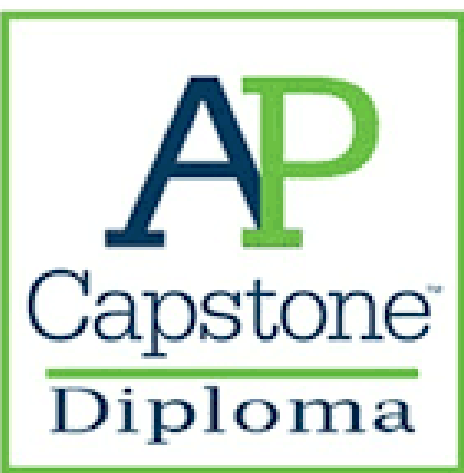# Connecting Project Based Learning and AP Physics to Social Connectedness: An Analysis of Its Overall Effectivity

How do PBLs affect feelings of social connectedness in AP Physics students?

Introduction

AP Physics is known to hold an excruciatingly low passing rate. The 2020–2023 AP Physics 1,2 and C exams possess only a combined **43% passing rate**. Physics 1 holds the **lowest pass rate of any AP exam**. For comparison, other AP sciences like chemistry, environmental science, and biology contain a 48–65% passing rate (CollegeBoard, 2023). Despite low pass rates, AP Physics remains an increasingly popular and essential class for most aspiring students. To combat this, researchers have suggested project-based learning, a method based on the constructivist learning theory, which emphasizes the importance of students taking previous knowledge to strengthen current and construct newer understanding (Holobova, 2021). According to Samsudin et al. (2020), project-based learning is a dynamic classroom approach that believes students acquire deeper knowledge through repeated exploration of real-world problems based on application. His team found that, **when repeatedly exposed to PBLs**, students conditions themselves to new challenges that facilitate leadership and social skills. These skills, they say, further transfer to new environments post-secondary education. He, and other researchers in the field, don't mention which specific social skills however. This became my primary focus. Overall, PBL's seem to be an effective, yet **underutilized**, alternative to the traditional teaching methods and **deserves** to be investigated.

Methodology

This study uses a correlation study and factor analysis. A correlational study investigates the relationships of two variables without controlled or manipulated variables; a factor analysis takes correlations and breaks them down to exact numbers and unobserved variables. The goal is to measure changes in specific elements of social connectedness and spur future growth of PBLs in AP Physics. This study focused on teacher-supplied mandatory bi-weekly lab. Firstly, I administered four surveys based on seven specific socials skills, which included a pre and post self and group analysis surveys. These seven social skills, obtained from Reiguleth et al. (2014), were active participation, communicating one's beliefs, resolving group conflicts, adjusting ones behaviors, open mindedness, listening to others, and respecting other's input. From this, I used a correlation coefficient calculator and found that students were the weakest in the three columns listed above in "findings." Afterwards, the student's were allowed to participate in two AP Physics labs and given a two-week period to assess any potential changes. Here, this time I noticed that student's experienced significant changes in their previously three weakest areas, while also significantly increasing their participation skills. These findings were conducted using a Pearson Correlation Coefficient Calculator where, based on student responses and a personalized point system, I was able to assess the connection between any desired social skill and their effect on social connectedness. Over 60% of the participants experienced overall changes, but the four listed are the most significant before and after. These surveys also had several short-answer responses which showed that subjects expressed greater conformability mostly because "the labs exposed [us] to new social environments."

Findings

Correlation values are scaled from 0.01–1, with 0.01 being the lowest score attributable and, hence, showing the lowest correlation.

Before observing PBL's, these were (of **the seven social skills**) the most noticeably **lowest scores**. Essentially, students tributed themselves to being the weakest in these three, out of the seven, areas.

Correlation Value of the Category **Resolving Group Conflicts**

The value of R is -0.2511.

Although technically a negative correlation, the relationship between your variables is only weak (*nb.* the nearer the value is to zero, the weaker the relationship).

Correlation Value of the Category **Adjusting One's Behaviors to the Group Needs**

The value of R is -0.3663.

Although technically a negative correlation, the relationship between your variables is only weak (*nb.* the nearer the value is to zero, the weaker the relationship).

Correlation Value of the Category **Communicating with Others**

The value of R is -0.4127.

Although technically a negative correlation, the relationship between your variables is only weak (*nb.* the nearer the value is to zero, the weaker the relationship).

This graph exemplifies which areas experienced the most growth before and after PBL's. Coincidentally, the three lowest skills also experienced the most changes with active participation also experiencing a noticeably large jump. Basically, I assessed which elements had the biggest changes by subtracting the value of the red by blue.
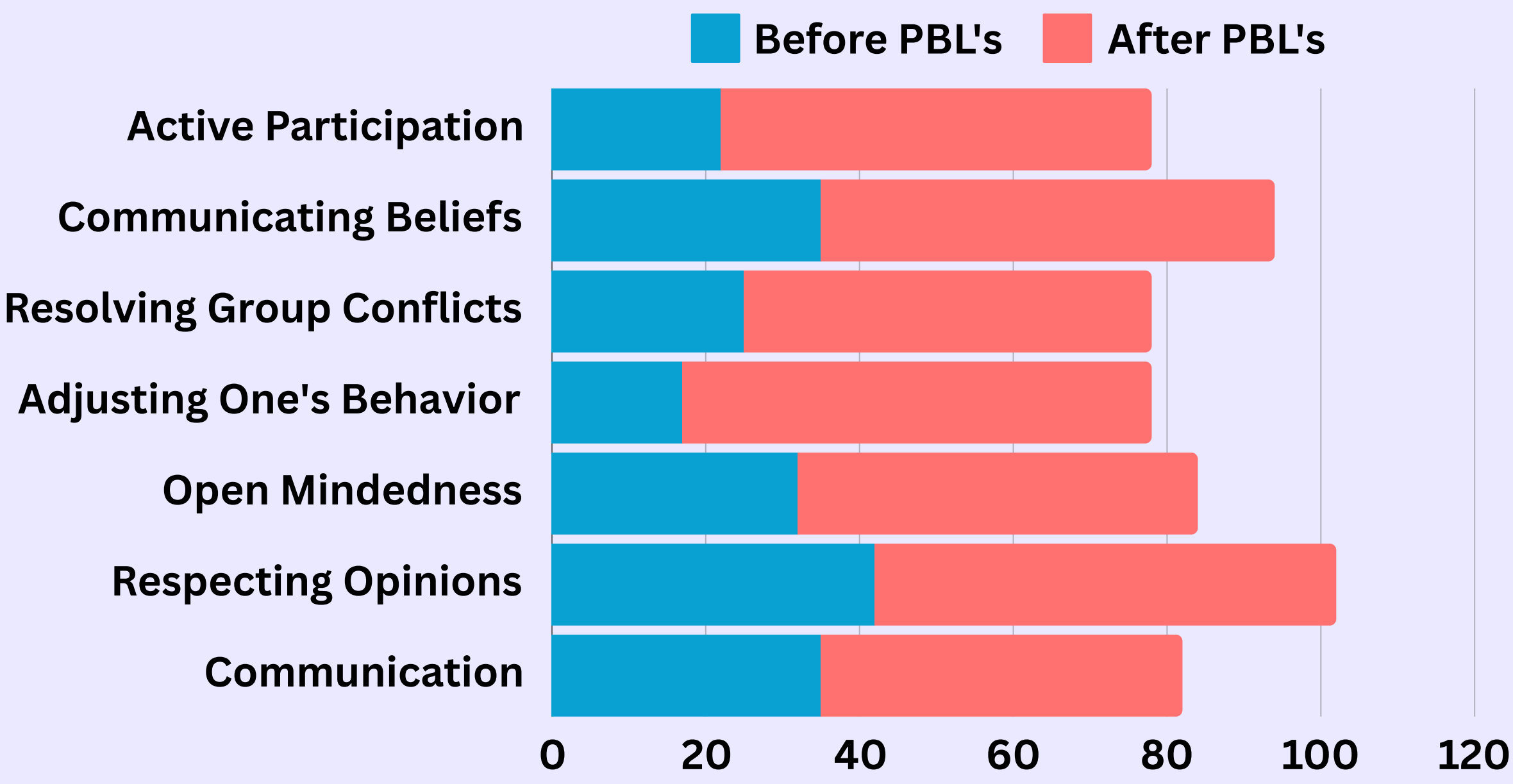
Conclusions

Overall, this study's findings emphasize the body of knowledge's understanding that PBL's **positively** effect numerous social skills in students. Specifically, this study **expanded** on the BOK by examining seven skills and assessing how strong or **correlated** they actually were to PBL's and clearly stated **how much** these areas were improved. My findings showed which areas were **previously weak** being resolving group conflicts, adjusting one's behaviors to group needs, and communicating with others. It also exemplified that active participation, resolving group conflicts, adjusting one's behavior to group needs, and communicating with others experienced the **most** change after PBL's. Moreover, despite not having a low correlation, active participation significantly increased before and after PBL's. This shows that, while students always relatively engage in class activity, PBL's actually strengthen this tendency. In conclusion, PBL's seem to effect certain aspects of social connectedness, especially when they're already low.

Future Research

My usage of a point system to turn quantitative data to qualitative was flawed; I only included 15 survey questions and associated at least two social skills with each question. This meant that the point system was **oversaturated** and made it slightly more difficult to differentiate changes. Future research should only use my point system on bigger, and more varied surveys. Also, I would recommend other experts to only investigate 1–2 social skills rather than all 7 because, while my data collection was concrete, it was too much data for the size of my study. An additional flaw was the range of my numbers; my point system consisted of numbers ranging from 0.16–1, while the correlation calculator also ranged from the same set of numbers. This meant that my results didn't show as **significant** of changes as desired. My results were only noted in the AP physics environment meaning future researchers should investigate ways to implement PBL's in other classroom environments. Particularly, the structure of AP Physics **benefits** consistent practice and application, which other AP science classes don't necessarily do. As a result, I recommend other educators to experiment in similar formats like the **Rube Goldberg** to produce similar results. Physics concepts also hold close ties to the engineering field, so individuals should experiment with PBL's in creating **stronger team bonds.**