

PRACTICING AND DEEPENING
LESSONS

Examining Errors in Reasoning

THE **MARZANO COMPENDIUM** OF
INSTRUCTIONAL STRATEGIES



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555 North Morton Street
Bloomington, IN 47404

888.849.0851
FAX: 866.801.1447

email: info@marzanoresearch.com
marzanoresearch.com

Visit marzanoresearch.com/compendium to access the Marzano Compendium of Instructional Strategies to view additional resources related to this element and others.

Director of Content and Resources: Julia A. Simms

Editorial Manager: Laurel Hecker

Production Editor: Ming Lee Newcomb

Editorial Assistants / Staff Writers: Elizabeth A. Bearden & Christopher Dodson

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INTRODUCTION

In 2007, Dr. Robert J. Marzano published *The Art and Science of Teaching: A Comprehensive Framework for Effective Instruction*. The framework, composed of three lesson segments, ten design questions, and forty-one elements, was based on research showing that teacher quality is one of the strongest influences on student achievement—that is, an effective teacher can positively and significantly impact student learning. As such, *The Art and Science of Teaching* sought to identify specific action steps teachers could take to improve their effectiveness.

In 2015, Dr. Marzano updated *The Art and Science of Teaching* framework to reflect new insights and feedback. The Marzano Compendium of Instructional Strategies is based on this updated model, presenting forty-three elements of effective teaching in ten categories. Each folio in the series addresses one element and includes strategies, examples, and reproducible resources. The Compendium and its folios are designed to help teachers increase their effectiveness by focusing on professional growth. To that end, each folio includes a scoring scale teachers can use to determine their proficiency with the element, as well as numerous strategies that teachers can use to enact the element in their classrooms. Indeed, the bulk of each folio consists of these strategies and reproducibles for implementing and monitoring them, making the Compendium a practical, actionable resource for teachers, instructional coaches, teacher mentors, and administrators.

EXAMINING ERRORS IN REASONING

Teachers can help students deepen their understanding of informational content by having them examine their own reasoning or the logic of the information presented to them. Students are often presented with unsupported or illogical information or develop errors in their own thinking as they try to learn content. The best way to correct those errors is to have students re-examine the content for accuracy. Students can also identify specific types of errors in reasoning, such as faulty logic, attack, weak references, and misinformation.

Monitoring This Element

There are specific student responses that indicate this element is being effectively implemented. Before trying strategies for the element in the classroom, it is important that the teacher knows how to identify the types of student behaviors that indicate the strategy is producing the desired effects. General behaviors a teacher might look for include the following.

- When asked, students can describe errors or informal fallacies in information.
- When asked, students can explain the overall structure of an argument presented to support a claim.
- Student artifacts indicate that they can identify errors in reasoning.
- When asked, students can describe common statistical errors.

Desired behaviors such as these are listed for each strategy in this element.

Teachers often wonder how their mastery of specific strategies relates to their mastery of the element as a whole. Successful execution of an element does not depend on the use of every strategy within that element. Rather, multiple strategies are presented within each element to provide teachers with diverse options. Each strategy can be an effective means of implementing the goals of the element. If teachers attain success using a particular strategy, it is not always necessary to master the rest of the strategies within the same element. If a particular strategy proves difficult or ineffective, however, teachers are encouraged to experiment with various strategies to find the method that works best for them.

Scoring Scale

The following scoring scale can help teachers assess and monitor their progress with this element. The scale has five levels, from Not Using (0) to Innovating (4). A teacher at the Not Using (0) level is unaware of the strategies and behaviors associated with the element or is simply not using any of the strategies. At the Beginning (1) level, a teacher attempts to address the element by trying specific strategies, but does so in an incomplete or incorrect way. When a teacher reaches the Developing (2) level, he or she implements strategies for the element correctly and completely, but does not monitor their effects. At the Applying (3) level, a teacher implements strategies for the element and monitors their effectiveness with his or her students. Finally, a teacher at the Innovating (4) level is fluent with strategies for the element and can adapt them to unique student needs and situations, creating new strategies for the element as necessary.

Scale for Examining Errors in Reasoning

4	3	2	1	0
Innovating	Applying	Developing	Beginning	Not Using
I adapt behaviors and create new strategies for unique student needs and situations.	When content is informational, I engage students in activities that require them to examine their own reasoning or the logic of information as presented to them, and I monitor the extent to which students are deepening their knowledge.	When content is informational, I engage students in activities that require them to examine their own reasoning or the logic of information as presented to them, but I do not monitor the effect on students.	I use the strategies and behaviors associated with this element incorrectly or with parts missing.	I am unaware of strategies and behaviors associated with this element.

The following examples describe what each level of the scale might look like in the classroom.

Not Using (0): A teacher generally assumes that students probably have errors or misconceptions about content but does not provide them with opportunities to examine their reasoning.

Beginning (1): A teacher points out errors in reasoning to her students when they become apparent in the course of a discussion or assessment. However, she gives them little or no opportunity to examine their own thinking.

Developing (2): A teacher asks students to examine their own thinking—as well as information presented to them—for errors as a preventative measure. However, he does not keep track of student outcomes, so he isn't sure how well it is working.

Applying (3): A teacher helps her students examine errors in reasoning by teaching them to find errors in the media and examine the support for claims that they read about. She records instances of erroneous thinking and is able to see that they are decreasing over time.

Innovating (4): A teacher notices that while most of her students have markedly improved in their ability to detect errors in reasoning, several students are still struggling. In particular, they are having trouble determining whether support for a claim is sufficient. The teacher shows these students how to diagram an argument as a way to visually assess the support for a claim.

STRATEGIES

Each of the following strategies describes specific actions that teachers can take to enact this element in their classrooms. Strategies can be used individually or in combination with each other. Each strategy includes a description, a list of teacher actions, a list of desired student responses, and suggestions for adapting the strategy to provide extra support or extensions. Extra support and extensions relate directly to the Innovating (4) level of the scale. Extra support involves steps teachers can take to ensure they are implementing the strategy effectively for all students, including English learners, special education students, students from low socioeconomic backgrounds, and reluctant learners. Extensions are ways that teachers can adapt the strategy for advanced students. In addition, some strategies include technology tips that detail ways teachers can use classroom technology to implement or enhance the strategy. Finally, each strategy includes further information, practical examples, or a reproducible designed to aid teachers' implementation of the strategy.

Identifying Errors of Faulty Logic

Students find and analyze errors of faulty logic. Errors of faulty logic refer to situations in which a conclusion is not supported by sound reasons. Specific types of errors in this category include contradiction, accident, false cause, begging the question, evading the issue, arguing from ignorance, composition, and division.

Teacher Actions

- Explaining errors of faulty logic to students with examples
- Asking students to recognize examples of errors of faulty logic

Desired Student Responses

- Explaining different kinds of errors of faulty logic
- Recognizing examples of errors of faulty logic

Extra Support

- Displaying written examples of each type of error of faulty logic along with pictures that symbolize each type

Extension

- Asking students to compose examples of errors of faulty logic

Technology Tips

- Use online presentation software such as Prezi to create a dynamic introduction to logical errors that includes examples from across the Internet.

Errors of Faulty Logic

- **Contradiction:** presenting conflicting information—for example, saying that downloading music illegally should be punished more harshly while also arguing that Internet providers and the government shouldn't be allowed to collect information about Internet users
- **Accident:** failing to recognize that an argument is based on an exception to a rule—for example, if a person argued that Scotland has a warm and sunny climate based on the weather during her one-week vacation there
- **False cause:** confusing a temporal (time) order of events with causality or oversimplifying the reasons behind some event or occurrence—for example, superstitious beliefs such as wearing a certain shirt so that your favorite team will win

Examining Errors in Reasoning

- **Begging the question:** making a claim and then arguing for the claim by using statements that are simply the equivalent of the original claim—for example, saying that Namibia is the most beautiful country because it has the prettiest landscape
- **Evading the issue:** changing the topic to avoid addressing the issue—for example, if a student defends himself against accusations of cheating on a test by saying that he always does his homework and never breaks curfew
- **Arguing from ignorance:** arguing that a claim is justified simply because its opposite has not been proven true—for example, claiming that a certain subatomic particle must not exist because we haven't discovered it yet
- **Composition:** asserting something about a whole that is true of only its parts—for example, creating a stereotype about a whole group of people based on the actions or traits of a few people from that group
- **Division:** making a claim about individual parts based on the fact that it is generally true of the whole—for example, saying that because you dislike sandwiches, you must dislike tomatoes

Identifying Errors of Attack

Students find and analyze errors of attack. Errors of attack happen when a person focuses on the context of an argument, rather than the argument itself, in trying to refute the other side. That is, instead of using evidence and sound reasons to argue a point, a person ignores counter-evidence and attacks the person who is arguing for the other side. Types of errors in this category include poisoning the well, arguing against the person, and appealing to force.

Teacher Actions

- Explaining errors of attack to students with examples
- Asking students to recognize examples of errors of attack

Desired Student Responses

- Explaining different kinds of errors of attack
- Recognizing examples of errors of attack

Extra Support

- Displaying written examples of each type of error of attack along with pictures that symbolize each type

Extension

- Asking students to compose examples of errors of attack

Technology Tips

- Use an interactive whiteboard to have students highlight errors in text or webpages.

Errors of Attack

- **Poisoning the well:** being so completely committed to a position that you explain away absolutely everything that is offered in opposition to your position—for example, refusing to accept that studies on the potential negative effects of drinking coffee are scientifically valid
- **Arguing against the person:** rejecting a claim using derogatory statements (real or alleged) about the person who is making the claim—for example, stating that an opponent was fired from her job during an unrelated debate
- **Appealing to force:** using threats to establish the validity of a claim—for example, threatening to expose unflattering information about an opponent to make the opponent surrender the argument

Identifying Errors of Weak Reference

Students find and analyze errors of weak reference. An error of weak reference occurs when a person uses information from untrustworthy or irrelevant sources to support an argument. Specific types of these errors include using sources that reflect biases, using sources that lack credibility, appealing to authority, appealing to the people, and appealing to emotion.

Teacher Actions

- Explaining errors of weak reference to students with examples
- Asking students to recognize examples of errors of weak reference

Desired Student Responses

- Explaining different kinds of errors of weak reference
- Recognizing examples of errors of weak reference

Extra Support

- Displaying written examples of each type of error of weak reference along with pictures that symbolize each type

Extension

- Asking students to compose examples of errors of weak reference

Errors of Weak Reference

- **Sources that reflect biases:** consistently accepting information that supports what we already believe to be true or consistently rejecting information that goes against what we believe to be true—for example, only reading articles from newspapers and websites that align with one’s own political leanings
- **Sources that lack credibility:** using a source that is not reputable for a given topic—for example, citing something that a movie star said in a debate about the causes of a disease
- **Appealing to authority:** invoking authority as the last word on an issue—for example, treating a police officer’s opinion as absolute truth in a discussion of gun laws
- **Appealing to the people:** attempting to justify a claim based on its popularity—for example, justifications that begin “everyone knows” or “everyone agrees”
- **Appealing to emotion:** using a “sob story” as proof for a claim—for example, justifying making a mistake by talking about the sad and stressful things that have happened lately

Identifying Errors of Misinformation

Students find and analyze errors of misinformation. Errors of misinformation occur when a person uses incorrect information in support of an argument. Two types of misinformation errors are confusing the facts and misapplying a concept or generalization.

Teacher Actions

- Explaining errors of misinformation to students with examples
- Asking students to recognize examples of errors of misinformation

Desired Student Responses

- Explaining different kinds of errors of misinformation
- Recognizing examples of errors of misinformation

Extra Support

- Displaying written examples of each type of error of misinformation along with pictures that symbolize each type

Extension

- Asking students to compose examples of errors of misinformation

Errors of Misinformation

- **Confusing the facts:** using information that seems to be factual but that has been changed in such a way that it is no longer accurate—for example, citing demographic information that is ten or twenty years old
- **Misapplying a concept or generalization:** misunderstanding or wrongly applying a concept or generalization to support a claim—for example, applying the generalization that Democrats are fiscally liberal to an individual Democrat's personal spending habits

Practicing Identifying Errors in Logic

The teacher uses practice exercises to help students identify errors in logic. These exercises can serve as a stepping stone for students as they progress from the basic step of understanding various errors in reasoning to the goal of recognizing them in everyday life. Typically, these exercises will describe a scenario in a few sentences and ask students to identify the reasoning error present in the scenario. Students might select the answer in a multiple choice or matching format or be asked to recall the answer from memory.

Teacher Actions

- Asking students to complete exercises that require them to recognize errors in reasoning
- Asking students to explain why an item represents a specific error in reasoning

Desired Student Responses

- Correctly completing exercises that require recognizing errors in reasoning
- Explaining why an item represents a specific error in reasoning

Extra Support

- Giving students fewer options to select from when they are learning to identify errors in logic (for example, Is this an example of contradiction or evading the issue?)

Extension

- Asking students to correct examples so they no longer contain errors in logic

Technology Tips

- Use polling technology to present practice exercises to students and receive immediate feedback about students' levels of proficiency.

Exercises for Practicing Identifying Errors in Reasoning

1. Connor's family has a dog that is almost twenty years old. When his friend's dog dies, Connor asks his mom how it could have happened. "His dog was only twelve," Connor says. "He should have lived a lot longer."
2. Jamie and Lewis are discussing the AIDS epidemic. "Maybe someday they'll find a cure," Jamie says. "There is no cure for AIDS," Lewis says. "They haven't found one yet, have they? And they've tried for a long time. That means there is no cure."
3. James is working on an essay for class, and Jamal asks him why he is writing it out by hand instead of using the computer. James says that the last time he used the computer he got a bad grade, so now he writes everything by hand first and types it on the computer later.
4. Annabelle and Zelda are assigned to debate whether or not Woodrow Wilson was a good president of the United States. Zelda goes first and presents her argument for why Wilson was a good president. When it is Annabelle's turn to speak, she begins by saying, "Since you all know Zelda, you'll understand that she is wrong, because she is always so rude."
5. Taylor asks Gale why she is wearing a jacket with a hole in the elbow. Gale tells him it is the new style. "Look around," she says. "Everyone is doing it."
6. Sasha has written a paper about the presidency of Ronald Reagan. Her teacher notices that most of the people Sasha quotes in the paper said that he was an excellent president. Almost all of them were people who worked very closely with him, and the quotes were recorded when they were still working for him.
7. Lawrence says he wants to get a master's degree in business administration after going to college, and Charlotte says she thinks that's great. "What kind of business do you want to go into?" she asks. Lawrence replies, "I don't want to go into business, I just want to make more money. People with MBAs make more money."

Answers: 1—Accident; 2—Arguing from ignorance; 3—False cause; 4—Arguing against the person; 5—Appealing to the people; 6—Using sources that reflect bias; 7—Misapplying a concept or generalization

Finding Errors in the Media

The teacher provides students with footage of political debates, televised interviews, commercials, advertisements, newspaper articles, blogs, and other sources and asks them to find and analyze errors in reasoning that underlie the messages therein.

Teacher Actions

- Asking students to find errors in teacher-selected media
- Asking students to bring media containing errors in reasoning to class

Desired Student Responses

- Finding errors in teacher-selected media
- Bringing media containing errors in reasoning to class

Extra Support

- Highlighting the section of media or text that contains errors in logic before asking students to identify the type of error being made

Extension

- Asking students to find media or texts that contain errors in logic, identify the type of errors being made, and rewrite the text to be logical

Technology Tips

- Using interactive whiteboard technology and color-coded highlighting to have students identify various reasoning errors in news stories and blog posts.

Resources for Examining Errors in the Media

The following websites are repositories of media in which students could be asked to look for reasoning errors.

- Intelligence Squared Debates (intelligencesquaredus.org): Oxford-style debates over controversial current issues in which two panels of experts attempt to change the audience members' minds with evidence and reasoned arguments for and against a topic
- Stanford University's Political Communication Lab (pcl.stanford.edu): Archived political campaign advertisement videos and research on political rhetoric and media
- Real Clear Politics (realclearpolitics.com): Aggregated commentary, news, and statistics representing a full range of political viewpoints
- The Fallacy Files (fallacyfiles.org): Website and blog by a former logic professor who finds and explains logical fallacies in the media
- Vintage Ad Browser (vintageadbrowser.com): Large image collection of advertisements, including propaganda posters, sorted by subject or topic

Examining Support for Claims

Students examine the support provided for a claim by analyzing the grounds, backing, and qualifiers that support it. Grounds are the reasons given to support a claim and backing is the evidence, facts, or data that support the grounds, while qualifiers address exceptions or objections to the claim. Defining the structure of the argument and identifying how the support presented for a claim relates to that claim can help students determine whether the claim is valid. For example, consider the claim “Denver is a great city to live in.” One of the grounds a person might give to support this claim could be that Denver has good weather. To provide backing for this, a person could present data such as average temperatures, number of sunny days per year, and so on. As a qualifier, one might say that while it does get cold sometimes in Denver, the periods of cold weather only last a couple of days.

Teacher Actions

- Explaining grounds, backing, and qualifiers to students
- Asking students to examine support provided for claims to find grounds, backing, and qualifiers
- Asking students to determine if claims are valid or invalid

Desired Student Responses

- Explaining what grounds, backing, and qualifiers are
- Determining if a claim is valid or invalid by examining the support provided for it
- Explaining why a claim is valid or invalid

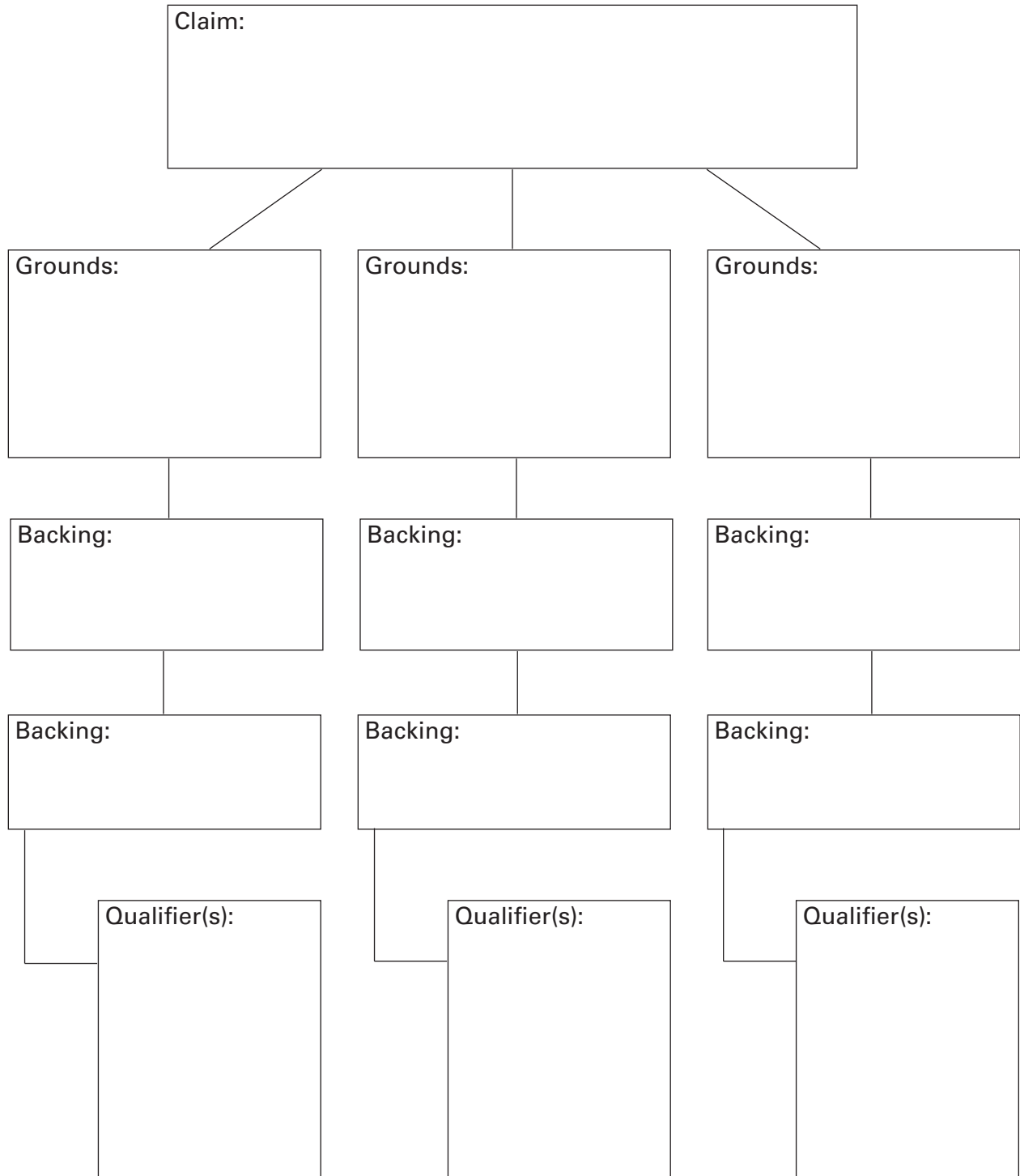
Extra Support

- Highlighting the elements of a claim and its support before asking students to examine the claim

Extension

- Asking students to find claims in advertising and the media and to examine the support provided for them to determine if they are valid or invalid

Diagramming an Argument



Judging Reasoning and Evidence in an Author's Work

Students apply their knowledge of reasoning and argumentation to delineate and evaluate the arguments presented in a text. To delineate an argument, students read a text and identify the claim, grounds, backing, and qualifiers. To evaluate an argument, students must decide whether the reasoning is valid or logical (containing no errors) and whether the supporting evidence is sufficient and relevant. If the evidence is sufficient, there is enough of it; if the evidence is relevant, it is related to the claim.

Teacher Actions

- Defining vocabulary such as *delineate*, *valid*, *sufficient*, and *relevant*
- Explaining to students how to delineate and evaluate an in-text argument
- Having students delineate and evaluate arguments

Desired Student Responses

- Understanding terms related to delineating and evaluating arguments
- Executing the process of delineating and evaluating an argument

Extra Support

- Having students diagram the argument to visualize how the evidence supports the claim
- Providing a list of logical errors to look for in a text

Extension

- Having students rewrite illogical or poorly supported in-text arguments to be valid and well supported

Delineating and Evaluating Arguments

Title:

Author:

What is the author's claim?

What grounds does the author use to support that claim?

What backing backs up the grounds?

What qualifiers does the author give?

Does the argument contain logical errors?

Is the evidence sufficient?

Is the evidence relevant?

Identifying Statistical Limitations

Students find and analyze errors that commonly occur when using statistical data to support a claim. The five major types of statistical limitations for students to be aware of are: (1) regression toward the mean, (2) conjunction, (3) base rates, (4) the limits of extrapolation, and (5) the cumulative nature of probabilistic events.

Teacher Actions

- Explaining statistical limitations to students
- Asking students to examine claims for errors involving statistical limitations

Desired Student Responses

- Explaining different kinds of errors involving statistical limitations
- Recognizing examples of errors involving statistical limitations
- Explaining how an error involving statistical limitations invalidates a claim

Extra Support

- Telling stories that illustrate how ignoring or paying attention to specific types of statistical limitations led to good or bad conclusions

Extension

- Asking students to gather statistics about a topic and make conclusions about the topic based on the statistics, being careful to take statistical limitations into account

Technology Tips

- Use a social bookmarking tool such as Diigo to have students find and annotate examples of statistical limitation errors online and share them with their classmates.

Statistical Limitations

- **Regression toward the mean:** An extreme score on a measure is most commonly followed by a more moderate score that is closer to the mean—for example, an area that receives far more rain in a year than is normal will probably receive a more average amount of rain in the following year.
- **Errors of conjunction:** It is less likely that two or more independent events will occur simultaneously than that they will occur in isolation—for example, the probability of being struck by lightning *and* falling off a cliff while hiking is less than the probability of being struck by lightning or the probability of falling off a cliff.

Examining Errors in Reasoning

- **Keeping aware of base rates:** Using the general or typical patterns of occurrences in a category of events as the basis on which to predict what will happen in a specific situation—for example, if a golfer shoots over par on the first ten holes of a course, then shoots one under par on the eleventh hole, it is probably unwise to predict that he or she will shoot under par on the rest of the holes.
- **Understanding the limits of extrapolation:** Realizing that using trends to make predictions (that is, extrapolating) is a useful practice as long as the prediction does not extend beyond the data for which trends have been observed—for example, if a teacher has been tracking one class's level of understanding using formative assessment, he or she can't necessarily extrapolate that information onto another class.
- **Adjusting estimates of risk to account for the cumulative nature of probabilistic events:** Realizing that even though the probability of a risky event might be highly unlikely, the probability of the event occurring increases with time and the number of events—for example, the more often a person breaks the speed limit while driving, the more likely it is that he or she will get caught

Student-Friendly Prompts

In order to help students remember to examine arguments for errors in reasoning, teachers can use prompts and questions phrased in nontechnical language. Especially with younger students or students who are just learning these skills, it may be more effective to remind students, for example, to look for “getting off topic” rather than “evading the issue.”

Teacher Actions

- Explaining various reasoning errors in nontechnical terms
- Using student-friendly language to prompt students to look for errors in reasoning

Desired Student Responses

- Describing different kinds of errors in their own words
- Looking for errors when prompted in student-friendly terms

Extra Support

- Creating visual representations or symbols for various reasoning errors

Extension

- Asking students to use student-friendly prompts with each other

Looking for Errors in Reasoning

1. Does this argument make assumptions that are inaccurate?
2. Is there enough information in this argument to support this conclusion?
3. Is the information that supports the argument accurate?
4. Is this person letting their own opinions about the topic determine what conclusions they draw or what information they use to support those conclusions?
5. Does this argument get off topic or make points that are unrelated to the main point?
6. Does this argument assume that something that happened once or twice is true all the time?
7. Does this argument assume that the second of two events was caused by the first, just because it happened after?
8. Is this person ignoring the possibility that he or she could be wrong or ignoring all the evidence that the other side presents?
9. Does this person say unkind things about people who disagree with his or her point of view?
10. Does this argument use emotions instead of reasons?

Anticipating Student Errors

When presenting content, teachers can prevent confusion or missteps by pre-emptively addressing common errors. When planning a lesson or assignment, the teacher identifies errors that students are likely to make. Then, during the presentation of content, the teacher alerts students to the potential problems. For example, when a teacher introduces the process for finding the area of a right triangle, he recalls from previous years that students sometimes have difficulty identifying the base and height if the triangle has been rotated. He shows an example on the board in which the hypotenuse could be mistaken for the height and leads a discussion of why is this an error.

Teacher Actions

- Identifying potential student errors
- Incorporating awareness of these errors into instruction

Desired Student Responses

- Understanding why common errors are incorrect
- Avoiding errors in independent work

Extra Support

- Displaying common errors on a whiteboard or poster around the room for students to refer back to

Extension

- Asking students to identify potential errors and explain why they are wrong

Anticipating Errors Planning Worksheet

What content are you covering?

In your experience, what are common errors that students make with this content?

For each error, create an example that demonstrates the error and allows you to correct it.

Avoiding Unproductive Habits of Mind

Habits of mind are ways we regularly approach situations. Unproductive habits of mind are those that hinder us from completing complex tasks. Conversely, productive habits of mind are those that help us complete complex tasks. Productive habits of mind include the following.

- **Staying focused when answers and solutions are not immediately apparent:** This disposition is typically executed when we are trying to solve a complex problem. It starts by recognizing that we have become frustrated because we can't find an answer or solution and are about to give up on the task. Upon this realization, we then re-engage in the task even though we are experiencing ambiguity.
- **Pushing the limits of your knowledge and skills:** This disposition is typically executed during long-term projects. It begins by recognizing that we have set goals that are limited by our natural tendency to operate within our zone of comfort. Upon this realization, we then adjust our goals such that their accomplishment will require us to acquire new knowledge and skills.
- **Generating and pursuing your own standards of excellence:** This disposition is typically executed when we are trying to create a product. It starts by consciously thinking of how the product will look when it is complete and the standards by which we will judge how well we did. While considering standard conventions for the product, we might adjust them so that they coincide with our personal level of development.
- **Seeking incremental steps:** This disposition is typically executed when we are learning something new that involves a number of interacting parts. Rather than trying to grasp the entire system as a whole, we continually strive to understand small subsets of the entire system. With the acquisition of each subset, we examine how it affects our understanding of the system as a whole and make adaptations in our thinking as necessary.
- **Seeking accuracy:** This disposition is typically executed when we are gathering information about a topic. It begins with an analysis of the source of the information we are receiving. If we are not completely sure of the accuracy of a source we then consult other sources we are more sure contain accurate information about the topic.
- **Seeking clarity:** This disposition is typically executed when we are trying to understand something new. It begins by asking ourselves if we have any confusions regarding the information we have processed thus far. If we do, then we stop taking in new information and seek clarification from whatever resources are available.
- **Resisting impulsivity:** This disposition is typically executed when we wish to respond to some stimulus or form a conclusion based on new information we have processed. It begins by realizing that we have an urge to respond or form a conclusion without collecting more information. We briefly pause and think about our response or conclusion with an eye toward making revisions.
- **Seeking cohesion and coherence:** This disposition is typically executed when we are creating something that has a number of interacting parts. Seeking cohesion means that we are continually monitoring the extent to which relationships between component parts are solid and stable and making adjustments if they are not. Seeking coherence means that we are continually monitoring whether the interaction of the parts is producing the desired effect and making adjustments if it is not.

Examining Errors in Reasoning

Unproductive habits of mind are ways of approaching situations that are the opposite of the productive habits of mind. For example, while a productive habit of mind would be staying focused when we are trying to solve a complex problem, an unproductive habit of mind would be quitting as soon as we get frustrated. While a productive habit of mind would be pushing ourselves out of our comfort zone when working on a long-term project, an unproductive habit of mind would be backing down any time we notice that we are uncomfortable executing our current level of knowledge and skill.

Teacher Actions

- Presenting students with various productive habits of mind
- Exemplifying unproductive habits of mind as the antithesis of productive habits of mind
- Providing opportunities for students to analyze whether they are exhibiting productive or unproductive habits of mind

Desired Student Responses

- Explaining the difference between productive and unproductive habits of mind
- Identifying examples of productive and unproductive habits of mind

Extra Support

- Providing examples from movies of people engaging in productive and unproductive habits of mind

Extension

- Having students generate other types of productive or unproductive habits of mind

Self-Analysis Questions

Use the following questions to help you determine if you are using productive or unproductive habits of mind in specific situations.

Habit of Mind	Situation	Self-Analysis Question
Staying focused when answers and solutions are not immediately apparent	You are trying to solve a problem that is very difficult	Am I giving up because I can't find the answer right away?
Pushing the limits of your knowledge and skills	You are working on a complex project or goal that takes a long time	Am I stopping because I have to acquire new knowledge or skills to accomplish this?
Generating and pursuing your own standards of excellence	You are working on a complex project or goal that takes a long time	Have I identified what the final product should look like in order for me to feel that I have done my best?
Seeking incremental steps	You are working on a complex project or goal that takes a long time	Am I breaking the big project into small pieces that can be more easily accomplished?
Seeking accuracy	You are seeing, hearing, or learning something new	Am I doing something or asking questions to determine if the new information is accurate?
Seeking clarity	You are seeing, hearing, or learning something new	Am I aware of when I'm getting confused and stopping to ask questions or do something to clarify things?
Resisting impulsivity	When you have to make a decision or react to something	Am I aware that I'm acting without thinking about my actions and then stopping for a moment to examine my conclusions?
Seeking cohesion and coherence	When you are creating something that has a lot of related parts	Am I making sure that all the pieces fit together and work toward a common goal?

REPRODUCIBLES

Teachers can use the following reproducibles to monitor their implementation of this element. The reproducible titled Tracking Progress Over Time helps teachers set goals related to their proficiency with this element and track their progress toward these goals over the course of a unit, semester, or year. Tracking Teacher Actions and Tracking Student Responses allow observers in classrooms to monitor specific teacher and student behavior related to this element. Teachers themselves can also use the Tracking Student Responses reproducible to document instances of student behaviors during class. The Strategy Reflection Log provides teachers a space to write down their thoughts and reflect on the implementation process for specific strategies related to this element. Finally, this section provides both a student survey and a teacher survey, the results of which provide feedback about teachers' proficiency with this element.

Tracking Progress Over Time

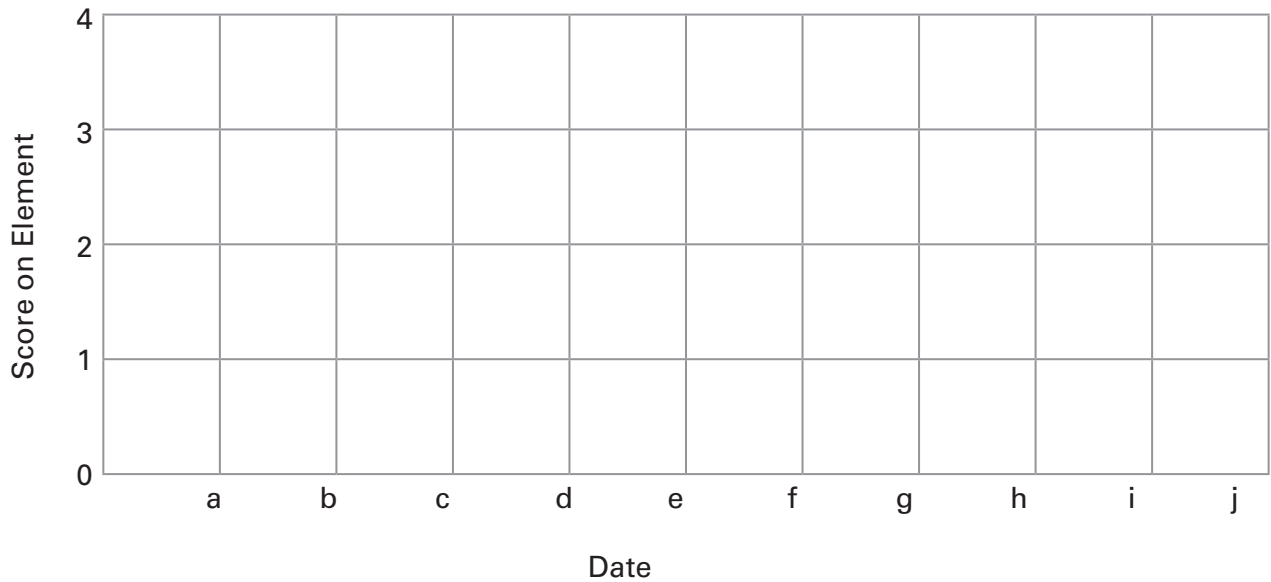
Use this worksheet to set a goal for your use of this element, make a plan for increasing your mastery, and chart your progress toward your goal.

Element: _____

Initial Score: _____

Goal Score: _____ by _____ (date)

Specific things I am going to do to improve: _____



a. _____

f. _____

b. _____

g. _____

c. _____

h. _____

d. _____

i. _____

e. _____

j. _____

Tracking Teacher Actions

During an observation, the observer can use this form to record the teacher's usage of strategies related to the element of examining errors in reasoning.

Observation Date and Time: _____ Length of Observation: _____

Check Strategies You Intend to Use	Strategies	Description of What Was Observed
	Identifying Errors of Faulty Logic	
	Identifying Errors of Attack	
	Identifying Errors of Weak Reference	
	Identifying Errors of Misinformation	
	Practicing Identifying Errors in Logic	
	Finding Errors in the Media	
	Examining Support for Claims	
	Judging Reasoning and Evidence in an Author's Work	

	Identifying Statistical Limitations	
	Student-Friendly Prompts	
	Anticipating Student Errors	
	Avoiding Unproductive Habits of Mind	
	Other:	
	Other:	

Tracking Student Responses

A teacher or observer can use this worksheet to record instances of student behavior to inform planning and implementation of strategies associated with examining errors in reasoning. Any item followed by an asterisk is an example of undesirable behavior related to the element; the teacher should look for a decrease in the number of instances of these items.

Observation Date and Time: _____ Length of Observation: _____

Behavior	Number of Instances
Noticing a logical error	
Identifying a specific type of error	
Explaining why specific reasoning is erroneous	
Explaining the support for a claim	
Describing the structure of an argument	
Evaluating the support for a claim	
Identifying statistical limitations	
Explaining why a statistical limitation invalidates a claim	
Identifying examples of productive and unproductive habits of mind	
Other:	
Other:	

Strategy Reflection Log

Use this worksheet to select a strategy, set a goal, and reflect on your use of that strategy.

Element: _____

Strategy: _____

Goal: _____

Date	How did it go?

Student Survey for Examining Errors in Reasoning

1. My teacher asks me to look for errors in the information I hear or read.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
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2. My teacher encourages me to examine the information presented to me to see if I think it is true.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
-------------------	----------	-------------------------------	-------	----------------

3. I know the differences between errors of faulty logic, attack, weak reference, and misinformation and look for these types of errors in the media, in texts, and in what I hear people say.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
-------------------	----------	-------------------------------	-------	----------------

4. I can figure out if a conclusion is likely to be true by identifying its premises.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
-------------------	----------	-------------------------------	-------	----------------

5. I can identify claims and delineate the grounds, backing, and qualifiers that support them.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
-------------------	----------	-------------------------------	-------	----------------

6. When I speak or write, my reasoning is logical.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
-------------------	----------	-------------------------------	-------	----------------

7. I try to avoid unproductive habits of mind.

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
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Teacher Survey for Examining Errors in Reasoning

1. I ask my students to examine information for logical errors.

Often Sometimes Rarely Never I don't know

2. I ask my students to examine the strength of the evidence supporting an argument.

Often Sometimes Rarely Never I don't know

3. I ask my students to examine information for statistical limitations.

Often Sometimes Rarely Never I don't know

4. I have my students look for reasoning errors in the media.

Often Sometimes Rarely Never I don't know

5. My students can describe different types of logical errors.

Often Sometimes Rarely Never I don't know

6. My students can evaluate the strength of an argument.

Often Sometimes Rarely Never I don't know

7. My students can identify statistical limitations.

Often Sometimes Rarely Never I don't know

8. My students can identify productive and unproductive habits of mind.

Often Sometimes Rarely Never I don't know