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## Introduction

A few years ago, Bishop Gorman High School in Las Vegas, NV instituted the GAELS period, a mid-day remediation and enrichment period. This period was designed to ensure that students who were in need of remediation were given the time they needed to re-learn any chapter material that they did not master in their first attempt. Mastery learning is clearly a valuable learning tool, but as time went on, I began to ask myself if my colleagues or I had a clear idea of the best practices for conducting remediation sessions. I often noticed that despite attending remediation, students often failed to improve their scores and were pushed to move on regardless of having not mastered the material. Through informal interviews with colleagues, I realized that there was a need to determine which teaching strategies seemed to work best as remediation strategies. Therefore, I investigated four teaching strategies that appealed to multiple learning styles, that were also not part of my regular classroom practices. This study investigated the effectiveness of flipped classroom, science journaling, table manipulatives, and concept mapping as remediation strategies.

## Research Focus Questions

### Main Focus Question

In their use as remediation strategies, how do flipped classroom, table manipulatives, concept mapping, and science journaling compare?

### Sub-Questions

- How does each strategy affect student confidence?
- How do students perceive their own preparation and readiness for assessments?

## Methods

After giving a unit summative assessment, students who were in need of remediation for the unit were identified and assigned to a mid-day remediation period called the GAELS period. Students in need of remediation were identified as those who scored 70 percent or below on their first attempt on the chapter assessment. Students who were assigned to remediation were then exposed to one of four remediation strategies, with one strategy used per unit. These strategies included table manipulatives, concept mapping, science journaling, and a flipped classroom approach. After having completed remediation, students were given a pass to attempt a retake for the chapter assessment. Normalized gains from students' first attempt on the chapter assessment to their retake test scores were calculated for each strategy and compared to one another to determine the most effective remediation strategy. Student confidence from pre to post-treatment was analyzed using a Likert Style survey given before and after the remediation sessions.

## Sample

The students who participated in this study were 10th grade college-preparatory level Biology Students at Bishop Gorman High School in Las Vegas, NV. At Bishop Gorman, college-prep level is the lowest placement level for science, due to that fact that we are a college preparatory school. Placement in this level is based on results from a placement exam given prior to freshmen year. Students who score higher on their placement exam are placed at the Honors or Scholars level for science.

The number of students who participated in each remediation varied by unit and depended on the number of students in need of remediation for each unit. The mean number of students assigned to any particular remediation session was (N=20). The mean number of students who both completed remediation and went on to take the retake test was (N=10) for each unit.

### Data Triangulation Matrix

Research Question	Data Source
Primary Question: In their use as remediation strategies, how do flipped classroom, table manipulatives, concept mapping, and science journaling compare?	<ul style="list-style-type: none"> <li>• Pre and post-test scores and normalized gains</li> <li>• Two sample two-tailed t-test</li> <li>• Student Interviews</li> <li>• Pre and post-test Student Confidence Survey</li> </ul>
How does each strategy affect student confidence?	<ul style="list-style-type: none"> <li>• Student confidence survey</li> <li>• Student Interviews</li> </ul>
How do students perceive their own preparation and readiness for assessments?	<ul style="list-style-type: none"> <li>• Student Perceptions of Learning Style Survey</li> <li>• Student Interviews</li> </ul>

## Data and Analysis

Each of the strategies yielded the following normalized gains when the two units for which the strategies were used were combined:

Science journaling: 10%  
Table Manipulatives: 9%  
Concept Mapping: 9%  
Flipped Classroom: 15%

Overall, the unit with the highest overall gain was the cell transport unit, which utilized concept mapping. Student scores increased 31% when normalized for possible gains.

The second highest individual gain was the meiosis unit, which utilized science journaling. Student scores increased 29% when normalized for possible gains.

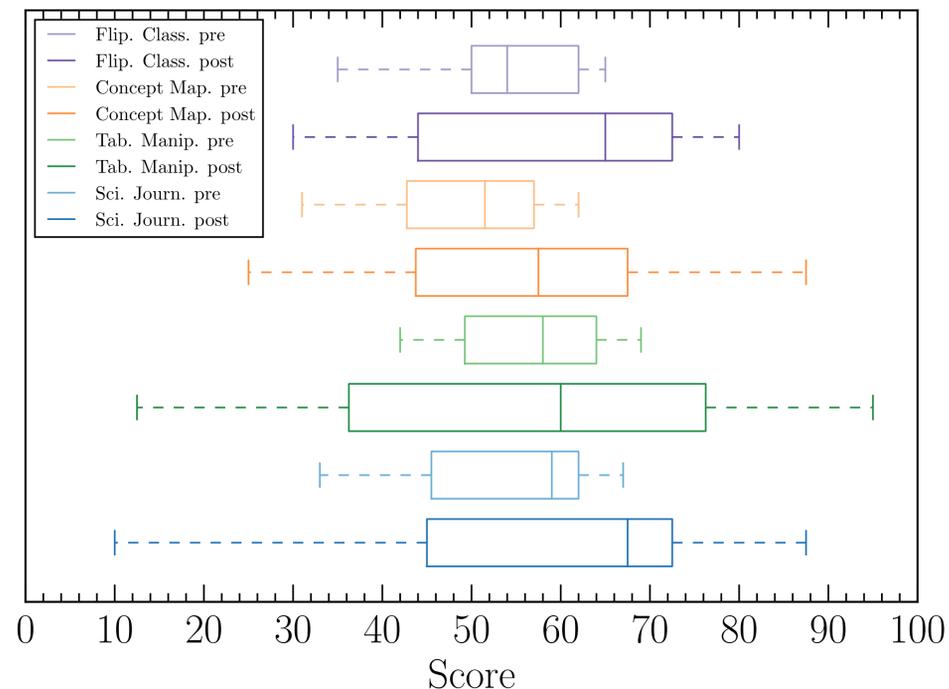


Chart 1. Pre and post-test results of the four remediation strategies

## Conclusions

The results of this investigation suggest that each of the four strategies were effective for improving students' test scores from pre to post-test for at least one unit, but some strategies worked better for one unit than another, sometimes producing a large normalized gain for one unit, and a negative normalized gain for another. Overall, concept mapping produced the largest gain from the study, 31%, when used with the cell transport unit. Flipped classroom produced the largest gain when the two units for which it was used were combined.



Figure 1. Students working on table manipulatives.

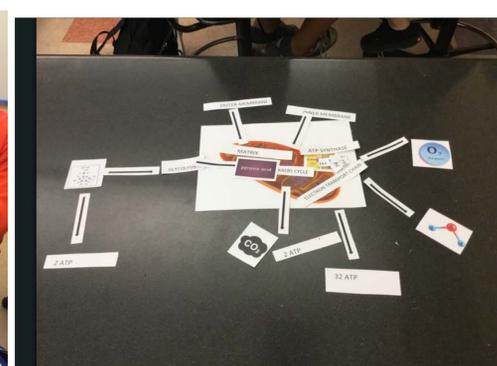


Figure 2. Mitochondria table manipulative.

## Contact

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