Lesson 1, Detailed Plan

BOWLAND MATHS

Prior to teaching

Refer to the Teacher Overview document, page 1

Introduce; Whole Class

20 minutes

- 1. Referencing the *Welcome Letter*, explain the context: students role-play as data analysts. Their goal is to develop the <u>best possible argument</u> for 1 country and make an <u>objective evaluation</u> of all arguments.
- Assign students to country teams (groups of 3). Multiple teams will study the same country.
- 3. Distribute the *Analyst's Guide* (required pages or the entire document).
 - o Optional: can distribute the Glossary to each group
 - Optional: can provide the maps, one for the class or for each group
- 4. Play the *WWRB Video* for the whole class. Instruct students to complete Getting Information on page 1. It is not essential that students capture all the information.
 - o Optional: Groups can review the video segment related to their country.
- 5. Verify what they learned from the video. Points to emphasize:
 - All 3 countries need more water.
 - o The countries have access to saltwater seas, but saltwater is not drinkable.
 - o Issues around water scarcity are complex. This case study is a simplified version.

Hypothesize; Whole Class

5 minutes

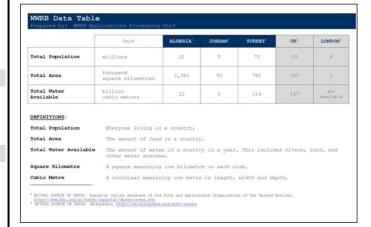
6. Discuss responses to the Reflection Boxes.

Investigate; Small Group

- 7. Give a copy of the WWRB Data Table to each group.
 - o The UK & London are provided for comparison only, and will not get aid.
 - Optional: can provide groups the electronic datasheet to have them work in Excel









Lesson 1, Detailed Plan

BOWLAND MATHS

- 8. Groups complete *Understanding the Data* on pages 2-3. Monitor student understanding:
 - o Using data is a quantitative way to characterize a country's water situation.
 - o The country with the largest area does not have the highest population.
 - o Population (people) is the important consideration for water needs.
 - o A compound measure will allow for a more fair comparison. (Question 7 is foreshadows this for the next lesson.)
 - o Check that reasoning in question 6 matches the logic of their answer in question 7.

Reflect; Whole Class

- 9. Using the *Reflection Boxes*, compare student ideas from the beginning of the class to now.
- 10. Assign the *Making the Headlines* homework.
 - o Emphasize that an accurate headline is more important than selecting a photo.
 - o Students select from the pictures printed from the *Gallery.ppt* document
 - OR, for the electronic option:
 - Provide students a copy of WWRB Gallery.ppt.
 - Distribute the file Headlines.doc electronically.







Lesson 2, Detailed Plan

BOWLAND MATHS

Prior to teaching

Refer to the *Teacher Overview* document, page 2

Introduce; Whole Class

10 minutes

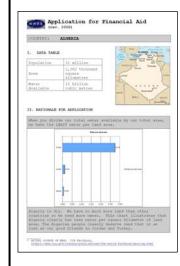
- 1. Plenary: selected groups present their headlines. Compare headlines for the same country and/or across the 3 countries. Transition to *Points to Ponder* on page 5.
- 2. Present the *Letter about Applications* from JT Smith.
- 3. Emphasize that (a) the data comes from the *WWRB Data Table* (provided in Lesson 1), and (b) each country used a different measure. The WWRB needs to use the same measure to make a fair comparison.

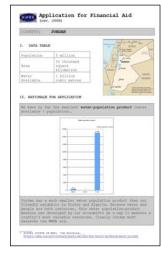
Hypothesize; Small Group

- 4. Provide a copy of the appropriate country application to each group. Instruct them to complete *Evaluating the Application* on page 5.
 - Optional: Can provide students with the excel sheet that shows the calculations and graphs used in the country applications. Note that each country calculation and graph is found in its own tab.
- 5. Probes for monitoring understanding:
 - Have you identified the data used?
 - o Is the measure in the application logical? Is it appropriate for determining water needs?
 - o Is the argument logical? Does the argument make sense for determining water needs?
- 6. Guidance for struggling groups:
 - Algeria: Land is not as appropriate a measure as population in this case study. Also, much of the land in Algeria is not populated.
 - o <u>Jordan</u>: water × population is mathematically correct but not logical in this context.
 - o <u>Turkey</u>: The measure does not include water. That is, Turkey may need more water than the other countries (we can't tell from the data), but they may already have all the water they need









Lesson 2, Detailed Plan



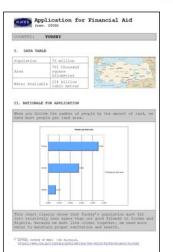
Investigate; Small Group

30 minutes

- 7. Groups complete *Using Compound Measures* on pages 6-7. If they don't finish, it can be completed as homework.
 - o Optional: Provide access to WWRB Datasheet.xls and Excel
- 8. Downplay the computation of the numbers and stimulate critical thinking.
 - o Some measures make mathematical sense but are not sensible in the real world, e.g., population × area.
 - o Emphasize the logic behind the resulting units. For example, "people square kilometers" [people minus sq. km] is not a mathematically sensible unit.
 - o Consider modeling one nonsensical or inappropriate compound measure for the whole class.
- 9. Inform the class about relevant compound measures: *per capita* and *population density*. *Per capita* = per person, similar to per cent = per 100.

Reflect; Whole Class 5 minutes

- 10. Discuss.
 - What measures make mathematical sense? E.g., what are the units if you subtract area from population?
 - o What measures make sense in the real world?
 - What measures are appropriate for describing a country's water needs? E.g., population density (people/area) is a common compound measure, but it is not the best measure for a country's water needs.







Lesson 3, Detailed Plan

BOWLAND MATHS

Prior to teaching

Refer to the *Teacher Overview* document, page 3

Introduce; Whole Class

5 minutes

- 1. If needed, give students additional time to complete *Using Compound Measures* on pages 6-7.
- 2. Remind groups that they will create an argument for their assigned country only. However, they will evaluate the arguments for all countries during the plenary.
- 3. Emphasize the text in Your Goal as well as the reminder from JT Smith on page 8. Points to highlight:
 - o All 3 countries can make an argument for needing more water since it is the "most water scarce region in the world."
 - Their role is not to win the case for their country but rather to understand and use the data to craft the best possible argument.

Hypothesize; Individual or Whole Class

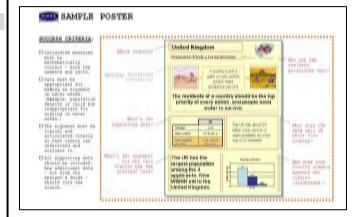
5 minutes

- 4. Students answer question 1 on page 8.
 - o Check or briefly discuss responses to question 1.

Investigate; Small Group

- 5. Instruct students to complete *Developing an Argument* on pages 8-9. Explain that the worksheet is designed to help them think through the data and guide them in developing their argument.
- 6. Introduce the poster. Present the sample poster provided, emphasizing the listed success criteria. (This may also be done as a whole class activity.)
 - o Encourage creativity but emphasize that students should concentrate on the logic rather than the aesthetics.
 - o Reiterate that best possible does not mean "winning" argument. This will be especially challenging for the team assigned to Turkey.





Lesson 3, Detailed Plan



7. Remind students of the coming plenary where they will evaluate the arguments for other countries. They will be allowed to vote on the country that needs water the most, and they may find that they do not want to vote for their own country.

Reflect; Individual Homework

- 8. Assign Reviewing Your Work on page 10 as individual homework. Students should articulate what s/he learned and express independent/ dissenting opinions regarding the group's argument, if any.
- 9. The *Point to Ponder* box on page 10 aims to elicit students' insights regarding the relevance of the case to maths class.







Prior to teaching

Refer to the Teacher Overview document, page 4

Introduce; Whole Class & Small Group

5 minutes

- 1. Ask each country team to hang their poster on the wall. Ensure that there is enough space for students to gather around and read each poster.
- 2. Remind students that the more posters they are able to read, the more informed their vote will be. At the minimum, they should review at least 1 poster from every country.
 - Provide students with stickies (or small pieces of paper with tape) so they can post comments or questions on the posters.
 - o Groups may want to divide & conquer so that every poster is read by at least 1 group member.

Investigate; Individual

10 minutes

15 minutes

- 3. Instruct students to complete the Poster Walk Table on page 11 as they are reviewing posters. Remind students that they will not be able to review all posters in this short time. Things to think about:
 - o Does the argument make sense?
 - o Is it supported by the data?
 - o Are they making a FAIR comparison?
 - o Are the calculations mathematically correct?
 - o Are the units appropriate?

Reflect; Whole class

- 4. Debrief with the class on their insights during the poster walk. Address common questions raised as well as particularly insightful questions or comments. Consider the following questions:
 - o What data was used as evidence?
 - o What were some of the approaches used in developing the argument?
- 5. Process the groups assigned to Turkey, which was the obvious "loser." Elicit reactions from the group as well as other students.
- 6. Reflect on the process of evaluating the work of peers.





Lesson 4, Detailed Plan

BOWLAND MATHS

Investigate; Individual 5 minutes

- 7. Provide each student with only 1 sticky (or small paper with tape) of a different color so that they can vote for the argument that best illustrates that the country has the greatest need for water. (A show of hands will also suffice.)
- 8. Encourage students to vote based on the argument; they do not need to vote for their own poster. Remind them of the success criteria:
 - o Data (simple and/or compound measures) must be relevant to their argument.
 - Calculated measures must be mathematically correct both the numbers and units.
 - o Data must be appropriate for making an argument on water needs. (Example, population density is valid but by itself it is inappropriate for arguing on water needs.
 - The argument must be logical and articulated clearly so that others can understand their case.
 - o All supporting data should be included. Any additional data not from the Analyst's Guide should include the source.

Reflect; Whole Class 25 minutes

- 9. How has your thinking changed/ developed since lesson 1? Elicit the following points:
 - o Data as objective evidence.
 - Data lends itself to making mathematical explorations for more complex investigations.
 - o Data can be manipulated in a way that distrorts reality/ truth.
- 10. What is their biggest takeaway from the experience?
- 11. Why do this case in maths? How is this relevant to maths? Key connections to look for:
 - o The case provides an opportunity to better understand large numbers.
 - o Maths (the data) lends itself to making fair comparison.
 - Maths allows us to go beyond the data and calculate compound measures.
 - o Maths is key in creating the best argument that is supported by data.
 - o Maths is a key part of evaluating the best argument.

