

English as a Second Language: Integrating English within Math Content

The integration of the English language within math content is essential for assisting ESL students to develop a good understanding of mathematics. The following are 17 examples of teaching strategies and instructional techniques for integrating English and math lessons.

1. Teach mathematical vocabulary and language structures daily.
2. Post math vocabulary cards around the classroom on completed problems, number lines, rulers, fraction diagrams, and other objects.
3. Model the problem solving process by talking aloud while solving problems on the overhead, chalkboard, or interactive white board to demonstrate thinking processes.
4. Use math Cloze exercises or sentence prompts for students to copy and complete when they enter class or during reviews.
5. Give students a computation problem to solve and then have them write the steps they used to solve it in complete English sentences.
6. Design multi-sensory lessons that address various student learning styles, i.e., visual, auditory, tactile, and kinesthetic.
7. Use visuals whenever possible to reinforce auditory instruction, i.e., charts, graphs, manipulatives, diagrams, models, real objects.
8. Provide explicit instructions and practice with reading and writing word problems. Teach students to identify key words for solving word problems and identifying mathematical operations.
9. Use graphic organizers to visually represent mathematical concepts.
10. Simplify the language used rather than the mathematical concepts taught by using known vocabulary and simple sentence constructions.
11. When ESL students speak, focus on their message rather than their grammatical skills and accuracy. Respond using the proper grammatical form rather than overtly correcting their mistakes.
12. Integrate reading and writing about math through the use of journals, learning logs, and literature.
13. Give ESL students alternate ways to participate in whole-class discussions and respond to questions, i.e., think/pair/share, flashcards to raise over head, hand and/or body movements, individual chalkboards for solving computations.
14. Integrate hands-on activities by using manipulatives, real life materials, and calculators.
15. Integrate educational technology tools, i.e., Web 2.0 online tools, interactive math websites, and interactive computer games.
16. Teach math note-taking skills, because copying notes is an effective way for learning English writing conventions.
17. Review mathematical vocabulary and concepts using math games, examples include Tic-Tac-Toe, bingo, and concentration.

Sample Structures for Practicing Academic Language

Think-Pair-Share: Pairs of students are given a question or a problem. They think quietly of an answer or solution. They discuss their response with their partner. One partner shares with the entire class.

Give One/Get One: Partners receive a worksheet to discuss and complete. One partner gives an answer, the other agrees or gives the correct answer.

Three Step Interview: Students form pairs and one partner interviews the other on a topic for two or three minutes; partners switch roles. Two pairs combine to form groups of four. Each group member introduces his or her partner, sharing the information from the original interview.

Jigsaw: Each member of a home group is assigned a topic to research. Students then meet in expert groups with others assigned the same topic to discuss and refine their understanding. Students return to their home groups and members teach their topics to each other.

Numbered Heads Together: In teams of four, each student is assigned a number (1-4). A problem or question is presented. Groups discuss topic for a set amount of time. Teacher calls out a number after randomly selecting a numbered card from a deck, a spinner, or some other form of selection. The person whose number is called reports for the group.

Roundtable: Groups of three or more students brainstorm on a topic. Each member takes a turn to write down one new idea on a single piece of paper. The process continues until members run out of ideas. One group member is reporter for the group.

Whip Around: A question or problem that requires a short answer (one or two word responses) is asked. Teacher whips around the room calling on each student to reply with their answer.

Talking Chips: Each member receives the same number of chips (plastic markers, pennies ...). Each time a member wishes to speak, he or she tosses chip into the center of the table. Once individuals have used up their chips, they can no longer speak. The discussion proceeds until all members have exhausted their chips.

Co-op Cards: Each partner in a pair prepares a set of flashcards with a question or a problem on the front and correct answer(s) on the back. One partner quizzes the other until the latter answers all the questions or problems in the set correctly. Then they switch roles and use the other set of flashcards.

Send a Problem: A group writes a question or problem on a flashcard. The group reaches consensus on the correct answer(s) or solution and writes it on the back. Each group then passes its card to another group. The new group answers the problem without looking at the previous answer. They list their agreed-upon answer on the back of the card. Cards rotate until they reach their original group. This group checks and compares all the answers listed on the cards.

Think-aloud Pair Problem-solving: Students are paired off, assigned a role of problem solver (student A), or listener (student B). Present a problem to solve. Student A solves the problem by talking aloud, while student B encourages, supports, and asks questions (to help with the solution). Randomly select a group and ask them to present the solution to the class. Present a second problem, but this time ask the students in pair to reverse roles.

Thumbs Up/Thumbs Down: The teacher poses a question or a problem that can be answered yes or no. At the teacher's signal the entire class responds by showing thumbs up or down.

Group Concept Mapping: Similar to the individual concept map, groups discuss ideas and information. They cluster ideas on a paper and draw connections.

Response Sticks: Have each student write their name on a popsicle stick or tongue depressor. Keep sticks in a cup at your teaching station. When asking questions pull one stick out and ask that student to answer.

Reflecting on Learning

Expressing Opinion

I think...

I believe / imagine / predict / hypothesize...

It seems to me that...

In my opinion...

I agree with _____ that...

My idea is similar / related to _____'s idea.

Not everyone will agree with me, but...

I conclude / deduce / suspect / speculate...

As _____ already pointed out, it seems to me...

Individual Reporting

I found out that...

I learned / heard / discovered that...

_____ told me...

_____ explained to me...

_____ mentioned / emphasized that...

_____ shared with me...

Outcome Statements

I learned...

I discovered...

I was surprised that...

I now realize...

I want to find out more about...

I am beginning to wonder about...

Partner / Group Reporting

We decided / agreed that...

We concluded that...

We noticed that...

Our group sees it differently.

We have different opinions. Some of us believe that... . One group member thinks...

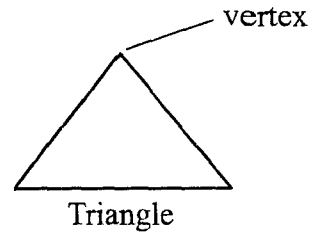
We had a different approach / idea / answer / solution.

Sample Visuals for Academic Language

Chain of Events: Used to describe the stages of the steps in a procedure.

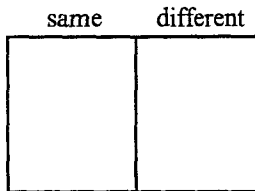


Picture Input: Used to develop understanding of topic and vocabulary.

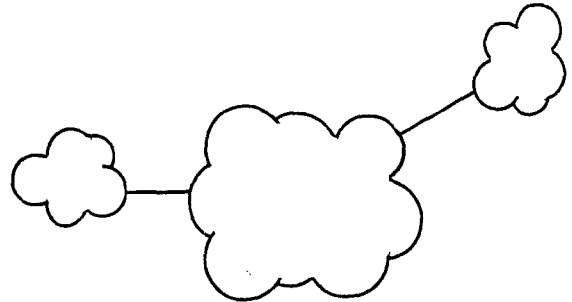


Compare / Contrast: Used to show relationships between two items.

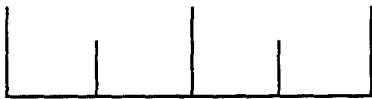
triangles and squares



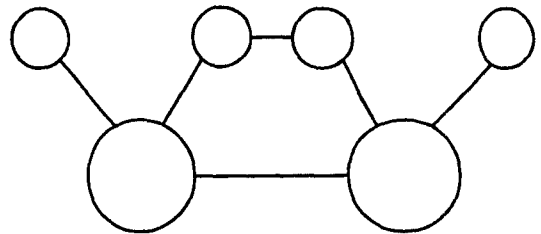
Clustering: Used to generate ideas and identify patterns around a stimulus word.



Continuum: Used for showing degrees of something or rating scales.



Double Cell Diagram: Used to describe two items linked by characteristics or attributes.



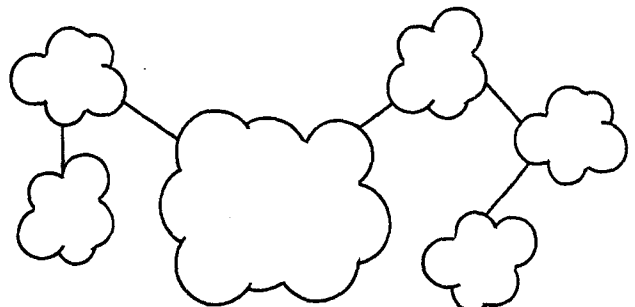
KWHL Chart: Used for planning and gathering initial information.

Critical Questions:

- What do we already know?
- What do we want to find out?
- What did we learn?

Know	Find out	Learn

Concept Map: Used to describe a central idea—a thing, a process, a concept, a proposition.



Sample Academic Forms and Functions in Mathematics

Function	Target Forms	Beginning Early Intermediate	Intermediate	Early Advanced/ Advanced
Describing Nouns	Nouns, Pronouns, Adjectives	A _____ has _____	A _____ has _____, _____, and _____ may not be _____.	A _____ always has _____, but _____ are not always _____.
Categorizing	Nouns, Adjectives	A _____ is a _____.	A _____ is a _____ because _____.	A _____ is a _____ because _____. It is not _____ because _____.
Describing Location	Verb tenses, Adverbs	I am putting the _____ next to the _____.	The _____ was next to the _____. _____ made a _____.	While the _____ and the _____ are unique shapes, together _____ make a _____
Comparing / Contrasting	Adjectives and Conjunctions Comparative Adjectives	A _____ has _____.	A _____ has _____, but a _____ has _____. _____ both have _____.	While a _____ and a _____ both have _____, a _____'s _____ are always _____, but a _____s may not always be _____.
Summarize	Compound sentences Conjunction that summarize (in conclusion)	_____ have _____ and _____.	_____ always have _____. The _____ are not always the same size.	In conclusion, _____ have _____ and _____, however _____ are not always congruent.
Sequence	Adverbs that order (first, third) Conjunctions with time (then, next)	First I put the _____. Second I put the _____.	I put the _____, then the _____.	Whenever I placed the _____ beside the _____, _____ created a _____.
Giving/Following Directions	Imperative statements Present, present progressive tenses	Pick up the _____.	Place the _____ on the right of the _____.	If I put the _____ next to the _____, then it will be a _____.
Hypothesizing	Future and conditional tenses Auxiliary verbs	N/A	If I put the _____ next to the _____, I will make a _____.	I ought to create a _____ by placing the _____ and the _____ together.
Predicting	Future and conditional verbs	The _____ will have _____.	A _____ and a _____ will make a _____.	If the _____ had been placed beside the _____ it would have been a _____.
Making inferences	Future tense verbs Auxiliary verbs	N/A	A _____ and a _____ will make a _____.	Connecting a _____ and a _____ will create a _____.
Drawing conclusions	Comparative adjectives	N/A	_____s are stronger because _____ have _____	Connecting a _____ and a _____ will create a _____.
Cause/Effect	Past tense and conditional verbs	The _____ and the _____ made a _____.	Together the _____ and the _____ make a trapezoid.	If we hadn't put the _____ and the _____ together we wouldn't have made a _____.

Levels of English Language Proficiency

Reading Success Network, SCCAC

Comprehends detailed information with fewer contextual clues on unfamiliar topics; produce, initiate & sustain spontaneous language interactions using circumlocution when necessary; interact with increasingly complex written material while relying on text and prior knowledge to obtain meaning from print; writes to satisfy limited social & academic needs via the recombination of learned vocabulary & structures; participates actively in all content areas; express more complex feelings, needs/opinions via extended oral & written production; & participates actively in non-academic settings requiring English

Comprehends a sequence of information on familiar topics presented through stories and face-to-face conversations; produces basic statements & asks questions in direct informational exchanges on familiar/routine subjects, interacts w/ variety of familiar print using previously learned words/phrases; writes basic personal information & short responses within structured context; uses high frequency vocabulary drawn from other content areas; expresses basic personal and safety needs; responds to questions & simple phrases; participate in simple, face-to-face conversations

Early Intermediate

Understands high frequency words & basic phrases in immediate & concrete surrounding; produces learned words, phrases & gestures to communicate needs; interacts with frequently-used English print in a limited fashion; demonstrates initial English print awareness; demonstrates understanding and writes familiar words, phrases & questions drawn from content areas; follows classroom routines/schedules; expresses basic personal & safety needs; responds to questions with one/two word answers; uses social conventions

Intermediate

Comprehends information on familiar topics in contextualized settings; produce sustained conversation on expanding variety of general topics; interacts interdependently with a variety of simplified print; writes basic information and expanded responses in contextualized settings; comprehend main ideas and basic concepts in content areas; express a variety of personal and safety needs and respond to questions in short sentences; & initiate simple conversations with English speakers outside of schools

Early Advanced

Comprehends concrete and abstract topics and recognizes language subtleties in a variety of communicative settings; produce, initiate, and sustain extended interactions tailored to specific purposes and audiences; read, with a limited number of comprehension difficulties, grade-level written material; write to meet most social needs and academic demands for specific purposes and audiences and audiences; participate fully in all content areas at grade level; express and satisfy personal and safety needs in a wide variety of settings; and participate fully in non-academic settings requiring English.

Advanced

Prompts for math journals (assessing disposition)

- My best experience with math was when...
- My worst experience with math was when...
- I hate math because...
- I want to become better at math so that I...
- Is math your favorite subject? Why or why not?
- What did you like most about your math class last year? What did you like the least?
- People who are good at math...
- One mathematics activity I really enjoy is _____ because...
- When I study for a test, I...
- When it comes to math, I find it difficult to...
- When I hear someone say math is fun, I...
- When I see a word problem, the first thing I do is _____ then I _____.
- Does mathematics or math class scare you in any way?
- Draw a picture of a mathematician and describe what a mathematician does.
- Explain how you feel about mathematics now as compared to before you took this class.

Prompts for learning logs (assessing learning)

- My three personal goals for this term are...
- Explain everything you know about _____.
- What is a _____? Write all you can about _____.
- Find something that you learned today that is similar to something you already knew. Write about these similarities.
- How would you use what you learned today in your life?
- The main idea of today's lesson was _____.
- Write a definition in your own words of a _____.
- What is the most significant thing you learned this week?
- What questions are still unanswered at the end of this week?
- Last week in math I learned _____.
- My favorite part of math last week was _____.
- The hardest part of math last week was _____.
- This is how I used math this week (outside of school) _____.
- Describe any discoveries you made about mathematics today, this week/month/year.
- Give two examples of situations in which you have used, seen or can find the concept of _____ OUTSIDE of this classroom.

- I want to learn more about _____.
- I wish I knew more about _____.
- I need more help understanding _____.
- My math grade now is _____ because _____.
- What was your grade on the exam/quiz/project? If you were not satisfied with your score, what can you do to improve? If you were happy with your score, what did you do well?
- Write instructions for a (insert grade level here) grader to follow when (adding fractions, finding percentages, calculating averages, etc.)
- How would you describe a _____?
- The difference between _____ and _____ is _____.
- Compare and contrast the terms _____ and _____.
- What patterns do you notice in _____.
- You know several ways to _____ (solve an equation, add fractions, etc.) Which method is your favorite? Why?
- Make a list of objects or figures in the room which have _____. How can you tell?
- Write a letter to your teacher explaining what you understand about _____, and what is still giving you trouble.
- Write and solve a word problem whose solution involves _____.
- Describe practical uses for _____.
- Write _____ possible test questions for this unit.
- Write a letter to a student who will be taking this class next year, giving some advice about this class.

Prompts to use for problem-solving (assessing process)

- The most important part of solving a problem is _____.
- Describe the process you undertook to solve this problem. (Problem needs to be provided.)
- I knew I was right when _____.
- Tips I would give a friend to solve this problem are _____.
- Could you have found the answer by doing something different? What?
- What strategy did you use to solve this problem and why?
- Was this problem difficult or easy? Why?
- Were you frustrated with this problem? Why or why not?
- Where else could you use this type of problem solving?
- What would happen if you missed a step? Why?
- What other strategies could you use to solve this problem?