Field Version of UMF Unit-Wide Lesson Plan Template

Name: Rachel Yorke	**Program:** Secondary Ed	**Course:** 460
Lesson Topic/Title: Box Plot Construction and Interpretation		
Lesson Date:	**Lesson Length:** 3 days	**Grade/Age:** 8th

Learning Objectives (Targets):

Students will be able to calculate the five number summary of a given set of data.

Students will be able to construct a box plot from a given set of data and will be able to analyze its shape and spread.

Students will know:

definitions: Minimum, Maximum, Five Number Summary, First Quartile, Third Quartile, IQR (interquartile range)

concepts: box plot construction

Content Standards:	**Content Standards Alignment & Justification:**
CCSS.MATH.CONTENT.6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots. CCSS.MATH.CONTENT.6.SP.B.5.C Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.	Students will be looking at data sets and calculating their five number summaries (minimum, quartile 1, median, quartile 3, and maximum). Students will then construct box plots from five number summaries and use them as a means for analyzing set of data. We will be looking at the plots in terms of their context to make inferences about the data.

Assessment:	**Assessment (Data & Student Feedback):**
☐ Pre ☑ Formative: Formative assessments will be used throughout the lesson. Students will be writing in their math journals, summarizing the material that we cover in class. I will be doing a guided lesson on their construction using noodles. Students will be constructing their own box plots from the lengths of the noodles. ☑ Summative: Students will use the knowledge they have acquired on reading and displaying data to figure out the optimal water level in a water bottle for bottle flipping. ☐ Student Self	For the box plot activity, students will be making their own product. I will walk around while they are being created to quickly check for understanding. If I notice any obvious issues with construction, I will communicate the instructions again (either verbally or visually). Summative: I will use the results of the water bottle activity to determine if students have understood one-variable data representation and interpretation. The worksheet asks students to perform multiple forms of statistical analysis including making predictions, finding averages, drawing graphs, and analyzing data.

Integration of Other Content Areas: (If appropriate)

Science: Students will be using experimental processes in their summative assessment to come to answer the question, "What is the optimal amount of water for bottle flipping?" They will collect data, graph data, and analyze the data to come to a logical conclusion.

Instructional Strategies to Differentiate Whole Class Instruction:

This lesson combines multiple instructional strategies ranging from direct instruction on box plots, to activity based learning with the bottle flipping. It encourages positive social interaction amongst students, while also giving them time to work independently. The lesson caters to students who prefer hands-on learning as it includes the box plot construction with spaghetti and data collecting with bottle flipping. Students used visuals and constructive projects to understand box plots and the use of manipulatives helped students gain a more concrete understanding. Students' preferences were at the forefront of the design for this lesson as it included several activities and catered to their interests.

Modifications / Accommodations / Extensions For Individual Students with Identified Needs:

Modifications: Expectations may be lowered for the C group because some of this material will be new to them. Depending on how well they understand the construction of box plots, more time may be spent on familiarizing them with the basics and building a solid basis of understanding instead of focusing on analyzing them. This may mean that we will not get to cover interquartile range and outliers.

Accommodations: There are a few students in each class who have ADHD. They sometimes have difficulty focusing and following directions. In the B group, students C, D, and B often need subtle reminders to stay on task. I typically will walk up to their desk and just tap it and that usually works. In the C group, students A and C also tend to get off track very easily. To accommodate these students, I will be explicit, yet simple and structured in my delivery of the content. The lesson also includes a hands-on activity to vary the pace of the instruction which should help in keeping students' attention. Also in the B group, D has a hearing impairment. D has been moved to the front of the room so they can hear my instructions and follow the lesson easier. In the A group, student E has Tourette Syndrome. This student's biggest difficulty is with writing and completing tasks within the given time frame. To accommodate this, time frames for all of the tasks are flexible. If students do not complete something in class, they are allowed to complete the tasks later at their own pace. Students also have assigned seats to prevent anticipated behaviors and to easily refocus students who have difficulty with staying on task.

Extensions: Since box plots were briefly covered in 7th grade math, it is likely that some students in the A group will have a good understanding of them and will only need a short review. Since the instruction on box plots is two days, if I notice that the A group is having no trouble with finding 5 number summaries and constructing box plots, the second day will be used to analyze the shapes of box plots and draw inferences.

Technology Integration: (if appropriate)

Students will be using their laptops to collaborate on the bottle flipping activity. Students will all be invited to edit a document in which they will enter their success rates for bottle flipping. The students will then use the results from the whole class to calculate averages and construct bar graphs and box plots.

Materials and Resources for Lesson Plan Development

Box plot construction reference sheet
Whiteboard
Notes
Spaghetti noodles
Paper
Student laptops
Water bottles
Bottle flipping packet
Masking tape

www.cpalms.org/Public/PreviewResourceLesson/Preview/51904

Teaching & Learning Sequence:

Day 1: (53 minutes)

Spaghetti box plot construction activity (approximately entire class)

Hand out a piece of paper to each student and prompt them to draw a bar graph frame

Give each student two pieces of spaghetti and have them break them into 12 distinct pieces. (Explain what distinct means and how each piece should be a different length)

Have students arrange their pieces from shortest to longest along the graph.

Have students find the minimum and maximum and take all other spaghetti pieces away.

Have students mark these heights on the y-axis and label minimum and maximum. Explain that we have found the two number summary.

Have students explain what the median is and have them find the median noodle length by getting rid of the outermost noodle on one side and then the other until the middle noodles remain. (Demonstrate how to split the difference between two noodle lengths to find median)

Have students mark this length on the y-axis and label it median or Q2. Open discussion on quartiles and what "quart" sounds like (quarter) and how the median is the second quartile. Explain that we have now found the three number summary.

Have students put all of the noodles back on the graph and break them into four groups of three. Have students find quartile 1 and 3 by finding the medians of the upper and lower halves of the noodle lengths.

Have students mark these as Q1 and Q3. Explain that we have found the five number summary then ask students what our variable is (noodle lengths) and what kind of variable it is (continuous quantitative).

Have students fold paper so all they can see is the y-axis, then demonstrate how to construct a box plot from the five-number summary.

Hand out box plot reference sheet

Use any remaining time to do more examples of constructing box plots.

Day 2: (53 minutes)

Kahoot! review over five-number summaries (10 minutes)

Box plot and five number summary example (5 minutes)

Box plot construction/interpretation and five number summary practice packet (38 minutes)

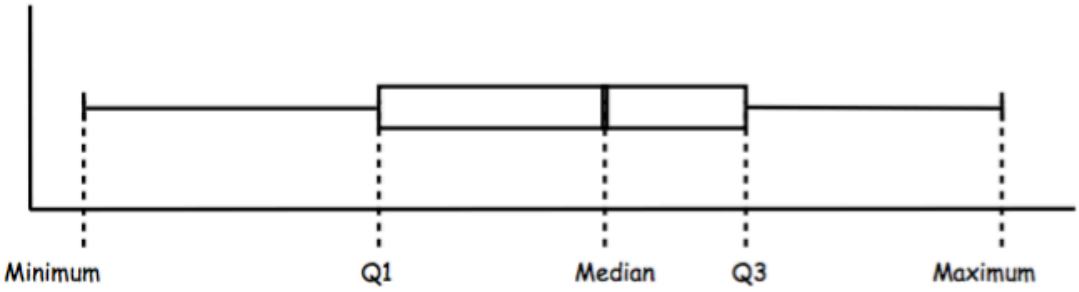
Day 3: (53 minutes)

Bottle Flipping Activity

Students will be using all of their learned skills from the previous days to complete this activity. Their goal is to figure out the optimal amount of water in a bottle for bottle flipping. Students will flip a bottle 25 times at 5 different water levels. They will record how many successful flips they complete and calculate their success rate at each level.

Students will then record their success rates at each level in a Google doc projected on the screen, then record their peers' success rates in their packets. They will then graph the success rates and make a box plot of the level with the highest average rates. They will also answer questions that analyze the graph.

Content Knowledge Notes: ***(if applicable/instructor discretion)***



Minimum: The smallest number in a set of data

Quartile 1 (Q1): The median of the lower half of the data

Median: The middle number of a data set (if there are two middle numbers, the median is the average of those two numbers)

Quartile 3 (Q3): The median of the upper half of the data

Maximum: The largest number in a set of data

Common Core Teacher Standards (CCTS) Alignment & Justification *(Field/Student Teaching Only)*

Standard #3 Learning Environments: *The teacher works with learners to create environments that support individual and collaborative learning, encouraging positive social interaction, active engagement in learning, and self motivation.*

To me, this is one of the most important standards for teachers. Engagement is the difference between a student who learns, and one who does not. This standard implies that I must develop meaningful lessons that meet learner preferences, get students interested in the content, and motivate them to succeed.

Description: The students participated in a data collection activity in which the flipped bottles containing different levels of water, collected data, and determined the best water level for bottle flipping.

Essential Knowledge 3(i):

Understands the relationship between motivation and engagement and knows how to design learning experiences using strategies that build learner self direction and ownership of learning.

Rationale: Bottle flipping is something that has become extremely popular recently, especially amongst middle school aged students. I had noticed that several students would bottle flip throughout the day, so I developed this activity as a way to get students interested in the math they were doing. All of the students were engaged in the activity and had a fun time. They were excited about the work they were doing and since they made predictions about the best water level for bottle flipping, they were excited to see the results of the lesson.

Standard #8 Instructional Strategies: *The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to access and appropriately apply information.*

This standard expresses the necessity of teachers to differentiate instruction. I must always remember that I am teaching with the student in mind, rather than teach in a manner that assumes all students have the same understandings and learn in the same way.

Description: This lesson combines multiple instructional strategies ranging from direct instruction on box plots, to activity based learning with the bottle flipping. The lesson caters to students who prefer hands-on learning, but it also incorporates plenty of group and independent work.

Performance 8(a): *Uses appropriate strategies and resources to adapt instruction to the needs of individuals and groups of learners.*

Rationale: Most of my students have indicated that they prefer hands-on, group activities, with some students preferring time to work alone. This lesson encourages positive social interaction amongst students, while also giving them time to work independently. Students used visuals and constructive projects to understand box plots and the use of manipulatives helped students gain a more concrete understanding. Students' preferences were at the forefront of the design for this lesson as it included several activities and catered to their interests.

Post-Lesson Reflection:

This lesson turned out to be extremely successful. The students were engaged during both of the activities and it was evident that they had fun. All of the students were able to construct a box plot from a five number summary and the only challenge that students had was finding the first and third quartile of a data set.

Almost everything in the lesson went exactly as planned. The only challenge I ran into was during the bottle flipping activity. Students were flipping their full bottles near the wall and the teacher next door could hear them. Once I realized they were creating a distraction, I had the students move away from the wall, and as the water level went down, they made less noise. Also, the activity took two class days to complete which altered my schedule slightly.

If I could do this lesson again, I would spend more time on constructing box plots and I would ask the students to analyze their bottle data flipping in more depth. Time constraints presented a challenge, and even though this is the first time students had seen box plots, we could only spend two days with direct instruction on them.