiry-based teaching methods, its goal is to create students who are scientifically literate. When students gain this literacy, they become part of a larger process where you practice different habits of mind like curiosity, inventiveness, and critical analysis. (Seraphin, K. D., Philippoff, J., Kaupp, L., & Vallin, L. M., 2012). Ideally, empowering students with these skills will not only strengthen them as learners, but also in their future contributions to society. Duggan and Gott (2002) explored societal needs linked to education reform. They found science-based jobs and local communities will need future students who have backgrounds focused more on procedural understandings of science processes, rather than content specific science knowledge. This added inquiry step should help to strengthen students' experiences and better prepare students to fill these future societal needs.

This paper focuses on the practice of the flipped classroom and its role in inquiry-based education by exploring the question, what method of flipped learning (traditional flip or explore-flip-apply) will strengthen student inquiry skills the most? In this study, there were two groups completing flipped learning, each in a different method and comparing the students inquiry skills as shown in a self-assessment. For this study, the traditional flipped learning cycle is defined as topic introduction through a video lesson assigned as homework. Explore-flip-apply is defined as introduction to a topic through inquiry-based observation activity, in class apply their understanding to exploration activities and a video is assigned during the exploration activity.

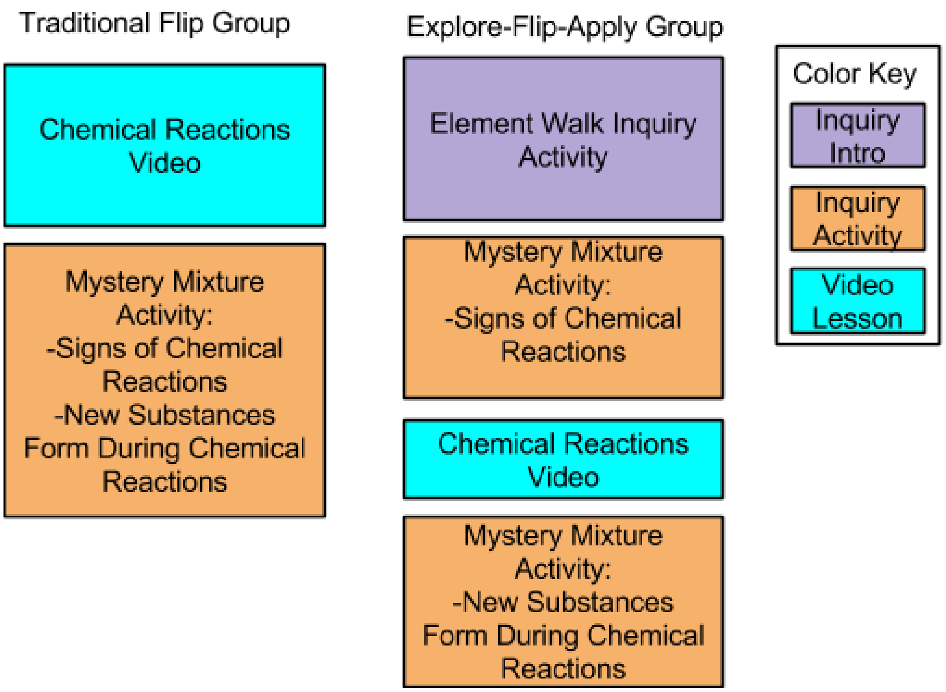
I predict that the explore-flip-apply group will be more motivated by the unknown, which will increase their general curiosity in the topic, compared to the traditional flip group. Further, I believe this will be translated to the explore-flip-apply groups' science procedural practices because they may feel they need to be more diligent in data collection because they will need to construct answers and build knowledge based on their inquiry skill practice. Therefore, I believe the explore-flip-apply group will show more growth in their inquiry skills than the traditional flip group.

Methods

This study compared two sections of students in a middle school science classroom. The subject population ranges in age from 13 -14 years old, and are members of 8th grade class at Mid-Prairie Middle School, in Kalona, Iowa. There are 98 students in the class. The demographics of the class break down as such: 95% of students are Caucasian, 3% are African-American, 1% Asian, and 1% Hispanic. 34% of this class qualifies for free or reduced school lunch. Only the students who completed a student/parent consent form (see Appendix A) have their results included in the study. From the completed consent forms, there were 15 students in each of the test groups during the course of the two-month study.

To determine the instructional lay-out of the curriculum with the two groups (traditional flip and explore-flip-apply), the activities and videos were organized using color-coded flash cards. (see Figure 1.)

Figure 1 - Instructional Layout Using Note Cards



Students in both groups received the same main activities focused on chemical reactions. The main variable examined in this study was the type of topic introduction to students. The traditional flip group received an introduction through a video and the explore-flip-apply group received an inquiry-based activity introduction. The traditional flip group was assigned a video for homework before coming to class to work on the main inquiry activity. The video explained the topic to the group and asked students to answer a comprehension question to gauge their understanding of the video. The explore-flip-apply group participated in an observation activity in class before beginning the main class activity. The observation activity asked for students to record observations into learning statements and write questions and predictions about the topic. Students in the explore-flip-apply group participated in the main inquiry activity, and were assigned a video during the process of completing the main activity.

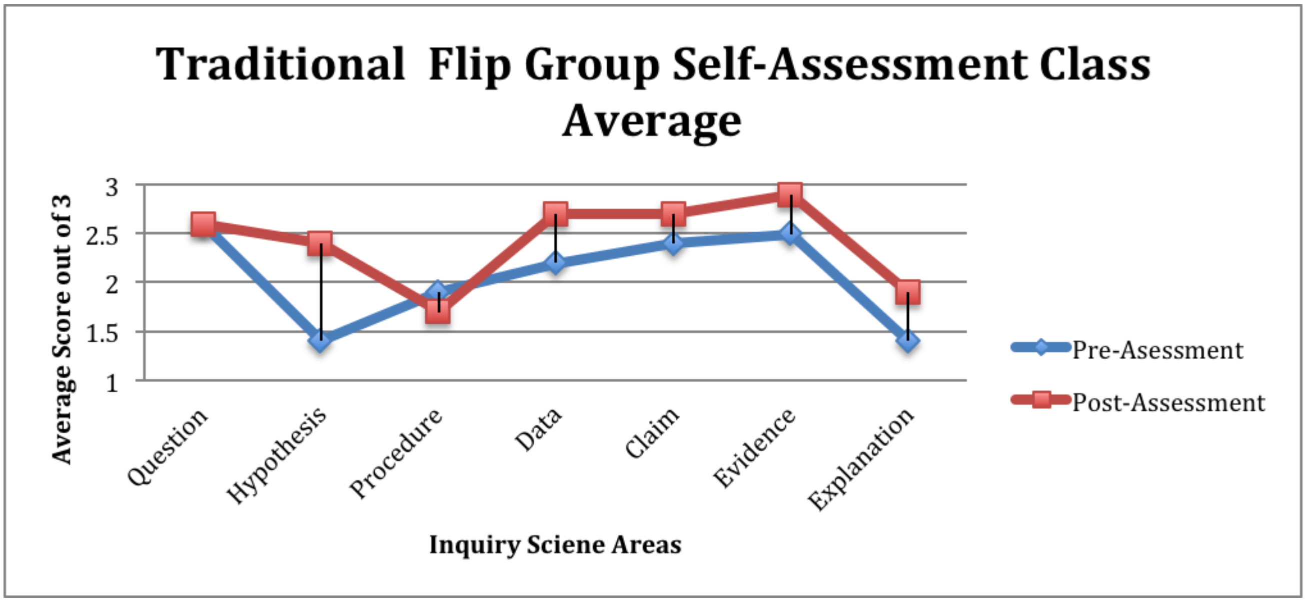
This study examined whether one of the flipped learning models will strengthen students' inquiry skills. The main instrument to gauge the strength of student inquiry skills was an inquiry skills checklist (see Appendix B). The inquiry skills checklist is a compilation of work completed by my school's science department over the last two years as we have explored science standards and criteria for measuring the standards. We created the criteria as a group to help measure student inquiry skills and I translated these criteria into a yes/no sheet to assist students in the self-evaluation process. The checklist was given to students before and after the study asking them to review specific inquiry-based labs completed in class. The students were asked to review and compare their work to the yes/no statements on the checklist and answer honestly based on the work they completed.

For data analysis, the inquiry skills checklist was set-up as a nominal self-evaluation, looking at three criteria for each inquiry skill section. There were seven inquiry skill sections in total: question, hypothesis, procedure, data, claim, evidence, and explanation. When students compared their work to the survey, they looked to match their skills with the identified skills in a yes/no format. Each of their yes answers was counted as one, and students could receive up to three points per inquiry skill section. Each group's inquiry sections were averaged and compared to the pre-assessment to look for student growth in the inquiry section. The students with growth in the inquiry section were counted as one and added to the group's total growth for each section. The class total growth was compared to each other to evaluate the flipped learning methods.

Results

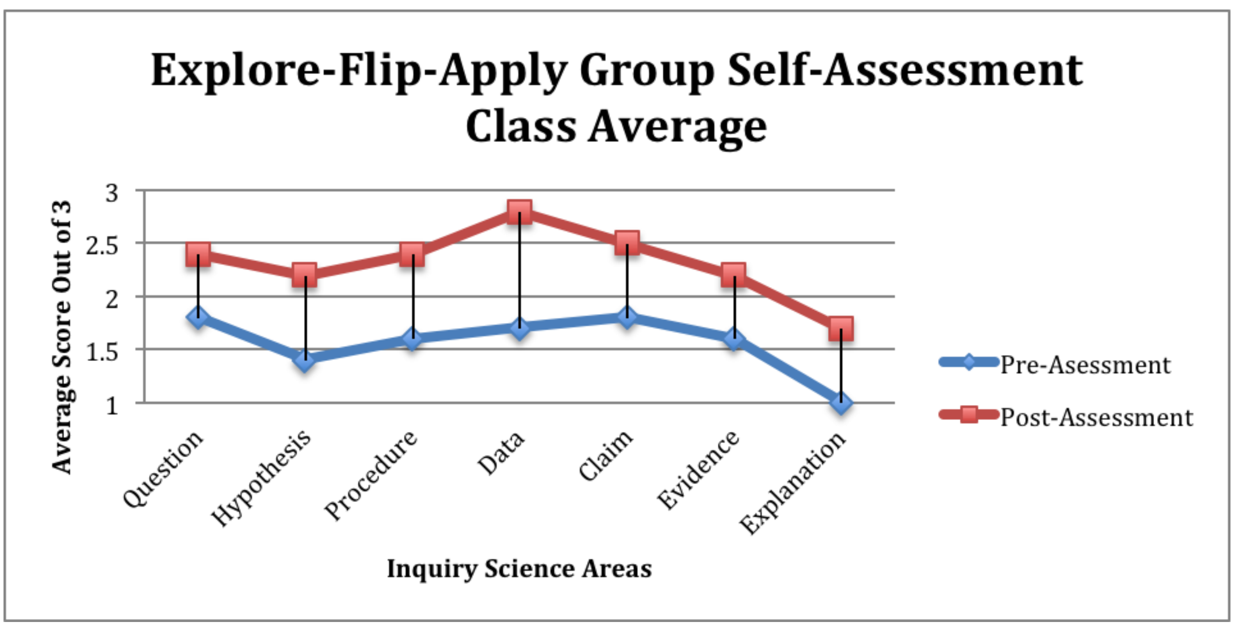
The data collected from this research comes directly from student self-assessments using the inquiry skills checklist. To look for patterns and conclusions, three pieces of evidence are examined in the results section: the class averages from the pre-and post-assessments from the traditional and explore-flip-apply groups, and the number of students who showed growth in the different inquiry skill areas.

Chart 1 – Traditional Group Class Averages in the Seven Inquiry Areas



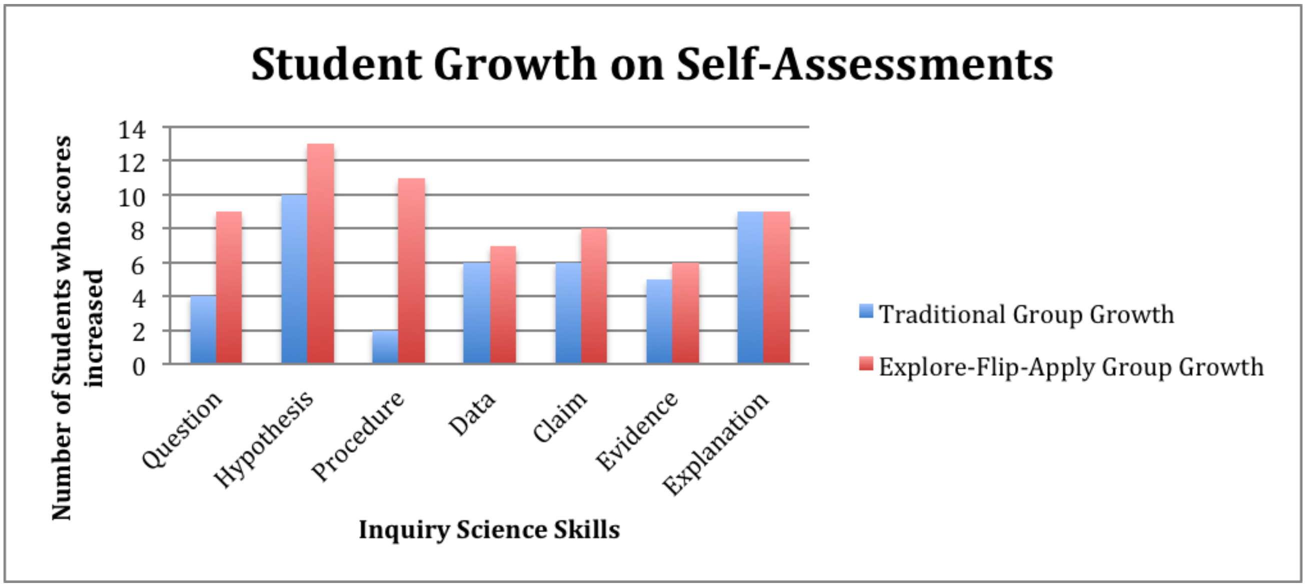
The traditional flip group displayed growth in five of the seven inquiry areas. In the area of questioning, the group showed no growth from pre- to post self-assessment. The traditional group had a negative self-assessed score in the procedure inquiry science area. The pre-assessment score average for the traditional group was 2.14. The post-assessment score average for the traditional group was 2.4. Therefore, the traditional group showed an overall growth of 0.26.

Chart 2- Explore-Flip-Apply Class Averages in the Seven Inquiry Areas



The explore-flip-apply group displayed growth in all seven inquiry areas from pre- to post-assessments. The area of greatest growth was the data. The inquiry area with the smallest growth was evidence. The pre-assessment score averages for the explore-flip-apply group was 1.6. The post-assessment score averages for the explore-flip-apply group was 2.3. The explore-flip-apply group showed an overall average growth of 0.7.

Chart 3- Number of Students Who Showed Growth in Each Group



In all but one section, more students in the explore-flip-apply group displayed growth in the different inquiry science skills areas through their self-assessments. In the explanation section, both classes had an equal number of students who displayed growth in this inquiry skills area. The traditional group had an average of six students that showed growth. The explore-flip-apply group had an average of nine students that showed growth.

Discussion

This paper is examining different methods of flipped learning and their influence on strengthening student inquiry skills. The main method of examining the data has been focused on student growth of inquiry skills from the pre- to post-assessment. The explore-flip-apply group had more students display growth in all inquiry skill areas except explanation. The explore-flip-apply group's class average also showcased more growth than the traditional flip group. This validates the hypothesis for this study that the explore-flip-apply group will show more growth in inquiry skills than the traditional group.

However, it is interesting to consider the pre-assessment data. The traditional flip group scored themselves higher than the explore-flip-apply group on the pre-assessment in every area, but hypothesis. The traditional flip group scored 0.5 higher than the explore-flip-apply group on the pre-assessment. This set a high bar for these students and possibly made it more difficult for them to show as much growth. When you continue to compare the class averages on the post-assessment, the traditional flip group scored higher than the explore-flip-apply group in five of the seven inquiry areas in the second self-assessment. The traditional flip group did not show as much growth as the explore-flip-apply group with an average growth of 0.26 across the inquiry skills areas. Yet, if the traditional flip method was able to strengthen students' inquiry skills more; then they would have shown topped-out scores with averages of three in the different areas, which the data does not support. The data shows the traditional flip group's average inquiry score 0.1 higher than the explore-flip-apply group. This is a higher, but narrow difference in scores.

This brings up further questions related to the structure of this study focusing on using self-assessments as a tool, and extending the time frame of the study. First, is a student self-assessment a strong way to measure a student's actual ability? In looking at other studies after this study was completed, which also used self-assessments at the middle school level, they have found no correlation between the use of self-assessments and student performance on assessments (Severance, 2012). Further, the process of using the self-assessment was an individualized task where the student was assessing their perception of their work. Did the structure of the videos being more for review and addressing misconceptions encourage students in the explore-flip-apply group to build more confidence than the traditional flip group?

Also, middle school students are typically very social in their learning. The individualized component of the self-assessment works in opposition to this learning trait. The idea of self-assessments may need to be altered to better fit a middle school learning style by adding in collaboration and discussion. By altering this component, there could be more accountability with the self-assessments where students explain to a peer or teacher how their assessments match their work. Adding in an added level of accountability may reflect in more accurate assessments of their work.

Finally, inquiry processes take time. During this study, a pre- and post- self-assessment were the main forms of data. If the study had an extended time frame, more inquiries could have been conducted leading to more data points. To be able to have more data points would lead to stronger conclusions about the best ways to increase students' inquiry skills.

Conclusions & Actions

In conclusion, flipped learning can be implemented in many ways, and to different audiences. The target audience of my study is one most often feared by educators, the middle schooler. It is sometimes difficult to understand what engages a middle school student in learning. For middle school students, it is about making a connection to them. Implementing flipped learning allowed me to have virtual discussions with my students, where they can connect with me outside of the school environment. I would make the videos in my home where they might see my husband, cats, or artwork in the background and use this as a way to talk and connect with me. During the class period, since there is less teacher directed instruction, I am allowed the opportunity to sit with groups and have one-to-one conversations about what they are learning, which further nurture these connections.

The main finding from my study is that both of the flipped learning techniques displayed growth. For future studies, the implementation of the self-assessment process should be looked at with the middle school student in mind. Adjusting self-assessments to be more collaborative may yield more accurate assessments of student work. By allowing students to conference with other students when they have completed their self-assessments, it would bring in a collaborative and social component that many middle school students crave in their learning. This may add in a level of accountability as another set of eyes may help students focus on comparing their actual work rather than their perceived work to the criteria in the self-assessment.

In the 2013-2014 school year, there are three teachers piloting flipped learning in my school district. I plan to share my results with them as we consider steps towards the future of flipped learning in my school district. I will be recommending to them that we look at the explore-flip-apply method in a longer-term study to see more of the impacts of this technique with students at this age level. In this short-term study, explore-flip-apply has shown to be a strong partner in the inquiry-education process. It has been able to make a positive impact on student growth in the area of inquiry skills, and deserves further exploration.

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Appendix A - Student/Parent Consent Letter

Hello!
I am working on completing a graduate level class which I began this past spring through Miami University.
Please review the following information to determine whether you will give your student permission to participate in this study.

Thanks for your consideration.
Amber Bridge - 8th Grade Science

What is the purpose of the study?
This is a research study. I am inviting your student to participate in this research study because they are in my science class. The purpose of this research is to understand how flipped learning method helps to strengthen students' science processing skills.
How long will my child be in the study?
With your permission, your child will take part in this study from September 30th through November 15th.
What will happen during this study?
Your child will be completing two learning surveys they will use to evaluate their classroom work. The learning surveys are part of the regular curriculum, but in this study I will be evaluating the growth of the students.
What are the risks & benefits of this study?
At this time, I do not anticipate any risks to participating in this research. All students may not personally benefit from being part of this research. However, I hope all students will gain a better understanding of science skills.
What about confidentiality?
I will keep your child's participation in this research confidential to the extent permitted by law. When I write my report about my research, I will summarize the results so that your child cannot be identified.
Is being in this study voluntary?
Participation in this research is completely voluntary. You may choose that your child not take part at all.
What if I have questions?
I encourage you to ask questions. If you have any questions about this study, please contact me at the middle school, 319-656-2241 or by email at abridge@mphawks.org. If you have questions or concerns about the rights of research subjects, you may contact the Research Compliance Office at Miami University at (513) 529-3600 or humansubjects@miamioh.edu.

Appendix A Continued - Student/Parent Consent Letter

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to allow your child to participate in this project.
Student's Name (printed):
____

Parent/Guardian or Legally Authorized Representative's Name and Relationship to the student:

____

(name-printed) (relationship to student - printed)

____

(Signature of Parent/Guardian (date)
Legally Authorized Representative)

Appendix B - Inquiry Skills Checklist

Yes or No Checklist

Name ____ Class Period ___________

Review your work and circle Yes or No to the statements below that best matches your work.

Your Question	
Your question clearly describes what you are planning on testing.	Yes No
Your question includes your independent and dependent variables.	Yes No
Your question is written in a sentence (beginning with a capital letter and ending in a question mark).	Yes No
Count Up Total Yes	
Hypothesis	
Your hypothesis predicts what will happen in the experiment.	Yes No
Your hypothesis chooses 1 of the independent variables and describes what you think will happen.	Yes No
You have written more than 1 hypothesis to predict and think about all of the possible outcomes.	Yes No
Count Up Total Yes	
Procedure	
Your procedure is written in numbered steps.	Yes No
Your procedural steps are easy to follow and include every, single step that you need to do to complete the experiment that you designed.	Yes No
You have created a labeled diagram that shows your experiment set-up.	Yes No
Count Up Total Yes	
Data	
Your data is put together in an organized, labeled table.	Yes No
Your data in interpreted into a graph with titles and appropriate labels.	Yes No
Your graph is the best graph type to showcase your data.	Yes No
Count Up Total Yes	

Appendix B Continued – Inquiry Skills Checklist

Conclusion – Claim	
Your claim is 1 sentence that explains what you learned from your experiment.	Yes No
Your claim explains what changed with the variables in the experiment.	Yes No
Your claim does not include your opinion.	Yes No
Count Up Total Yes	
Conclusion – Evidence	
Your evidence includes specific pieces of data your collected in your experiment.	Yes No
The data that is included in this section is labeled and supports the claim.	Yes No
Your evidence section does not include your opinion.	Yes No
Count Up Total Yes	
Conclusion – Explanation	
Your explanation section explains any vocabulary or science theories or laws that connect to your experiment.	Yes No
Your explanation section explains how your claim and evidence section are connected.	Yes No
Your explanation section includes your opinion about your learning of the experiment.	Yes No
Count Up Total Yes	