Explicit Instruction for Mathematics Vocabulary

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Characteristics of Effective Vocabulary Instruction

• More than copying words and looking up definitions
• Unambiguous and contextual
• Multiple exposures
• Active engagement

Explicit Vocabulary Instructional Routine

1. Introduce the word and enter in Vocabulary Log
2. Introduce the meaning of the word
   • Student-friendly explanation
   • Determine critical attributes
3. Illustrate with examples
4. Verify students’ understanding
   • Students distinguish between examples and non-examples
   • Students generate examples
   • Students show they know how to use the word

Four-Column Organizer for Word Mastery (Lazo & Dougherty, 2007)

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
<th>Connect</th>
<th>Visual</th>
</tr>
</thead>
<tbody>
<tr>
<td>malleable</td>
<td>Capable of being pounded or rolled into thin sheets without shattering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>brittle</td>
<td>Likely to shatter or break into pieces when pounded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>conductor</td>
<td>Matter that allows electricity to flow through easily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>insulator</td>
<td>Matter that does not allow electricity to pass through easily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>luster</td>
<td>The way matter reflects light from its surface. Can be shiny or dull</td>
<td></td>
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</tr>
</tbody>
</table>

Student-friendly explanations

1. Contain known words
2. Indicate how word is used
   • Attention
     • Non-Example: (1) The act or state of attending through applying the mind to an object of sense or thought. (2) A condition of readiness for such attention involving a selective narrowing of consciousness and receptivity.
     • EXAMPLE: When you give something your attention, you look or listen carefully

Examples/Non-examples (Beck, McKeown, & Kucan, 2008)

• Students determine if statements represent example of target word and explain choice to a partner.
• Materials
  • Teacher-generated example statements
• Sample variation 1
  • “If I say something that sounds precarious, say ‘precarious’ when I give the signal. If not, don’t say anything.”
  • “Walking over a rickety bridge that goes over a deep canyon.”
  • Students respond chorally
  • “Now, 1s tell 2s why that statement showed precarious”
  • Partners explain, and teacher calls on one person to report out.
Examples/Non-examples
(Beck, McKeown, & Risan, 2008)

• Sample variation 2
  “2s tell 1s which would make you scream frantically: a kitten purring or a rattlesnake rattling?
  Partners respond and explain; teacher calls on a 1 to report out.
• Sample variation 3
  “Would you want the people who cook the school lunch to be versatile or frugal? Everyone?”
  Students respond chorally
• “1s tell 2s why you want them to be versatile?

Students generate examples through Graphic Organizers
• Concept of Definition Map

Dramatic Movement
(adapted from Alber & Foil, 2003)

• Kinesetically “act out” the meaning of target words
• Teacher-demonstrated or student-generated
• Procedure
  1. Place target words in a hat/bow
  2. Student select word
  3. Act out (i.e., pantomime) meaning
  4. Other students guess what is being acted out
• Sample
  “deciduous”
  Student pantomimes being a tree with arms out, fingers spread.
  To show season change, sway back and forth, hands fluttering down to the floor. Then, stand tall with hands in fists.

Wordo
(Rasinski, Padak, Newton, & Newton, 2007)

• Vocabulary version of Bingo
• Materials
  • List of 16 words
  • Wordo card for each student/pair
• Procedure
  1. Write words on board
  2. Students may choose a FREE space on Wordo card, then write words randomly in remaining boxes
  3. Call out clue for each word
  • student-friendly explanation, synonym or antonym, sentence with target word missing
  4. Students mark answers on sheet with pens or removable pieces
  5. Winner gets four in any directions, becomes caller for next round

Odd Word Out
(Rasinski, Padak, Newton, & Newton, 2007)

• Students select word that is dissimilar from group and explain why it doesn’t fit the group
• Materials
  • Teacher-generated worksheet
• Sample
  • A worksheet would include variations on this for all words being reviewed
  
  Odd Word Out
  Look at the four words. Write the word that doesn’t belong on the line. Then write how the other words are the same.
  premature
  premised
  premised
  prenatal
  The word that doesn’t belong is _________.
  The other words are the same because _________.

Semantic Feature Analysis  
(Pittelman, Heimlich, Berglund, & French, 1991)

- Link students’ knowledge with target words that are conceptually related
- Materials
  - Matrix for each student with words from the reading/unit
- Procedures
  1. Project matrix with vertical list of target words down left side
  2. Students suggest features to be written across top row
     - Teacher could have these filled out in advance
  3. Students complete matrix with a symbol for features that apply to each word
- Sample on next slide

SFA for ENERGY  
(adapted from Richardson, Morgan, & Fleener, 2012)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Renewable</th>
<th>Non-renewable</th>
<th>Manmade</th>
<th>Conservable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranium 235</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geothermal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passive solar heat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active solar heat</td>
<td></td>
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</tr>
<tr>
<td>Oil</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Coal</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Natural gas</td>
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<td></td>
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</tr>
</tbody>
</table>

SAFMEDS  
(Adapted from Graf, 2000)

- S – Say
- A – All
- F – Fast
- A – A
- H – Minute
- E – Each
- D – Day
- S – Shuffled

SAFMEDS are like flashcards:
- Text on both sides of card
- Learner sees what is on front of card
- Learner says what is on the back
- Use frequently to improve both speed and accuracy

SAFMEDS example Card

Front of Card | Back of card
---|---
- The combination of speed and accuracy is ________.
- Fluency

Using SAFMEds  
(Adapted from Eshleman, 2000)

1. Before starting, SHUFFLE the deck of cards
2. Feel free to STUDY cards before a timed session
3. Set timing sessions for 1 minute
   - You can time how long it takes to get through the entire deck, but repeatedly doing 1-minute timings is standard
4. The learner holds the cards
5. Set a timer and begin
6. For each card, SEE what is on front of card, then SAY what is on back out loud before turning it over
7. Place correctly answered cards in one stack, errors in another
8. Chart the number correct per minute
9. In general, top performance equals 50 terms stated correct in a minute
FIGURE 3.3. Math concept: Use of examples and non-examples.

**Setting:** Eighth-grade geometry

**Situation:** Vocabulary Instruction

**Step 1: Introduce the word. (I do it.)**

[Teacher displays the word.] This word is chord. What word? **Chord.**

**Extensions—Multiple-meaning words: Introduce other familiar uses of the word.**

You have probably heard the word chord in the past. In music, it is a group of three or more notes that are sounded together. For example, if you were playing piano, you might play three notes with the same hand at the same time. The group of notes would be a ____________ chord. On a guitar, the musician might press three fingers onto three different strings on the neck of the guitar to create a ____________ chord. In geometry, chord has an entirely different meaning.

**Step 2: Introduce the meaning of the word. (I do it.)**

**Option 3. Have students determine the critical attributes embedded in a glossary definition.**

Please locate the word chord in the glossary. [Teacher monitors.] Read the definition with me: A **chord** is a line segment whose endpoints lie on a circle. Record the word chord in your vocabulary log. [Teacher monitors.] Let's break the definition into the critical attributes. First, a **chord** is a ____________ line segment. We know that a line segment is straight. Next, the endpoints of the line segment lie on a ____________ circle. Please list the critical attributes under the word.

[Students' logs should be similar to this:]

- chord
- line segment
- endpoints lie on circle

**Step 3: Illustrate with examples and non-examples. (I do it.)**

- The line segment AB is a chord. It is a line segment, a straight line with two endpoints, and the endpoints lie on a circle.

- The line segment CD is a chord. It is a line segment, and its two endpoints lie on a circle.

- The line segment EF is not a chord, because endpoint E is not on the circle.

- The line segment GH is not a chord, because only endpoint G lies on the circle.

**Step 4: Guide students in analyzing examples and non-examples, using the critical attributes. (We do it.)**

- Is AB a line segment? Yes. Are the endpoints on the circle? Yes. Is AB a chord? Yes.

- Is CD a line segment? Yes. Are the endpoints on the circle? No. Is CD a chord? No. Even though it is a line segment, the endpoints are not on the circle.