# ENGAGING THE GRADE 11 BOY: GIVING VOICE THROUGH CHOICE DESIGN TASKS IN PHYSICS

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## Abstract

In Physics class, my Grade 11 boys are often overwhelmed by the rigorous concepts and math problems. In this action research project, I sought to increase engagement of students by allowing choice in their assessment. Choice design tasks were created by 18 students in Physics class. These design tasks focused on one of three broad choice areas of sports, ballistics, or aircraft. Using their area of choice, the boys researched content and then created and executed their own lab experiment. Finally, the boys had the choice to produce either a video, a lesson for a Fourth Grade class, a TED talk, or a physical object. Student questionnaires and reflections revealed that the use of choice design tasks aided the boys in developing agency. In addition, the results showed that they valued choice and that their intrinsic curiosity correlated directly with their engagement.

## Glossary

*Choice Design Tasks:* A collection of academic work, including assignments, lab reports, and student created works.

*Engagement:* The level of awareness, inquisitiveness, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education.

## Introduction

### Background

As a Science and Math teacher to upper school boys, I realize that boys yearn for making choices with their unique voice. For example, in my teaching practice, I often use examples from hunting and sports because these are areas of student interest. The boys use their past experiences to relate to concepts and math analysis. When coupled with choice in their assignments, intrinsic curiosity empowers the boys to learn topics on a deeper level. My desire was for boys to yearn for genuine understanding instead of memorizing facts. Boys often ask me, "Will this be on the test?" However, authentic learning often cannot be shown on a traditional pen-and-paper test. Even though the Physics course includes labs, projects, and tests, boys often fail to make connections between the assignments. By contrast, the design

task allowed choice in assessments and provided many avenues for reflection, including self-reflection, small group feedback, and student-teacher meetings. Collectively, the student-produced larger body of work was used to determine mastery. Student created design tasks gave choices to allow for the development of the boys' voices.

### Research Question

*How does creating choice design tasks develop engagement in Grade 11 boys?*

### Action Research Methodology

Action research was the ideal methodology for the research question because it allowed for the boys' voice and work to be the primary focus. Allowing teacher and student reflection, I gained a better understanding of the strengths and weaknesses of choice design tasks. Action research allowed for a systematic approach to my professional development in the science classroom by connecting theory with action. With this thoughtful approach, numerous elements and findings can be applied to various content areas and grade levels.

## Literature Review

Problem-solving, critical thinking, and connecting disparate concepts are vital to a 21st-century student. However, the mastery of these relatively new, yet essential, skills is difficult to judge with 20th-century assessment tools. Just as teenagers do not access the internet over copper telephone lines, skills they need for college and beyond should not be assessed using the same tools that left such indelible impressions of anxiety and self-criticism on generations before them. Boys, in particular, are more engaged in class when they can design their own learning experience. When the choice and control is in their hands, boys are more likely to engage with the task. This action research project explored the engagement of boys while they chose a design task to showcase their essential and science skills.

On traditional assessments, students are often overwhelmed by memorizing information instead of applying knowledge to complement their understanding. With traditional testing, students cannot offer a reasonable argument when asked to justify their thinking. Students seek a "right" answer instead of using complex thinking. Anxiety causes the mind to release chemicals that negatively affect clear thinking and memory (Abeles & Rubenstein, 2016). Daniels (2010) concludes:

> Most students want to be able to wrestle with the content, talk to each other about their emerging understandings, and identify where/why/how the content matters in their lives. When we put students in control of constructing understandings, they learn better and feel more engaged. (p. 27).

Additionally, students can be overwhelmed by the constraints of time on a test. Students should be grappling with science concepts and applications instead of memorizing steps. Often, traditional

assessments place value on the speed of math completion instead of allowing time to understand through logic. Stanford University Professor Jo Boaler (as cited in Abeles et al., 2016) notes the irony that "mathematicians are some of the slowest thinkers of all" (p. 105).

Abeles et al. (2016) concludes that by requiring a design choice task with a larger body of work, instructors can teach science concepts while also integrating important 21st-century skills, such as "analysis, persistence, organization, communication and original creative thought" ( p. 113). Wagner et al. (2016) notes that the introduction of the alternative assessment will potentially allow for positive changes, including decreasing stress for test-taking, honing creative thinking and problem-solving skills, and emphasizing teamwork. Teamwork will be utilized by requiring peer-feedback loops throughout the process. These peer-feedback loops will require essential skills including collaboration, encouraging peers, reflection, communication, and flexibility of thought. McDonald (2012) summarizes the many benefits of design choice assessment: "A range of skills normally overlooked are highlighted. Best of all the developmental process of learning, understanding, and reflection can progressively be followed in a systematic manner allowing for personal improvement and the encouragement of lifelong learning" (p. 3).

By using design tasks, teachers and students are afforded the opportunity to take risks, develop creative solutions, and make judgments about their own performances (McDonald, 2012). Roecker et al. (2007) found that the students and faculty in the Chemistry Department at Berea College agree that choice design tasks have had a positive impact. The greatest strength of the choice design tasks is a program-level assessment for all students to attain acceptable levels of skills. Faculty observed an increase in student confidence, professionalism, and communication skills (Roecker et al., 2007).

Often an aspiration of teachers, engagement is difficult to define and assess. In the *Handbook of Research on Student Engagement*, Chrisenson et al. (2012) define student engagement as "the student's active participation" in many aspects of school life, but most importantly as a student's "commitment to educational goals and learning."(p.816) Chrisenson et al. dig deeper into the habits of engaged students by stating, "[they] find learning meaningful, and are invested in their learning and future. Student engagement drives learning, requires energy and effort; is affected by multiple contextual influences; and can be achieved for all learners" (p. 817). Engagement motivates the teacher's goal for the boys in the classroom. By connecting the content to their own lives, students are encouraged to design their own understandings (Daniels, 2010). Through the coupling of choice and engagement, students learn topics on a deeper level because of intrinsic curiosity.

According to Reichert and Hawley (2010), experts on boys' learning, "many teachers reported that their most effective practices involved student-created products. Moreover, many of them felt that vigorous creation of products was especially effective with boys" (p. 17). After studying choice in the science classroom, Schmidt et al. (2017) found that students are more likely to be fully engaged when afforded a

choice of any kind. In fact, exercising choice in topic selection, task, or problem definition has the most positive impact on student engagement. Choosing how to conduct an activity, its materials, and the use of time lead to further student engagement (p. 33). Schmidt et al. (2017) conclude, “Framing choices emerge as facilitating full engagement in science learning activities, which aligns with the shift to position science learners as active agents in deciding critical components of learning tasks” (p. 38).

Boys best engage with content when given a choice. Reichert and Hawley’s study (2010) agrees that “both boys and teachers attested to the skill and self-confidence gained in the process of conceiving and creating products” (p. 33). In Daniel’s (2010) view, “Teachers cannot make students motivated, but they can create environments that allow the students to feel motivated for themselves” (p. 27). Harnessing the power of the student’s unique voice, as well as allowing choices, develops the agency required of thinkers in today’s world.

## Research Context

Established in 1911, Saint Christopher’s School educates approximately 970 Grade Junior Kindergarten through Grade 12 boys in Richmond, Virginia, USA. The school prides itself on the “whole boy” approach to education, including weaving honor, leadership, and community service into an academically rigorous environment with a supportive community. The action research project took place in October 2019 with a regular-level Physics class of 18 boys. Boys in Physics are typically in Grade 11 and have successfully completed Algebra I, Algebra II, and Geometry. These boys often lack confidence in math and scientific reasoning. Before the action research process began, boys and parents gave consent to participate in the action research. The participants were given identification numbers so that their identity would not be revealed and the information provided would be confidential.

## The Action

When considering the topic in Physics to include a design choice task in lieu of a traditional assessment, I considered many options. I needed to complete my research during the fall but wanted to get a baseline of knowledge of physics and classroom routines for my boys. Projectiles is a particularly difficult topic in Physics class, so I decided that projectiles would be a great topic for which to change the assessment tools. The projectile unit began about six weeks into the fall semester.

The choice design task was given to assess each boy's understanding and was weighted the same as a test. The outline of the design choice task was given in a Google document that was shared with each boy. The students needed this scaffolding to best complete all requirements. This document led the boys through activities to narrow their choices and ultimately decide on their design choice task. The first assignment included a visual thinking activity that allowed boys to choose one of three broad topics including sports, ballistics, or aircraft. The next set of assignments were completed by boys at their own pace, allowing me

to help the boys individually as needed. The self-paced assignments included answering a series of projectile motion questions from their topic of choice, identifying two experts to interview, researching content, completing the nerf launcher lab, and designing and executing their own lab. They were given one week to complete these assignments. In the second week of the unit, the boys created their final product given the choice of a video, a lesson for a Fourth Grade class, a TED talk, or a physical object. Each creation had specific requirements for the students to follow, which they received as the grading rubric. I assisted each boy through the process and gave feedback regularly for them to complete their best work.

## Data Collection

My research focused on qualitative data to focus on multiple phenomena. This focus allowed for the polyangulation of the data to help "establish their trustworthiness or verification of the consistency of the facts while trying to account for their inherent biases" (Mertler, 2017, p. 11). The methods of data collection were pre-project surveys, observations, interviews, mid-project surveys and post-project surveys. These methods included questions to gauge engagement and the idea of choice.

## Data Analysis

After completing the action, I began to code the data. I selected a color-coding system for the themes of engagement that emerged. Engagement themes included active participation in decision-making, intrinsic curiosity, motivation, and student choice. First, I coded data from the pre-project surveys to get a baseline for engagement. These surveys were given before the action began, but the boys had already been in my class for eight weeks. The surveys allowed boys to give opinions on how engaged they were in the class and in general during the school day.

During the action, I kept a journal of daily observations. I gave a survey after the first week of the action. After the action was completed, I sorted through my field journal of observations to code for signs of engagement. I interviewed small groups of boys during key points of the action. At the conclusion of the project, surveys were again given to all the boys. The concluding survey allowed me to see what changed in their engagement through the action. Lastly, interviews and post-project surveys were coded for themes as well. Following a thorough review of the data, three themes emerged and confirmed that engagement increased as a result of choices in learning:

1. Boys value choice;
2. Choice design tasks aid in developing agency; and
3. Intrinsic curiosity correlates directly with engagement.

## Discussion of Findings

**Boys Value Choice**

From my experience as a teacher, student choice is often absent in our schools. Teachers and administrators dictate schedules and assignments, whereas students are rarely consulted as to what class or assignment they would like to tackle. On the survey given prior to the project starting, boys were asked, “What choices do you have in what you learn?” The most common response was about class choice. The boys focused on the level of class such as regular or honors/Advanced Placement. Part of the same group also noted that electives such as music ensembles are a choice. An equal second response involved stating that no choice was given. One boy stated, “Not much because we follow what the teacher does.” Only one boy mentioned that he chose whether or not to engage with the subject according to his own study habits. When asked to identify a favorite class, 9 out of 15 boys mentioned their teacher as the reason. First the boys said that their teacher was “nice” but when pushed to further explain, the boys stated that the teacher valued their opinion and wanted to listen to their voice. These teachers gave boys the opportunity to make small choices such as topics of discussions or free reading selections. Boys valued even these contrived choices, giving them a positive outlook on the class. A response that gave me pause was, “In school, I don’t have a choice, but in my free time I can learn anything I want online.” This statement points directly at knowledge being constantly available to our boys and educators not harnessing that power.

By the completion of the project, boys expressed positive viewpoints of their choice in Physics class. All of the boys recognized that choices were given throughout the project. A boy stated that his favorite part of the project was “getting to choose what my topic was rather than have something assigned.” The responses to the survey were so much more elaborate than at the beginning. Boys understood that learning is complex and choices enabled them to engage differently with physics. One boy noted, “I chose to add certain things to my lab and video and physical object. I added videos and post-lab questions to make the lab and data better, and photos to make the object more creative. I also chose to do it on sports, because I really love sports and have always been interested in how kickers kick the ball so far and accurately.”

**Choice Design Tasks Aid in Developing Agency**

Skills that are valued by colleges and employers are complex and rely heavily on self-motivation and working with technology. Often, pen-and-paper tests cannot hone these critical thinking skills or even assess comfort level in applying these skills. The choice design tasks dived deep into critical thinking skills and allowed boys to express their own interests and strengths. When the students were asked if they would rather have a test or do a project, only 5 out of 15 students stated that they would rather do a project. Most noted that tests were more straightforward and require less critical thinking. One of the few students who preferred a project noted that, “a test cannot always express your knowledge.”

Halfway through the project, boys were asked to give feedback on their learning. The responses consistently reported concrete content information about physics topics, such as launch angles and projectiles. Only one student commented, “Projects take a lot of time and work.” In contrast, by the end of the project when assessing their learning, only 3 out of 15 students mentioned physics concepts, while the majority focused on the paths to understanding and connections they made, demonstrating their developing agency. Students wrote about how physics is related to the world and how to accomplish a major project. They connected that this was not about a single physics concept but about a larger picture, which was made obvious by the quote, “This project helped me understand physics in a different way.” As the boys were given more choices throughout the project, they refined their understanding and employed their voice to show mastery of their concept.

**Intrinsic Curiosity Correlates Directly with Engagement**

Many boys regularly engage with information on the internet yet often are not taught how to evaluate the validity of sources. On the first survey, students were asked, “If you want to learn more about a topic, what would you do to find out more?” Only 5 out of 15 boys mentioned consulting a teacher, while 12 out of 15 acknowledged seeking YouTube videos to learn new topics. Five out of 15 boys mentioned that they have not sought out learning additional information about topics from school. These responses suggest that the current curriculum is not yet engaging boys to be independently curious about topics covered during school.

Part of the project asked boys to consult experts for the topic that they chose. This point proved difficult for many of the boys. They hesitated to ask adults for help and struggled at how to best utilize these resources. Once they were forced to consult an expert, they found it helpful and it brought value to their projects. An example included using our digital arts teacher to help with videos and making posters. Boys realized they could not just state their findings but instead needed to engage their audience. A boy stated, “I never considered someone would not be interested in golf. I now understand that I have to make my findings interesting to everyone, not just people that play golf.”

Creating their own experiment was consistently a student favorite. Since boys were given the opportunity to learn about a topic of their own choosing, most readily engaged and sought additional information. One boy stated, “My favorite part of this project was seeing what the actual velocity was for a dive. This will actually help me in my swimming, so this lab was important for me.” Curiosity is strong with Grade 11 boys, and when harnessing that ability, they can produce valuable connections in their learning.

## Conclusion

Allowing Grade 11 boys to learn the physics concepts of projectiles using choice design tasks increased engagement and developed student agency. When setting out with my action research question, I was

hopeful that my initial presumptions that boys value choice would be true. By allowing time for the boys to develop their voice in the assignments, and through the scaffolding of the design choice task, the students had the freedom to ask questions and become intrinsically curious about a topic of interest. Importantly, boys made connections between the learning in the physics classroom and the world. These connections and their curiosity point to increased engagement in the physics students.

With action research being an iterative process, this initial cycle provided great insights to providing alternatives to traditional assessments. With the rapidly changing skills needed in today's world, we should continue to consider how boys are engaging in their own learning. Teachers should no longer be just content experts, but should also lead students through processing their intrinsic curiosity to make connections in novel ways. I will continue to develop units of content using this model and hope that others do the same.

## Reflection

Throughout the process of action research, I experienced that learning and reflection are important for teachers. The process and the structure that it provides allows for the careful examination of teaching methods. The literature review gave me ample guidance on best practices and allowed me to dive deeply into my research question. I also enjoyed engaging with team members across the globe to give me a wider perspective. While considering my research question, I asked questions of my colleagues at St. Christopher's and better understood their approach. The collective knowledge among teachers is so great, but we often do not allow for the time to collaborate and reflect on these best practices. The action research gave me the framework for this collaboration to take place. I truly enjoyed the space for reflection on how to better my teaching methods. By empowering best practices, teaching this difficult topic seemed easier this year. I was more relaxed knowing that I had built in time for questioning and individual meetings. The boys were less anxious as well, knowing that they had clear expectations through the use of rubrics and no traditional assessment. The excitement and flow of the class was invigorating. Although there was much preparatory work for this project, the outcome was fantastic.

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