**Table 4. Traditional to Culturally Responsive/Relevant Modifications (African American Culture)**

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| **5E Stage** | **Traditional Lesson** | **Lesson with CRP** | **Modification Strategy** |
| **Engage** (accessing prior knowledge, peaking student-curiosity) | **Questions posed:**  Does anyone know what causes a river to flow in a certain direction or how its shape might be altered?  Do you think the land around our rivers impacts the quality of river water? Why or why not?    What is a watershed? How does water move through a watershed?  How does topography impact the flow of water?  Describe pollution.  What are the implications of a polluted watershed for humans and living organisms?  **Video clip**: Watersheds | **Questions posed:**  Does anyone know what causes a river to flow in a certain direction or how its shape might be altered?  Do you think the land around our rivers impacts the quality of river water? Why or why not?  What is a watershed? How does water move through a watershed?  How does topography impact the flow of water?  Describe pollution.  What are the implications of a polluted watershed for humans and living organisms?  What has been on the news since 2014 about Flint, Michigan?  Describe the population of Flint, Michigan.  What are some of the struggles the citizens of Flint faced/are facing because of the water crisis?  **Video clip**: Flint residents discussing the polluted watershed crisis. Scientist discussing the causes and implications of the crisis. | Questions redesigned to be relatable to underrepresented students.  Video clip illustrates a health crisis connected to African American culture. |
| **Explore** | In groups, students construct a watershed model using materials provided (based on their understandings of watersheds) and include a sewage treatment plant at top of plant structure, and an industrial plant building near deforested area.  Working together, each group creates an elevation map.  Group members predict how water will flow over the model when sprayed with water.  Group sprays the model with water and traces its flow.  Group works together to illustrate how water flowed across the model on the elevation map.  Students then construct a cocoa sludge (pollutant) and interject it into the model in two areas: sewage treatment plant at top of plant structure, industrial plant building near deforested area.  Students observes the pollutant as it is discharged directly into water.  Group works together to illustrate how the sludge flowed across the model on the elevation map. | Diverse and gender segregated groups form and divide tasks among group members.  Working together, group members construct a watershed model using materials provided (based on their understanding of watersheds) and include a sewage treatment plant at top of plant structure, and an industrial plant building near deforested area.  Working together, each group creates an elevation map.  Group members predict how water will flow over the model when sprayed with water.  Group sprays the model with water and trace its flow.  Group works together to illustrate how water flowed across the model on the elevation map.  Students then construct a cocoa sludge (pollutant) and interject it into the model in two areas: sewage treatment plant at top of plant structure, industrial plant building near deforested area.  Students observes the pollutant as it is discharged directly into water.  Group works together to illustrate how water flowed across the model on the elevation map. | Student groups carefully constructed.  Group assigns members tasks.  Exploration modified to be directly related to the Flint water crisis. |
| Explain | **Concepts covered:**  Components of a watershed: boundaries and directional flow; source and stream order; drainage divides; tributaries. Point source, and nonpoint source pollution. Water cycle stages. | **Concepts covered:**  Components of a watershed: boundaries and directional flow; source and stream order; drainage divides; tributaries. Point source and nonpoint source pollution. Water cycle stages.  Teacher asks student groups to share how water flows in a watershed based on their findings from the Explore.  Teacher uses flint photos, maps, and other resources to elaborate on watershed components and characteristics.  Students break into diverse small groups and discuss two topics from the following list of possible topics related to the Flint watershed crisis:  Why did Flint officials decide to switch the drinking water source from Detroit systems to the Flint River?  What inept water testing procedures contributed to the crisis and residents’ related health problems?  How did the city of Detroit react to mounting complaints by citizens?  Where did the poisonous water in the lead come from and what did it do to its consumers?  Do you believe this could have happened in Grosse Isle (wealthy Detroit suburb.) Why or why not? |  |
| Elaborate | In groups, students will access the EDNA-Derived Watershed Atlas Home Page and search for watersheds in their city and state and on Google Earth and will click on a watershed of their choice, then click on the Watershed Layers Folder and explore landcover, population, streams, etc.  Students write a description of their watershed, using screenshots to support their descriptions.  Teacher evaluates the descriptions using a checklist she has not disclosed to students. | Students are asked to describe how their lives are like watersheds using the metaphor “life as water.” To do this, students generate a list of watershed features (mountain, valley, waterfall, ocean, stream, etc.) and water cycle stages (water vapor, ground water, evaporation, etc.).  They then generate descriptive words for those features (waterfall is powerful, dynamic, etc.) that would serve to metaphorically personalize identity categories.  Using a prompt “My (identity, trait, influence) is like (watershed, water cycle phase) because…” students will describe how their lives are similar to watersheds.  *Adapted from “Three Circles:” https://www.threecircles.org/cultural-watershed/* | Criteria for evaluation is explained and a rubric is provided.  Interdisciplinary connections are made.  Using personal stories to connect to content is a pedagogical strategy that increases students’ learning and enhances content relatability.  Student life-experiences are connected to learning science. |
| Evaluate | Group members prepare a brief presentation using the model they created to explain how the water crisis happened.  Teacher evaluates the groups’ performance using a checklist she has not disclosed to students. | Group members will either prepare a brief presentation using the model they created to explain how the Flint water crisis happened OR create a photo essay that portrays the town of Flint and its residents as they respond to the water crisis OR using a writing prompt, each student demonstrates his or her understanding of the crisis in essay format.  Group members will assess the collaborative performance of other members and themselves using a group performance rubric that is explained by the teacher. | Students choose from among three types of evaluations.  Peer and self-assessment are used.  Criteria for evaluation is explained and a rubric is provided.  Groups are purposely constructed to reflect diversity.  Discussion groups are given choice of topics.  Topic choices relate to African American students because the Detroit area African American community suffered health problems.  Socio-political and economic elements were involved in the decision to use the Flint River for consumption. |