18. What do I typically do to help students examine errors in reasoning?

When content is informational, the teacher helps students deepen their knowledge by examining their own reasoning or the logic of the information as presented to them.

<table>
<thead>
<tr>
<th>Teacher Evidence</th>
<th>Student Evidence</th>
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<tbody>
<tr>
<td>Teacher asks students to examine information for errors or informal fallacies such as:</td>
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<tr>
<td>• Faulty logic</td>
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<tr>
<td>• Attack</td>
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<tr>
<td>• Weak reference</td>
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<td>• Misinformation</td>
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<td>Teacher asks students to examine the strength of support presented for a claim by looking for the following:</td>
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<tr>
<td>• Statement of a clear claim</td>
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<tr>
<td>• Evidence for the claim presented</td>
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<tr>
<td>• Qualifiers presented showing exceptions to the claim</td>
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<tr>
<td>Teacher asks students to examine claims to determine if they contain statistical limitations involving regression, conjunction, base rates, extrapolation, or the cumulative nature of risk.</td>
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<tr>
<td>When asked, students can describe errors or informal fallacies in information.</td>
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<tr>
<td>Student artifacts indicate that they can identify errors in reasoning.</td>
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<tr>
<td>When asked, students can explain the overall structure of an argument presented to support a claim.</td>
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<tr>
<td>When asked, students can describe common statistical errors.</td>
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</tbody>
</table>

How Am I Doing?

<table>
<thead>
<tr>
<th>Helping students examine errors in reasoning</th>
<th>4 Innovating</th>
<th>3 Applying</th>
<th>2 Developing</th>
<th>1 Beginning</th>
<th>0 Not Using</th>
</tr>
</thead>
<tbody>
<tr>
<td>I adapt and create new strategies for unique student needs and situations.</td>
<td>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.</td>
<td>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 so in a somewhat mechanistic way.</td>
<td>I use the strategy incorrectly or with parts missing.</td>
<td>I should use the strategy, but I don’t.</td>
<td></td>
</tr>
</tbody>
</table>

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Element 18: What do I typically do to help students examine errors in reasoning?

**Strategies**

*Identifying errors of faulty logic*

Students find and analyze errors of faulty logic including contradiction, accident, false cause, begging the question, evading the issue, arguing from ignorance, composition, and division. Marzano and Brown (2009) defined these errors in the following ways (p. 95):

- **Contradiction**—presenting conflicting information
- **Accident**—failing to recognize that an argument is based on an exception to a rule
- **False cause**—confusing a temporal (time) order of events with causality or oversimplifying the reasons behind some event or occurrence
- **Begging the question**—making a claim and then arguing for the claim by using statements that are simply the equivalent of the original claim
- **Evading the issue**—changing the topic to avoid addressing the issue
- **Arguing from ignorance**—arguing that a claim is justified simply because its opposite has not been proven true
- **Composition**—asserting something about a whole that is true of only its parts
- **Division**—asserting about all of the parts something that is generally, but not always, true of the whole

*Identifying errors of attack*

Students find and analyze errors of attack including poisoning the well, arguing against the person, and appealing to force. Marzano and Brown (2009) defined these errors in the following ways (p. 96):

- **Poisoning the well**—being so completely committed to a position that you explain away absolutely everything that is offered in opposition to your position
- **Arguing against the person**—rejecting a claim using derogatory facts (real or alleged) about the person who is making the claim
- **Appealing to force**—using threats to establish the validity of a claim

*Identifying errors of weak reference*

Students find and analyze errors of weak reference including using sources that reflect biases, using sources that lack credibility, appealing to authority, appealing to the people, and appealing to emotion. Marzano and Brown (2009) defined these errors in the following ways (p. 96):

- **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
- **Sources that lack credibility**—using a source that is not reputable for a given topic
- **Appealing to authority**—invoking authority as the last word on an issue
- **Appealing to the people**—attempting to justify a claim based on its popularity
- **Appealing to emotion**—using a “sob story” as proof for a claim

### Identifying errors of misinformation

Students find and analyze errors of misinformation including confusing the facts and misapplying a concept or generalization. Marzano and Brown (2009) defined these errors in the following ways (p. 96):

- **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

- **Misapplying a concept or generalization**—misunderstanding or wrongly applying a concept or generalization to support a claim

### Practicing identifying errors in logic

The teacher uses practice exercises to help students identify errors in logic. The teacher can create his or her own exercises or use those found in *Teaching and Assessing 21st Century Skills* (Marzano & Heflebower, 2012) or online at marzanoresearch.com/classroomstrategies.

### 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.

### Examining support for claims

Students examine the support provided for a claim by analyzing the grounds, backing, and qualifiers that support it, as follows:

- **Grounds**—initial evidence for a claim. Students should analyze claims to see if they provide grounds that answer the question, *Why is this claim true?* Grounds might be common knowledge, expert opinion, experimental evidence, or factual information.

- **Backing**—additional information about grounds that helps establish their validity.

- **Qualifiers**—exceptions to claims. The number of qualifiers needed for a claim can help determine the certainty of a claim.

### 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. Marzano and Brown (2009) defined these limitations in the following ways (pp. 127–128):

1. **Regression toward the mean**—being aware that an extreme score on a measure is most commonly followed by a more moderate score that is closer to the mean

2. **Errors of conjunction**—being aware that it is less likely that two or more independent events will occur simultaneously than that they will occur in isolation
3. **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.

4. **Understanding the limits of extrapolation**—realizing that using trends to make predictions—extrapolating—is a useful practice as long as the prediction does not extend beyond the data for which trends have been observed.

5. **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.

**Technology Links**

- Work with the district and school to create electronic collections of resources to help students find errors in reasoning (for example, a common list of errors in reasoning with definitions and examples). The use of a common language from class to class will help students recognize and label errors more easily.

- Use audio and video clips from the news media as examples of errors in reasoning. Ask students to find and label the errors, and then ask them to rerecord their own versions of the clip with the errors eliminated.