

**Key:**

Description shown in **bold**  
Analysis shown in underline  
Reflection shown in *italic*

**Instructional Context**

**My Advanced Placement (AP) Biology class was a very homogenous class relative to the rest of the school. In this class, students ranged in age from 16 to 17, with 19 students in the 11th grade and 2 students in the 12th grade. There were twenty white students and one black student, with no Hispanic, Multiracial or Asian students. There were no students identified as ESE or on a Free or Reduced lunch plan. There were 13 girls and 8 boys. There was no significant ethnic, cultural, or linguistic diversity in this class that affected the personality of the group. Many of these students have been grouped together in classes since elementary school and have few issues that affect their performance or congeniality.**

**A majority of students in my class were from prominently wealthy families in our community and stated they "were accustomed to success." Many have had few academic challenges until they enrolled in this college level biology course. At least half of the students showed difficulty in text comprehension and recognizing main ideas. Many students also faced difficulty in pacing the requirements of the course in addition to meeting the demands of a rigorous schedule and demanding extracurricular activities. The only previous science course many of these students had was a freshman level integrated science curriculum. Only half had experience with a chemistry course, and it focused primarily on dimensional analysis.**

With the composition of class in mind, I was careful not to assume that my students' learning styles were as similar as their ethnic backgrounds which motivated me to introduce personality and multiple intelligence surveys. From the results of these surveys, I was able to diversify my

## Example 1 (Continued)

instructional and assessment practices to increase student comprehension. For example, I noticed this class had many visual/spatial learners, so I used a software program to turn vocabulary terms into crossword puzzles. As a result, I immediately noticed many of my visual students were scoring higher on their summative assessments. Sarah, a bright girl who used to say she didn't "get it" later said that she enjoyed the class more and found the material more interesting when she had the assessments and materials tailored to her learning needs.

In my observations, the difference between the students who consistently scored well and those who struggled was not a major cognitive difference, but a difference in the ability to juggle the demands of a college course with other activities. The majority of the students struggled to remain on task when presented with a classroom interruption or deviation from the instructions.

This class was scheduled during the last period of the day, where it competed with extracurricular events and scheduled or unscheduled announcements. Frequently students had to leave early for a game, and this was also the period where many of our assemblies and meetings were held. Most of these students were involved in many of these events, and therefore often missed at least part of a class. For this reason the course sequence was delineated early in the year and posted at all times in the room and on the website. This way, students could be held accountable for their missed classes. The sequence of my instructional activities was meant to create interest, develop a connection between the major idea and the world around them and to reflect on the evolutionary relationships that define taxonomy today. This allowed me to deepen students' conceptual understanding and situate the major idea with a broader context.

## Example 1 (Continued)

### Planning

Throughout the course of this activity, students were to actively participate in a scientific discussion and use the cognitive and manipulative skills associated with the formation of scientific explanations. This activity was designed to bring together their prior knowledge and develop their contextual understanding of invertebrate organisms under a taxonomic or evolutionary context (Goal 1). Through the use of evolutionary biology we attempted to reconstruct a partial history of life on Earth (Goal 2). Another goal of this discussion was to evaluate the techniques through which systematists test and refine their hypothesis about phylogeny and classification (Goal 3). In the process, students would learn how molecular biology is changing systematics, as it is changing every field of biology (Goal 4).

These goals are important for my students because they are standards represented in the AP and AICE (Advanced International Certificate of Education) curriculum, both of which require a rigorous standardized exam as well as the National Science Standards. The significance of this major idea is the understanding of life's diversity. Students usually exhibit a general understanding of classification; however when presented with unique organisms they often revert to purely structural differences rather than appeal to the scientific basis of genetic or evolutionary differences.

A discussion was a particularly useful teaching approach for this lesson because ideas were examined and discussion in class so that other students could benefit from the feedback. Group discussions allowed students to develop meaning from active involvement, continued exposure and understanding of the concepts that guide phylogeny and classification. I was able to gain information about the students' current explanations. This allows me to immediately identify and correct student misinformation. Those student explanations then became the baseline for

## Example 1 (Continued)

instruction as I helped students to construct explanations aligned with scientific knowledge. I also helped students evaluate their own explanations and those made by scientists.

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### Reflection

*Looking back to the goals for the activity, I feel that my approach was successful because I was able to modify instruction based on each student's need....I feel I was successful in helping students contextualize their knowledge of invertebrate organisms in an evolutionary context through thought-provoking questions and an inquiry method of discussion as part of Goal 1. Since this was a new activity to my repertoire, I feel that I can increase the relevance for students by having illustrations of the representative organisms to reinforce their prior knowledge. I will also align future assessments to represent the new discoveries in taxonomy and will include more studies into binomial nomenclature.*

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The instructional goals for this lesson were for students to comprehend and enjoy a novel ["The Pinballs" by Betsy Byars], to identify dialect and theme, to make predictions, to identify, understand, and propose alternatives to conflict, to use prior experience during discussions, to interpret symbolism, to think long-term, to exercise problem-solving and decision-making skills using details from the text, to reflect on how this literature imitates life, and to extend understanding of the book through a variety of multimodal and cross-disciplinary activities. These instructional goals are consistent with the state's objectives and the school curriculum. They meet the requirements for listening, speaking, writing, literature study, reading, reference/research skills, and technology integration. **This selection ["The Pinballs"] is a good example of how culture transmits itself through literature, and students see how literature reflects true human experiences. I chose the small group format for two reasons. First, students are comfortable talking to each other as they work in collaborative groups on assignments in the classroom. This method allows them to take intellectual risks without feeling as though they have to "act" for me. For example, Kevin...used good oral language skills, but his dialect included incorrect grammar such as, "Ain't got no." As I monitored discussion, I knew I would need to address verbs and double negatives in a later lesson. My second reason for choosing the small group format is because this model ensures a greater number of students actively participating in discussion while simultaneously learning to appreciate cultural, linguistic, and personal interests of others. For example, Caroline... spoke low and was slow to respond. Her behavior is**

## Example 2 (Continued)

consistent with her family's belief that it is disrespectful to be the center of attention so she resists bringing attention to herself. Erika...and Christian,...my two ESOL students, were vocal in small group discussion. This does not happen during whole class discussion. Since English is a barrier for them, they often shy away or speak too low to be heard by other students in a whole class discussion. I noticed how a small group setting facilitated ESOL students' speaking abilities because they felt validated by their peers. This method allowed all students to make personal and reading connections to the novel as they engaged in meaningful discussion about conflict.

Considering that the original nature of this unit was to expose students to literary works written by women, I made sure that there were at least two females in each group who represented at least two different cultural or ethnic backgrounds. My rationale was for the groups to have insight from each female's point of view based on their cultural experiences. I then assigned male and female students to groups equally. This setup automatically promoted differing opinions based on gender, race, cultural, and linguistic diversity. An informal assessment of my students' cultural backgrounds, prior learning experiences, etc. helped me strategically place students in groups to maximize discussion. Each group had five to six students to allow each student an opportunity to participate.

To spark interest and to set purpose for the discussion, students wrote letters to each other about a time when they encountered conflict and how they resolved it. To further set purpose for small group discussion, the class viewed a website (via scan converter) of a picture of pinballs. I connected the computer to a large screen television so that the class could view the image during group discussions. This helped students transfer prior knowledge so that they would have a clear understanding of conflict and how it relates to a pinball. I then told my students how Carlie, a character in the novel, had conflict with everyone and was treated like a pinball (has no control where it lands).

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*I was so intrigued with the level of discussion within groups that I did not focus on theme. Before the video, Tycheri told me that theme was prose. I knew that she confused genre with theme. I did not discuss theme because I assumed other students had mastered the concept. I need to teach theme separately as a literary concept. I should have asked fewer questions in group two because I interrupted Christian. Had I facilitated more, he would have talked more. I did a good job of asking leading questions, but I should have let students ask some questions that facilitated critical thinking as well.*

Small group discussion was effective. Prompts helped students stay focused on the topic. Groups even competed in pinball tournaments on the computer!

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Many interactions on the videotape show students learning to reason mathematically and to communicate their reasoning. One interaction is when the group of boys is rotating the right triangle. In this interaction, Jonathan (the boy in the gray shirt) turns the coordinate plane  $\frac{1}{4}$  turn to the right, then locates the coordinates of point I. He communicates those coordinates to be over 2 and up 2. However, when Jonathan made an error in the original position of the shape, I probed his thinking further, resulting in his understanding. In the video, I ask the group to observe the patterns in the table for the rotation of the rectangle. I led the group to the understanding that the opposite of the old x-coordinates have become the new y-coordinates and the old y-coordinates have become the new x-coordinates. As a result, the group notices their coordinates for the rotation should follow the same pattern. Thus, the real coordinates of Point I must be (2, -3). Another interaction which shows students reasoning mathematically is when the group of girls is working on the reflection of the isosceles triangle. During this part of the video, the two girls demonstrate how to correctly reflect the isosceles triangle over the x-axis by flipping from Quadrant II to Quadrant III. In addition, they demonstrate mathematical thinking as they work together to locate the coordinates of each point on the isosceles triangle. The girls communicate the coordinates of each point out loud to each other. Also, Megan (the girl in the black shirt) places her fingers on the graph and then counts how many units point F is over and down from the origin.

The analysis of the lesson suggests that the learning goals for these students were best achieved through small group interactions. One reason is the small groups allowed students more hands-on experience with manipulatives to perform the transformations. In the video,

### Example 3 (Continued)

students physically moved their fingers on the graph and located the points. This experience is far more enriching and can not be duplicated by the use of a worksheet. Another reason is small groups provided students with the opportunity to interact with other individuals to communicate and correct their thinking. Both groups in the video communicated the location of points with each other, monitored their work with the graph, and corrected their thinking about location of points or positioning of figures. In addition to small groups, students worked in a whole class format before and after the videotaped segment. The inclusion of the whole class format enhanced the lesson. Before the videotaped segment, it allowed students to process the instructions and ask questions about the assignment. At the end of the lesson, it provided an opportunity for each group to communicate with the class and for students to report observations they made about the coordinates of different transformations.

The use of manipulative materials had a positive effect on the students' learning experience. First, the manipulatives increased the students' level of access to the mathematics at hand. Instead of simply performing the transformations on a worksheet or listening to a lecture about transformations, students were actively engaged in concrete explorations with the materials. For instance, the two girls in the video tried to reflect the isosceles triangle but could not figure out why points F and G's coordinates were the same. After focusing their attention on where point G was and where their assignment said it should be, they were able to figure out they needed to flip the figure over. Next, the use of manipulatives enhanced student conceptual understanding. This point is best illustrated by the opportunity the manipulatives provided for me to correct student misconceptions with translations. *Until students engaged in the group activity, I did not realize they thought a translation could be performed while also turning or rotating the figure. However, when they began working in groups I immediately noticed students sliding the point of the figure to its given location, but they were also changing the orientation of the figure. As a*

### Example 3 (Continued)

result, I utilized class time during the whole group discussion to address this misconception.

Last, the use of manipulatives provided maximum abilities to assess student knowledge of the learning goals. By simply observing students, I determined their ability to perform a given transformation. I noticed whether students slid the figures the correct amount in the right direction, rotated the coordinate plane the correct amount, or flipped a figure accurately over the x-axis. Since the table contained many patterns, I could immediately discern whether the coordinates were accurate.

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*If I were given the opportunity to teach this particular lesson with these students again, I would make two improvements. One improvement would be to replace the recording page where students had to graph the transformation of the figures with a page of questions focusing on the specific patterns within the coordinates. By creating a page of questions, I could extend students' thinking beyond just transforming figures and recording the coordinates. I could target specific observations I would like them to make for certain transformations. For instance, I could ask them to observe the pattern created when a figure is reflected over the x-axis. Then, I could extend their thinking by asking them to predict what would happen to the coordinates if the original figure had been flipped over the y-axis. Another improvement would be to supply each group with a transparency of the recording sheet. When groups began presenting their result to the class, they filled in their coordinates and graphed the figures on the overhead at the front of the room. While groups were recording their data, valuable class time was lost. By using transparencies, groups could just place their data on the overhead and conserve class time.*