PERFORMANCE-BASED CLUSTER GROUPING IN NINTH GRADE HONORS PHYSICS

PROJECT OVERVIEW

Gifted students at Twin Valley High School often report that they are not academically challenged during their freshman year. A lack of rigor may promote poor work habits, study skills, and attitudes among the brightest students. When paired with proper instructional strategies, purposeful cluster grouping has been shown to positively affect motivation and academic achievement among gifted learners. This action research study compared two concurrent sections of ninth grade Honors Physics. Both sections were taught by the same teacher to minimize instructional variability; however, only one section received the intervention of performance-based cluster grouping with targeted instructional strategies.

"The tendency to view talented students as ancillary classroom helpers rather than children with individual needs, curiosity, and desires of their own devalues them." (Robinson, 1990, p. 21).

QUESTIONS & METHODS

Table 1
Data Triangulation Matrix

#	*Action Research Question*	*Method 1*	*Method 2*	*Method 3*
1	How do the classroom teacher and the students perceive the effectiveness of homogeneous grouping and the Most Difficult First strategy?	Most Difficult First Student Survey	Semi-Structured Student Interviews	Semi-Structured Teacher Interview
2	How does performance-based cluster grouping affect students' confidence and perception of challenge in ninth grade Honors physics?	Student Attitude and Confidence Survey Initial	Student Attitude and Confidence Survey Final	Semi-Structured Student Interviews
3	How does performance-based cluster grouping affect students' conceptual understanding of Newtonian mechanics in ninth grade Honors Physics?	Force Concept Inventory Pre-Test	Force Concept Inventory Post-Test	Summative Assessments

INTERVENTION

- Performance-based cluster of five of the top math and science students
- Purposeful homogeneous grouping within the cluster class
- Several opportunities to demonstrate mastery by completing the most difficult problems first, and if successful, to engage in more challenging replacement work

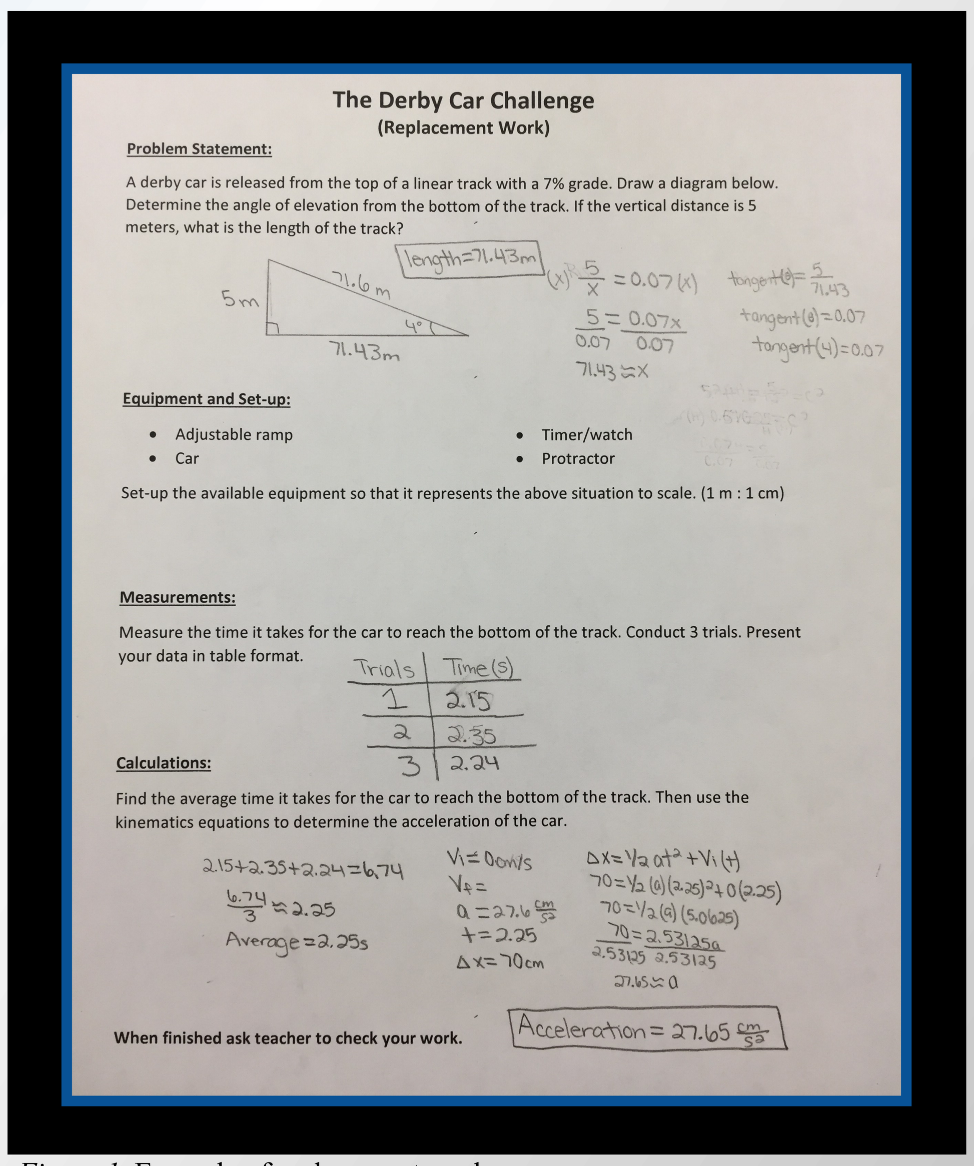

Figure 1. Example of replacement work.

RESULTS

Action Research Question 1

- The majority of students in both classes reported that working with peers of a similar ability level is "most beneficial to their learning."

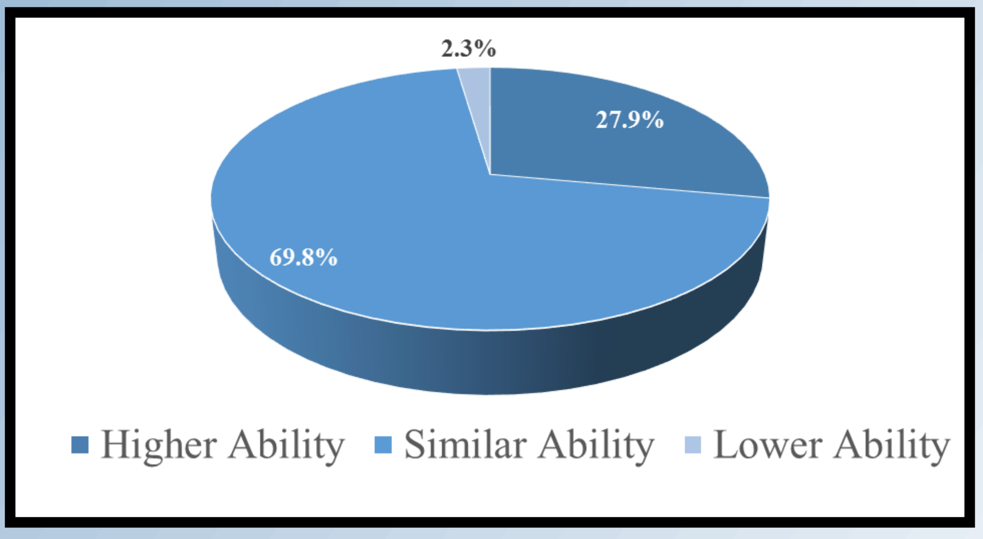

Figure 2. Preferred grouping arrangement: Peer ability level, (*N*=43).

- In the cluster class 84.0% of students (*N*=21) appreciated or were indifferent to the opportunity to complete the most difficult problems first.
- One student commented:

"You can work at your own pace and if you get done faster than others you can move on."

- The cluster teacher noted a more serious and competitive tone to the cluster class when the MDF option was offered.

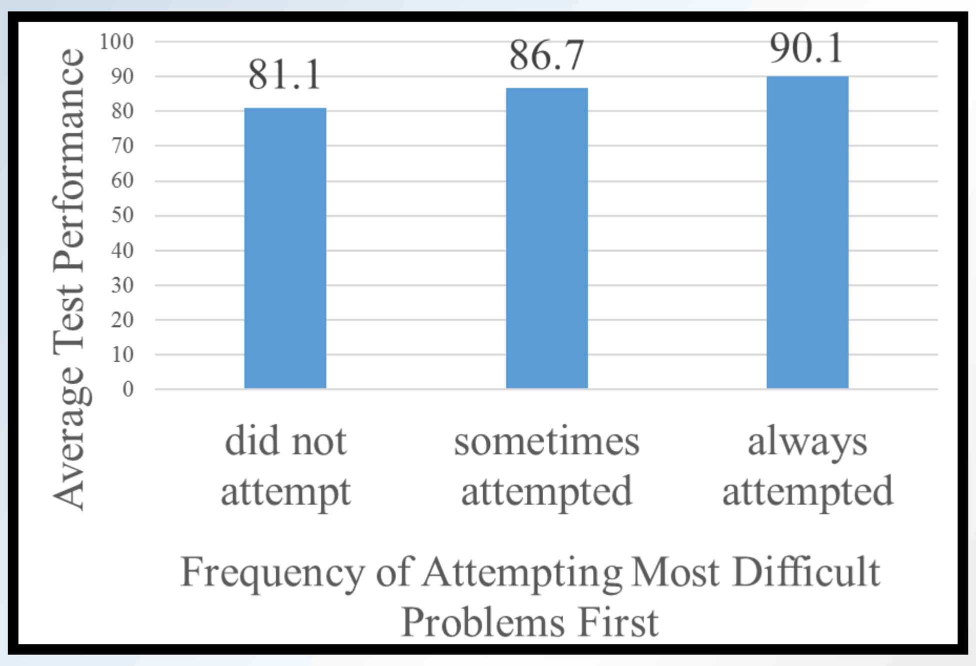

Figure 3. Average test performance by frequency of attempting most difficult first.

- A strong positive correlation (r=0.99) was observed between how often students opted to try the most difficult problems first and how well they performed on their summative assessments.

Action Research Question 2

- Students' confidence in their math ability improved for the cluster class, whereas it declined for the non-cluster class.

Table 2
Change in Confidence in Math Ability

Confidence Indicator	Change in Non-Cluster Class	Change in Cluster Class
Agreed with statement, "Math comes easily to me."	15.0% ↓ (*N*=3)	8.7% ↑ (*N*=2)
Confident in solving math-based physics problems	5.0% ↑ (*N*=1)	17.4% ↑ (*N*=4)
Confident in solving a new type of problem with 5 or less practice problems	15.0% ↓ (*N*=3)	17.4% ↑ (*N*=4)

Action Research Question 3

- The intervention did not have a significant impact on student's conceptual understanding of Newtonian mechanics, as measured by the average normalized gain on the FCI.
- An example question from the FCI is below:

A ball is fired by a cannon from the top of a cliff as shown below. Which of the paths 1-5 would the cannon ball most closely follow?

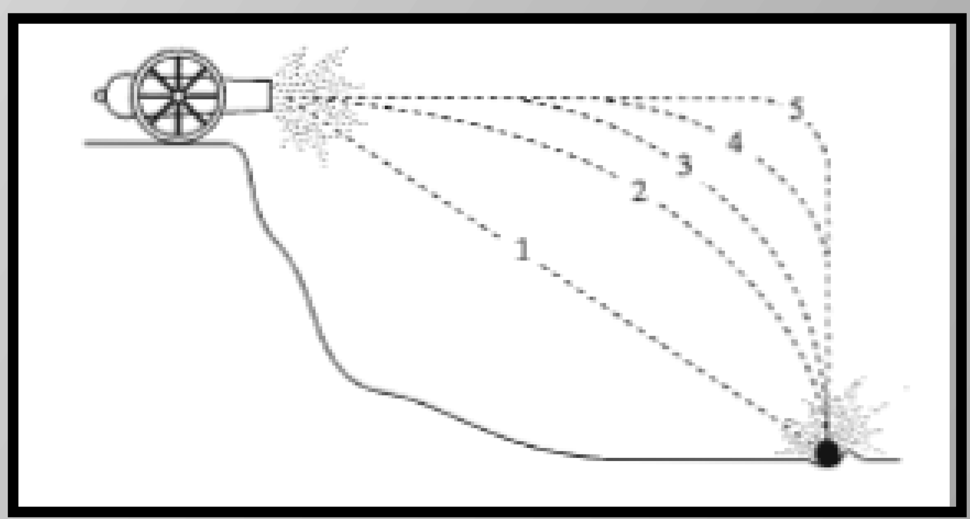

Figure 4. Example question from Force Concept Inventory.

INTERPRETATION & CONCLUSION

The results of this action research project highlighted the importance of incorporating purposeful homogeneous grouping and other instructional strategies for gifted learners into the regular classroom setting. The majority of students appreciated the opportunity to complete the most difficult problems first. Students' confidence in their math ability improved for the cluster class, whereas it declined for the non-cluster class. The intervention did not have a significant impact on student's conceptual understanding of Newtonian mechanics. Interestingly, students who always attempted the most difficult problems first performed better on summative assessments than those who did not attempt the most difficult problems first. The most common reason that students gave for not attempting the most difficult problems first was a lack of confidence or understanding. This finding suggests that the students exercised good judgement when choosing whether or not to attempt the MDF.

"In heterogeneous grouping, there was a leader, and the group deferred to the leader. But with the homogeneous grouping there was more of a conversation going on, which benefited everyone in the group. There was a more even distribution of the workload. Also, from a teaching standpoint it was easier to differentiate when students were grouped homogeneously."

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