Accelerated Reader

Lesson Plan

Real-World Context	Possible Math Tools
Many students have goals for the number of words they need to read by the end of the year. Such large numbers may feel daunting, and so scheduling reading time to meet that goal can be helpful in showing the students it is something they are capable of. Students should answer the following questions: • How much am I reading? Is it less than I thought? • What would I have to do to become a "reading millionaire" (read 1,000,000 words in a semester?)	3 – 5 students: • **Arithmetic:** Repeated addition, multiplication, and division • **Number Sense:** Estimation, approximation, rounding, place value to 1,000,000 • **Measurement & Data:** Averaging, rates, obtaining and representing data

Relevant Common Core Standards:

CCSS.MATH.CONTENT.3.NBT.A
Use place value understanding and properties of operations to perform multi-digit arithmetic.
Task: Use reading data to make sensible goals for the next week, month, and year.

CCSS.MATH.CONTENT.3.NF.A
Develop understanding of fractions as numbers.
Task: Visually represent progress toward each reading goal.

CCSS.MATH.CONTENT.3.MD.B
Represent and interpret data.
Task: Present reading data on a graph and visualize any improvement.

CCSS.ELA-LITERACY.W.3.1 / CCSS.ELA-LITERACY.W.4.1 / CCSS.ELA-LITERACY.W.5.1
Write opinion pieces on topics or texts, supporting a point of view with reasons.
Task: Justify reading goals and demonstrate improvement.

CCSS.ELA-LITERACY.SL.3.1 / CCSS.ELA-LITERACY.SL.4.1 / CCSS.ELA-LITERACY.SL.5.1
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 3/4/5 topics*, building on others' ideas an expressing their own clearly.
Task: Discuss reading goals and progress, so students are accountable to each other.

CCSS.ELA-LITERACY.SL.3.4 / CCSS.ELA-LITERACY.SL.4.4 / CCSS.ELA-LITERACY.SL.5.4
Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.

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Task: Reflect on how a week of reading compared to the goal for that week.

CCSS.MATH.CONTENT.4.OA.A
Use the four operations with whole numbers to solve problems.
Task: Extrapolate reading goals across the year, and calculate reading rates.

CCSS.MATH.CONTENT.4.NBT.B
Use place value understanding and properties of operations to perform multi-digit arithmetic.
Task: Represent reading goals in terms of word count. Find out what's required to reach 1 million words.

CCSS.MATH.CONTENT.4.NF.B
Build fractions from unit fractions.
Task: Calculate one half, third, etc. of a reading goal. Express progress as a non-unit fraction.

CCSS.MATH.CONTENT.4.MD.B
Represent and interpret data.
Task: Use graphs of reading data to quantify success and improvement.

CCSS.MATH.CONTENT.5.NBT.A
Understand the place value system.
Task: Develop reading goals at different scales (over the week, month, and year)

CCSS.MATH.CONTENT.5.NBT.B
Perform operations with multi-digit whole numbers and with decimals to hundredths.
Task: Express reading rates on several scales and extrapolate over a year or more.

CCSS.MATH.CONTENT.5.NF.B
Apply and extend previous understandings of multiplication and division.
Task: Relate short-term and long-term goals, and see if they can be reached at the current rate.

CCSS.MATH.CONTENT.5.MD.B
Represent and interpret data.
Task: Demonstrate results by presenting a performance graph and recording the slope.

Dive In:

Students begin exploring the topic.

Student Actions	Teacher Actions
Students will explore the topic by answering questions such as: • What do you notice? What do you wonder? • What is interesting about this topic? • What about this topic is important? • What information do you need? Students will brainstorm these questions in groups.	*What will you show/tell students to launch the real-world context and capture their interest?* **Ask students how much they think they read. Previous versions of this lesson have launched with school-wide rewards for reaching reading goals.** Allow students time to brainstorm. Monitor student progress and group dynamics. Take note of anything that should be shared with the class: • ideas that help students mathematize the problem • common misconceptions

Define the Problem:

Ideas are narrowed to a focused, mathematically relevant problem.

Student Actions	Teacher Actions
Students will choose a focused problem that can be answered and justified with information and mathematics. Students should consider questions such as: • What information do you need to make a model? • What quantities are required by the model? Which ones are provided? • Do quantities have only one value, or can they have a range of values? • What mathematical tools could you use in your model?	Guide students towards a focused problem that can be answered and justified with information and mathematics. *What are my expectations for the model? Will the whole class focus on the same problem, or will variation be allowed?* **Different students should set different goals. They might vary in how they schedule reading time (time per day, books per week, difference between weekdays and weekends, etc.) Grouping students by similar reading levels may be necessary for efficiently taking data.** *What mathematical tools/connections could you suggest to students who aren't using math?* **Suggest using multiplication and rates, since students may have trouble using math to connect the data they can take (e.g. how long does it take to read one page) to the data they need (e.g. how long will it take me to read my word goal.)** *How will you guide your students to use new skills they are less comfortable with?* **Schools may have systems for determining reading goals or levels. These systems can be used to help the students determine their goals.**

Do the Math:

Iterate the model until it is done and can be evaluated.

Student Actions	Teacher Actions
Use mathematical tools to develop a model. Mathematically justify all estimations and numerical values in model. Use the model to suggest a solution. Record work.	Note the mathematics that develops during model building. *What are some common misconceptions that could arise at this stage, and how might you address them?* **Students may overgeneralize from one data point about every book or page; they might also be confused if they aren't sure if a goal is for the year, the semester, or the quarter. Ask students how many data points they have, and what their data points mean.** Address misconceptions individually or as a group. *When are natural times to regroup?* **Transitioning students between taking data and building their model may take a regrouping. If not all groups have enough data, class data for words/page and days/quarter can be compiled so all students advance to the next section of the problem with accurate data.**

Decide Whether You're Satisfied, and Declare Victory:

Evaluate your model and decide when the model is ready to be presented.

Student Actions	Teacher Actions
Students should be evaluating their model by asking questions such as: • If there is a rubric or checklist, see if you did everything. • Is your solution reasonable? Why or why not? • Is your solution useful for answering your question?	*What components do you expect the students' models to include?* **A reading goal which clearly results from the student's data, and a credible argument for it.** *What will a useful model be able to do?* **Present both a goal and a plan to get there. The student should be able to follow the plan while working on their reading goals.** **Define an ending point** for your students' models, and set clear expectations. Guide students through reviewing their models by considering the questions on the left.

Demonstrate Solution:

Present and interpret your model that solves the problem.

Student Actions	Teacher Actions
Students will reflect, justify, and present their models by asking and answering questions such as: • Why would you recommend your model to someone? • What mathematical tools did you use, and how did they help solve the problem? • What did you change in your model throughout the modeling process? • Are there situations where your solution wouldn't work or your model wouldn't apply? • How would you need to change your model to apply to more situations? • If you had more time, what else would you do? • Are there any mathematical tools or pieces of information that would have been helpful to have?	*What expectations do you have for students' presentations?* **Students should offer a timeframe and plan for what they want to read, and show how much the plan says they'll read.** Guide students in evaluating their solutions by answering the questions on the left, as a whole class or in groups. (A presentation rubric from IMMERSION is available on the Math Modeling Hub.)

Revisit:

These questions may help you consider possible extensions to the problem. Tying the problem to more advanced math gives students a frame of reference for newer mathematical tools.

Q: *When could you recall the math used in this lesson as a starting point or an example later in your curriculum?*

A: **This lesson is a good introduction to the advantages of multiplication over repeated addition and the difference between generalized averages and singular values.**

Q: *Is there a time later in the year when you might come back to this real-world scenario with different mathematical tools? Remember that students sometimes reach for tools that are most familiar and it might take them a while to build confidence to use a new tool in a modeling situation.*

A: **Students might apply their models to students with different reading goals or reading rates, to discover which quantities in the model change and which do not.**

Q: *Throughout the year, will you be collecting new information about this scenario? Are there times you could use that information to reflect on and improve your model?*

A: **Though it can be completed in only a week, this lesson can be revisited over the year as students work toward their reading goals.**

Q: *Are there other similar scenarios where you could use the same kinds of models? What might change? What might stay the same?*

A: **This kind of model applies to many rate problems where the goal is to find how long it will take to complete large tasks. The number of steps to calculate the final rate may change from this relatively simple problem.**

For more resources on how to change parameters and constraints or how to extend this task to other grades, consider consulting the GAIMME report pages 136-139 http://www.siam.org/reports/gaimme.php.