LDC **Literacy Design Collaborative**

Critiquing an argument: Mathematics Used as Evidence

⭐ TASK ⭐ LADDER

by Kelly A. Stidham

This one week module focuses on students writing a response to an author's use of a model of data as evidence towards a claim. The text is focused on content relevant for 8th grade students. In it, the author presents a rudimentary model (graph) of data using a few selected data points and uses this model to make claims. The students interpret the claims made by the author, analyze the source data in order to validate the author's model, and compare the fit of other possible functional families as the model.

While it might seem that there would be a closed, "correct," response to the task, the text and source data was selected so that there would be a spectrum of reasonable and mathematically valid arguments to the task.

From this analysis, students write a response to the author's argument. The work of this module includes the analysis of the mathematical argument but also intentional instruction in the literacy standards. The students are engaged in interacting with the written argument by evaluating claims and assessing whether the reasoning of the argument is sound. The students are engaged in explicit instruction on writing an argument in the form of a response to the article. They consider examples from the field to develop quality criteria, create and revise drafts, and provide feedback to peers.

Beyond the scope of this module, students might also be engaged in further learning where they develop their own questions, research source data that addresses their question, building models that describe the data, and using their models to address the question. They report on their findings including a description of their assumptions and variables, their claims, and a validation and revision of their model.

GRADES	DISCIPLINE	COURSE	PACING
8	**Math**	**Any**	🕐 **6hr**

Section 1: What Task?

Teaching Task

Task Template A9 - Argumentation

Is this author's use of mathematics as evidence for their argument plausible?After reading an article on the decline of income for American Males, write a response to the article in which you discuss the source data and evaluate if the author's argument is reasonable. Support your position with evidence from the text/s.Explain how the function used to model the data and the claims made from the data are related.

Standards

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

RST.6-8.7

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

WHST.6-8.1   **Focus**

Write arguments focused on discipline-specific content.

RI.8.8   **Focus**

Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.

Kentucky Core Academic Standards - Mathematics

MP.4

Model with mathematics.

CCSS.Math.Content.8.F.B   **Focus**

Use functions to model relationships between quantities.

MP.3   **Focus**

Construct viable arguments and critique the reasoning of others.

Texts

📄 **HIstorical Median Income- By people and sex , Census.gov.xls**
📄 **For US Men, 40 Years of Falling Income.docx**

Student Work Rubric - Argumentation Task - Grades 6-8

	Emerging	**Approaches Expectations**	**Meets Expectations**	**Advanced**
	1	**2**	**3**	**4**
Controlling Idea	Makes an unclear or unfocused claim.	Makes a **general** claim **that addresses the prompt**, with an **uneven focus**.	Establishes and maintains a clear claim that addresses all aspects of the prompt.	Establishes and maintains a clear, specific, and credible claim that addresses all aspects of the prompt.
Selection & Citation of Evidence	Includes minimal details from sources. Sources are used without citation.	Includes **details, examples, and/or quotations** from sources that are **relevant to the claim**. **Inconsistently** cites sources.	Includes details, examples, and/or quotations from sources that are relevant to the claim and supporting ideas. Consistently cites sources with minor formatting errors.	Includes well-chosen details, examples, and/or quotations from sources that support the claim and supporting ideas. Consistently cites sources using appropriate format.
Development / Explanation of Sources	Explanation of ideas and source material is irrelevant, incomplete, or inaccurate.	Explanation of ideas and source material is **minimal** or **contains minor errors**.	Accurately explains ideas and source material and how they support the argument.	Thoroughly and accurately explains ideas and source material, using reasoning to support and develop the argument.
Organization	Lacks an evident structure. Makes unclear connections among claim, reasons, and evidence.	**Groups ideas and uses some transitions** to connect ideas, with **some lapses in coherence or organization**.	Groups and sequences ideas to develop the controlling idea. Uses transitions to clarify the relationships among claim(s), reasons, and evidence.	Groups and sequences ideas logically to develop the controlling idea and create cohesion. Uses varied transitions to clarify the relationships among claim(s), reasons, and evidence.
Conventions	Major errors in standard English conventions interfere with the clarity of the writing. Language or tone is inappropriate.	**Errors** in standard English conventions **sometimes interfere** with the clarity of the writing. Uses language and tone that are sometimes inappropriate for the audience and purpose.	Consistently applies standard English conventions; minor errors, while noticeable, do not interfere with clarity of the writing. Uses language and tone appropriate to the audience and purpose.	Consistently applies standard English conventions, with few errors. Demonstrates varied syntax and precise word choice. Consistently uses language and tone appropriate to the audience and purpose.
Additional Task Demands (When applicable)	Does not address additional task demands.	Addresses additional task demands **superficially**.	Addresses additional task demands adequately to support the argument.	Addresses additional task demands effectively to strengthen the clarity and development of the argument.
NGSS Practice: Analyze Data	Analyzes data using inappropriate methods or with major errors or omissions.	Analyzes data using appropriate methods with minor errors or omissions.	Accurately analyzes data using appropriate methods to identify patterns.	Accurately analyzes data using appropriate and systematic methods to identify patterns.

Background for Students

Very often, authors will use evidence from numerical data or statistics as evidence for a claim. In this article, the author uses a graphical representation of linear functions that he created from source data to support his argument. You will evaluate his argument by considering the fit of his model to the data, the validity of his inferences about the data, and the degree to which his use of data is reasonable evidence.

Extension

Use a function expressed in equation form to model the source data from the article. Present an argument as to why this model is an effective description of the data and use your model to justify or challenge the authors' claim that American Male income is in decline. You may research other sources of data if needed to address the critical questions.

Section 2: What Skills?

Preparing for the Task

TASK ANALYSIS: Ability to understand and explain the task's prompt and rubric.

Reading Process

QUESTIONING: Ability to identify and interpret quotes in the text that address a priority question or sections that they have questions about.

GATHERING EVIDENCE: Ability to identify the claim, evidence and warrents used in argument.

Data Analysis and Interpretation Process

EVALUATING CLAIMS AND REASONING BASED ON DATA: Ability to compare an author's model of data to the source data in order to evaluate the author's assumptions and validate the model's representation of the relationships between quantities in the model.

Transition to Writing

DISCUSSION: Ability to participate in a discussion to prepare for writing the product

Writing Process

INITIAL DRAFT: Ability to produce an initial draft with all relevant elements in response to the teaching task

REVISING A DRAFT: Ability to revise a draft to improve meaning by rethinking and rewriting elements, including structure and language.

EDITING: Ability to proofread and format a piece to make it more effective.

FINAL DRAFT: Ability to submit final piece that meets expectations.

Section 3: What Instruction?

PACING	SKILL AND DEFINITION	PRODUCT AND PROMPT	SCORING GUIDE	INSTRUCTIONAL STRATEGIES
Preparing for the Task				
50 mins	**TASK ANALYSIS**: Ability to understand and explain the task's prompt and rubric.	**QUESTIONING THE TASK/QFT** What questions will you need to answer in order to complete the task below? *Is this author's use of mathematics as evidence for their argument plausible? After reading an article on the decline of income for American Males, write a response to the article in which you discuss the source data and evaluate if the author's argument is reasonable. Support your position with evidence from the text/s. Explain how the function used to model the data and the claims made from the data are related.* Working in small teams and as a class, develop and prioritize questions that arise from reading the task. These will guide our work in reading and evaluating the argument presented in the article "For US Men, 40 years of Falling Income."	Meets expectations if student: • Develops and prioritizes questions that arise from the language of the task. • Explains their question thoroughly. • Is engaged in the class discussion concerning the most important questions. Is it also important to make note of evidence of misconceptions, previous knowledge and vocabulary present in the question lists as a guide to addressing individual students needs as they enter into the task. While this is not a criteria for their work in the task, it is critical in forming coherent and effective instruction throughout the remainder of the module.	**Note**: This mini-task is an adaptation of the Question Formulation Technique developed by The Right Question Institute (rightquestion.org). A handout (**QFT Small Group Worksheet** under Student Handouts below) has been attached to help students organize their work for this mini-task. You may want to type the task in the box provided on the handout. **Instruction**: 1. Provide students with a sample task and the four rules of developing the questions. After the brainstorm in groups of 4-6, direct each team to label each question as open or closed. 2. Once the team has brainstormed and labeled each question, direct each team to pick their three priority questions that need to be answered in order to achieve the goal of the task. 3. Give them two to three minutes to get these questions written on the board. If you don't have a large area of board space, you could hang a large piece of paper on the wall and have students write their questions on the paper using markers. Another option is to project a Powerpoint slide or Word document and ask students to take turns typing in their responses. 4. In groups of four, have students discuss all the questions on the board and decide how they might group the questions. 5. When the discussion is finished and the top five questions have been selected, keep this paper up on the wall as a guide throughout the module.

Standards:

CCR.R.1 : Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

CCR.SL.1 : Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

Additional Attachments:

📄 **QFT-Small-Group-Worksheet-2.pdf**
📄 **Experiencing-the-QFT-3.pdf**

PACING	SKILL AND DEFINITION	PRODUCT AND PROMPT	SCORING GUIDE	INSTRUCTIONAL STRATEGIES
Reading Process				
25 mins	**QUESTIONING**: Ability to identify and interpret quotes in the text that address a priority question or sections that they have questions about.	**FOCUSED TEXT MARKING** Read the text and make tracks in your reading. Think about the questions we asked during the QFT. • place an exclamation point after anything that will help answer one of your priority questions.	Students' markings should demonstrate • recognize and indicate relevance of quotes from the text that are relevant to a given questions and use these markings to craft answers. • recognize and indicate	Reasoning: Focused reading helps students pay attention to what they are reading in a text and provides them with a lens for reading. Students will be reading a text and making tracks in their reading. Students will place an • place an exclamation point after anything that will help answer one of your priority questions. • a question mark after anything that is confusing to you • underline any language that indicates the author is making a claim.

- a question mark after anything that is confusing to you
- underline any language where the author is making a claim.

where the author is making a claim.

Process:

1. Students receive a copy of the article and the prompt is projected or copied for each student.

2. Students are given time to read the article individually, making their initial marks. The teacher monitors the work, making note of interesting, important or extraneous markings.

3. Students are given time to discuss their work with a partner, sharing their markings. The teacher monitors conversations, listening for reasoning that is exemplar.

4. Teacher facilitates a whole class discussion, using student reasoning as points for discussion and questions to deepen student reasoning.

5. Students return to their copies of the article to re-read and revise their markings as needed.

6. Students use post-its or a shared virtual document to record answers to the priority questions developed in the Questioning the Task/QFT time and to add any new questions to the list.

Standards:

RI.8.8 : Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.

RH.6-8.1 : Cite specific textual evidence to support analysis of primary and secondary sources.

RH.6-8.7 : Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.

Additional Attachments:

📄 **Text marking Strategy**

| 35 mins | **GATHERING EVIDENCE**: Ability to identify the claim, evidence and warrents used in argument. | **EVALUATING CLAIMS, EVIDENCE, AND WARRANTS FROM A TEXT AND ITS USE OF MATHEMATICS** Use your annotations and re-read the article to determine the author's claim. Then, read the article again and complete the Evaluating Evidence worksheet to identify the evidence the author provides to support that claim and determine whether the author makes a solid case for his/her claim. | *For Evaluating Evidence:* Level 1: Students identify relevant evidence from the article and accurately paraphrase the evidence. Students provide some connections to the author's claim. Level 2: Students identify relevant evidence from the article, accurately paraphrase the evidence, and provide appropriate connections to the author's claim. Level 3: Students identify relevant evidence from the article, accurately paraphrase the evidence, provide insightful connections to the author's claim, and evaluate the quality of the author's argument. Students include evidence the author cites based on the source data. | *Important Considerations:*
 • *Because this article and the goal of the module include the author's use of his inferences of the source data regarding the income of American males, it is critical that students include these claims in their analysis. This is an especially important point for the teacher to listen for in student work and to target with purposeful questioning.*
 • Evaluating the quality of the evidence provided in an argument requires a critical reading process that may require some support the first few times students try this sort of evidence-based reading practice. Students must determine the author's claim, find the specific evidence the author offers in support of that claim, and explain how (or whether) the evidence supports the claim by writing warrants.
 • If student have never engaged in this process, you might want to begin by modeling the process with a Think-Aloud before asking students to follow your process with another article. Each step in the attached note-taking guide helps students break down an argument. The note-taking guide can also serve as a formative assessment that helps teachers determine the reading deficiencies that are causing students to struggle.
 Teacher Steps:
 1. Pass out the Evaluating Evidence worksheet. Have students skim the article and identify the claim in the article. Discuss the claims identified by students and |

have the class determine which claims best represent the author's position. (10 minutes)

3. Ask students to return to the article to identify evidence provided by the author to support his/her claim. Each piece of evidence should be written in the first column of the Evaluating Evidence Worksheet. Ask students to use the exact language of the author and to use quotation marks or site specific characteristics of the chart used. Then in the second column, students should "translate" the information from the first column into their own words. (15 minutes)

4. After completing the first two columns for the article, ask students to explain the connections between each piece of evidence and the author's claim. Then have students add this information in the third column of the Evaluating Evidence worksheet. (5 minutes)

5. As students complete Step 4, pair students to discuss the quality of each author's argument. Then have students write 3-4 sentences at the bottom of each Evaluating Evidence worksheet explaining why they think each author did or did not provide a compelling argument for his/her claim. (5 minutes and homework). *This step is continued in the evaluating data skills cluster as well.*

The instruction and materials for this mini-task have been adapted from Johannessen, L.R., Kahn, E.A., and Walter, E.A. (2009). *Writing about Literature: Theory and Research into Practice.* NCTE.

Standards:

CCR.R.1 : Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

CCR.R.8 : Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.

Additional Attachments:

🔗 **New York Times Learning Network**

📄 **Argumentation and Warrant Note-Taking Guide.docx**

Data Analysis and Interpretation Process

1 hr and 30 mins	**EVALUATING CLAIMS AND REASONING BASED ON DATA**: Ability to compare an author's model of data to the source data in order to evaluate the author's assumptions and validate the model's representation of the relationships between quantities in the model.	**COMPARING SOURCE DATA TO A MODEL TO EVALUATE THE STRENGTH OF THE MODEL** Using a dynamic plotting tool (graphing calculator, Desmos, Geometer's Sketchpad, etc), create a scatterplot of the data from the table that is relevant to the author's claim. Then compare his linear models presented in the article, describing how well the model fits the data and discussing the patterns (clustering, outliers, linear vs nonlinear association, etc) evident in the data that might effect the author's	Successful students will: • Identify which variables and parameters from the source data is relevant to the author's discussions (which years, which variables, etc). • Use source data and digital tool to create a scatterplot of the data which includes appropriate domain, range and labels. • interpret data accurately and make note of the patterns evident in the data. • Compare the fit of the data to the author's model and identify at least one	1. Notice and Wonder (looking for patterns in the data): Students are given electronic copy of the data and complete a Notice/Wonder chart about the data individually. The students should write down patterns or characteristics they notice and questions they wonder about. The students then share their noticings with a partner while the teacher makes note of important ideas and questions the pairs reveal. Finally, the teacher highlights the ideas from the class and asks clarifying questions to prepare students to analyze the data. (15 minutes). 2. Students then identify what information in the data is and isn't relevant to the author's claim. They highlight these data points and use a digital tool to create a scatterplot of the data (the resources below utilize Desmos, a free online graphing tool, but any tool that can plot data points and linear equations will suffice). Note that there are three different sets of data (by age group) and students may choose to differentiate by creating three different graphs or my color-coding the different sets of

	claims. Use this analysis to validate or challenge the author's model of the data, describing the strengths and limitations of the graphical representation.	strength and one limitation of the model. • Use their information to validate the author's model or provide an alternative model and explanation of their conclusions.	data. (15 minutes) 3. The students make note of what patterns they see in the data (linear vs nonlinear association, positive vs negative association, outliers and clusters, etc). They then graph the author's model on top of the scatterplot and evaluate the strengths and limitations of the author's model in representing the true story of the data. (30 minutes) 4. Having made observations on the students' graphs and interpretations, the teacher calls the group together to highlight interesting and important thinking evident in the student work, calling attention to trends in student thinking and contrasting different but equally valid student conclusions. The teacher focuses this whole class discussion on reasoning about the fit of the author's model to the data. (15 minutes) 5. Students use their scatterplots, graphs of functions and observations to write a brief critique of the model (could be in narrative or outline form, but should include their graphical representations). Students may being to draw conclusions as to the strength of the author's claims at this point, but the object of this task is for them to focus on the strength of the mathematics representation. (15 minutes)

Standards:

RST.6-8.7 : Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

8.SP.1 : Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.2 : Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

8.F.2 : Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Additional Attachments:

📄 **How well does this model describe our data.docx**

🔗 **Introducing scatterplot activity in Desmos**

Transition to Writing

| 20 mins | **DISCUSSION**: Ability to participate in a discussion to prepare for writing the product | **MAPPING AND CRITIQUING AN ARGUMENT**
Make a visual map of the author's argument, noting his claims and the evidence used. Then annotate your map using your analysis of his model to verify or challenge each claim. Defend your markings with evidence from the source data within your small group. | Students will demonstrate proficiency by..

• identifying important claims in the author's argument
• recognize and cite both the strengths and limitations of the author's model of the data and use this as evidence in their critique of the argument.
• Ask clarifying and challenging questions of other group's work that demonstrate understanding of the data. | 1. Working in small teams, students create concept maps on large poster paper of the author's argument, noting the claims, reasoning presented and evidence cited.

2. Students take time to individually write responses to the claims, evidence and reasoning, using post-its for each response. The teacher monitors the students' thinking, making note of trends and outliers.

3. Within each group, each student shares their post-it reactions. They ask clarifying and challenging questions of each other in order to refine their thinking. The teacher continues to monitor discussions, again making note of trends and outliers and asking feedback questions to support student reasoning where appropriate.

4. Students return to individual work to complete the prompt "I used to think _____ but now I think___ about the author's argument." |

Standards:

RI.8.8 : Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.

MP.3 : Construct viable arguments and critique the reasoning of others.

Writing Process				
1 hr	**INITIAL DRAFT**: Ability to produce an initial draft with all relevant elements in response to the teaching task	**DRAFTING A RESPONSE TO THE AUTHOR** Write an initial draft complete with opening, development, and closing; insert and cite textual evidence as well as your evaluation of the author's use of data.	• Provides complete draft with all parts. • Supports the opening in the later sections with evidence and citations. • Provides visual and verbal discussion of the source data, the author's model of the data, and the validity of the model as evidence in the argument.	• Encourage students to begin their drafting by writing their thesis statement. Then have them re-read the prompt and re-read their statement to a partner. They should ask clarifying and challenging questions as feedback to each other. • Encourage students to re-read prompt partway through writing, to check that they are on track.
	Standards: **WHST.6-8.1** : Write arguments focused on discipline-specific content.			
40 mins	**REVISING A DRAFT**: Ability to revise a draft to improve meaning by rethinking and rewriting elements, including structure and language.	**RECEIVING AND USING FEEDBACK TO REVISE YOUR REPSONSE** Read your partner's draft, writing questions about which parts are unclear to you as a reader. Then you will take feedback questions from your partner, answer these in writing, and apply what you have learned about the strengths and weaknesses of your response to revise your work.	• Asks clarifying questions about what is unclear in partner's writing. • Answers partner's questions in a complete and thoughtful way. • Uses feedback to improve earlier drafts.	• Students are assigned partners and read each other's response to the author. • Each partner writes questions about what is unclear, incomplete, or confusing to them as the reader. They then label these as technical or open questions (grammar or correctness issues might be considered technical, while open questions might target reasoning, organization, or focus). • Each student then answers the feedback questions in writing and uses this to revise their draft. • Each student then reflects on the revision process by responding to the prompt "The feedback question that was most helpful to me in improving my writing is....because..."
	Standards: **WHST.6-8.1** : Write arguments focused on discipline-specific content. **WHST.6-8.5** : With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.			

20 mins	**EDITING**: Ability to proofread and format a piece to make it more effective.	**RECEIVING AND USING FEEDBACK TO EDIT YOUR RESPONSE** You will use CUPS editing strategy to edit writing and help give systematic feedback to others to improve their writing.	Assess self editing and/or peer editing as complete or not complete.
			
			 Complete:
			
			 • Evidence of student feedback from self and/or peer(s)
			   ○ comments/suggestions
			   ○ proofreading marks
			
			 • Completed Checklist
			
			 Not Complete:
			
			 • No evidence of student feedback from self and/or peer(s)
			 • No Checklist
				• Explain: Once you've revised your writing, it's time to edit. When editing, use the **CUPS** strategy.
				 • Display the **CUPS** strategy (i.e. anchor charts, projected for students, etc.
				   ○ Check the following in your writing and when peer editing:
				     ■ **C**apitalization
				     ■ **U**sage
				     ■ **P**unctuation
				     ■ **S**pelling
				 • Briefly review the **CUPS** strategy with the students who have used it before.
				 • For students unfamiliar with this strategy, model how to edit for capitalization, usage, punctuation, and spelling with a example text (suggestion: use a piece of your own writing to edit)
				 • assign students to partners to employ the **CUPS** strategy with a piece of their writing
				   ○ walk around and give feedback to students where

				needed
				• Invite students to conference with their partner, outlining and explaining the edits made.
				Note: "NCTE Edit Checklist" and "Peer Checklist" included below in teacher resources outline alternative editing strategies

Standards:

CCR.W.5 : Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.

Additional Attachments:

📄 **CUPS Editing Checklist**
📄 **CUPS Editing Checklist**
📄 **CUPS Editing Strategy**
🔗 **NCTE Edit Checklist**
📄 **Peer Checklist (Revision and Edit)**

10 mins	**FINAL DRAFT** : Ability to submit final piece that meets expectations.	**COMPLETING YOUR REPSONSE** Turn in your complete set of drafts, plus the final version of your piece.	• Fits the "Meets Expectations" category in the rubric for the teaching task.	- Students collect their drafts, scatterplot and analysis in a google folder or as hard copies. - Students each respond to the reflective prompt "This task asked me to think about.... and practice.... This is important because...." - Students submit their drafts and reflection.

Standards:

CCR.W.10 : Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

Instructional Resources

Teacher Resource

🔗 **Desmos - Charge! A lesson designed to engage stuents in thinking about linear models**
🔗 **Desmos - Penny Circle - A lesson designed to engage students in comparing linear, quadratic or expoential functions as models for data.**