



Supporting Dual Language Learners (DLLs) and English Learners (ELs) in Early Math

RESEARCH-BASED TIPS FOR TEACHERS



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General Approaches and Tips

Bilingual instruction is ideal (Collier & Thomas, 2012; National Academies of Sciences, 2017; Thomas & Collier, 2014). When math activities are taught in English, an effective strategy to maximize comprehension is to briefly preview the big ideas, and the critical math vocabulary, in the child’s primary language (see also “Cognates”) so that they can better understand English instruction (Clements & Sarama, 2014; Sarama & Clements, 2009).

Remember that children who are Dual Language Learners and English Learners (ELs)(henceforth, “DLLs/ELs”) are learning a new language while still developing their home language. Additionally, they are in the process of forming new relationships with adults and other children as well as participating in new routines and learning about expectations for their behavior.

Expectations that Support DLLs/ELs

Teachers can and must learn to distinguish between the length of time it requires for a child to acquire a second language and their ability to use their second language in a school context. Research suggests that it takes an average of six years for children to perform at or above grade-level academically, if they receive high-quality dual language instruction beginning at kindergarten, during which half of instruction is in their home language. It may take 7-10 years or more if the student has not had the opportunity to attend school in their home language (Collier & Thomas, 2012; National Academies of Sciences, 2017; Thomas & Collier, 2014). Indeed, the amount and quality of home language support in schools is the most powerful predictor of the long-term success of language minority students (Collier & Thomas, 2012; Thomas & Collier, 2014).

DLLs/ELs are a highly heterogenous group (National Academies of Sciences, 2017). Some have high proficiency in their home language (L1) and are



low in English (L2), others are low in L1 and more proficient in L2, still others are mid-range for both L1 and L2. Teachers can't only rely on a DLL or EL label and use a "one size fits all" approach. It is important to understand precisely where students are with regard to their language development, in either language.

Develop Vocabulary and Preview Big Ideas

English learners may benefit from clarification of some common words and phrases that proficient English speakers probably know. Occasionally words have more than one meaning, words sound the same but have different meanings, or are used in potentially puzzling idiomatic expressions. Before or during the lesson, be sure to clarify the words and phrases (below) as others that might be unfamiliar.

Be aware of common phrases, idioms, and colloquialisms. There are many words in English that have multiple meanings, which can cause problems for any children, but especially DLLs/ELs. For example, children may hear the words one/won, two/to/too, and four/for and be confused. Recommend to the children that when they hear a word that does not make sense to them they should think about the context. In this case, they are naming numbers, so they should probably think of the number word. Recommend that if they get stuck and do not understand, they can always ask you or a friend what a word means.

Be Linguistically Responsive

Be aware of the language or linguistic diversity of children. Some tips follow.

- Find out to what extent the child is able to talk about the mathematical topic in his/her home language or English.
- If you have access to a speaker of the home language: One strategy to maximize comprehension is to briefly preview big ideas in the child's home language so that the child can better understand instruction.
- If you do not have access to a speaker of the home language: One strategy to maximize comprehension is to have basic vocabulary on hand to link words in the home language to English words. In this case, the numerals one through five, "How many do you see?" (¿Cuántos ver?). Relevant words or phrases can be found by asking family members, school district staff, or volunteers (National Academies of Sciences, 2017).
- Use "you" language. Saying "You are given 8 candies..." rather than "Jose was given 8 candies..." helps guide young children to understand the problem and produce correct answers (Artut, 2015; Di Stefano, Litster, & MacDonald, 2017).
- Avoid phrasal verbs (a verb with another word). As an example, "take off" and "take away" can be confusing. A good substitution is the English

“remove”/Spanish “remover” (Di Stefano, Litster, & MacDonald, 2017).

- Consider tiered levels of questions in order to assess child understanding (Krashen & Terrell, 1983; Tabors, 2008).

Non-verbal questions (closed): “Show me...”, “Point to...”

Telegraphic/Formulaic (closed): Yes/No, Either/Or

Productive (open-ended): “How do you know?”, “What is another way to show me X?”

Support Math Talk and Communication

At all ages, support math talk and other modes of communication. Accept multiple representations as responses to tasks – for example, fingers, marks on paper. The following 5 strategies are particularly helpful for DLLs/ELs (Banse, Palacios, Merritt, & Rimm-Kaufman, 2016).

1. Ask open-ended questions (e.g., “How do you know?”).
2. Follow open-ended questions with close-ended questions, as needed (e.g., Re-voice the child’s spoken or written idea by asking “Is this what you mean?”).
3. Scaffold students’ responses by repeating, extending, and rephrasing. For example, if a student is describing a triangle and says “It has three”, the teacher could repeat, extend, and rephrase by saying: “Yes, it has three! There are three straight sides and three angles, which is how we know it’s a triangle.”
4. Model mathematical vocabulary in context. For example, “You only have *two* crackers! You can have three! How many more do you need to have three?”
5. Strive to include DLLs/ELs in mathematical discourse each day.

Focus on the math DLLs/ELs Say and Do

It can be tempting as a teacher to solely focus on DLLs’ language abilities. As a result, a teacher may either (a) exclude DLLs from all math discourse, assuming they’re not capable of participating or (b) use discourse as an opportunity to correct DLLs’ language use. Unfortunately, neither of these approaches furthers DLLs’ math understanding. It is important to give DLLs regular opportunities to participate in math discourse *and* to pay attention to the math in DLLs’ responses (Moschkovich, 2015). A student may have low English proficiency but high math competencies (or vice versa, or any combination in between). If the teacher only pays attention to DLLs’ English language proficiency, then the teacher may overlook DLLs’ math abilities, and thus lose the opportunity to further their DLLs’ math understanding and that of their peers.

Paying attention to the math in DLLs’ responses will require a willingness

to consider multiple types of responses. Teachers may need to consider how DLLs use gestures, images, or switching back and forth between their first and second languages to participate (Shein, 2012). Most importantly, teachers must be willing to accept all of those forms of communicating as legitimate means of describing mathematical understanding.

In other words, to make learning and the learner visible, we must consistently and carefully listen first (Rinaldi, 2004). We must be sensitive not only with our ears, but with all of our other senses. Listening is an active verb and subjective act, as it requires that we interpret and give meaning to children's messages and ideas, which may take conventional and less conventional forms, symbols, and gestures.

In informal language, let's not get so hung up on correcting children's language that you miss the math that DLLs/ELs are capable of and thus move them forward. This is consistent with the developmental approach to math that uses learning trajectories.

Choose Materials To Support Language Development

Choose materials that give children clues about the competencies they are supposed to be learning, regardless of how much English or their first language they understand (Clements & Sarama, 2007/2013). See <https://www.naeyc.org/resources/pubs/tyc/oct2017/make-math-meaningful-diverse-learners>.

Repeated Experiencing

Experiences should be throughout the day! Songs with motions, finger plays, and chants are an excellent way to help English learners get a lot of repetition without the dreariness of drill-like sessions. The accompanying motions often can make the words more comprehensible. There are many counting songs and rhymes in English that may be new to English learners, such as the traditional song "This Old Man." Review the words and explain the meaning of the words and phrases in the song. In this example, point out that "knickknack paddy whack" is a nonsense phrase.

Pairing or grouping children who are DLLs/ELs with children whose home language is English during activities benefits all children. DLLs/EL children have the opportunity to interact with English speakers who may serve as language models and provide authentic practice for listening and speaking in English. In addition, English speakers can practice clearly communicating task directions as well as their own mathematical thinking and reasoning, as well as learn about other languages.

Cognates

Using cognates—words that are similar in two languages—takes advantage of what children and their families may know in their home language to support

the acquisition of math concepts in English. We list some Spanish Cognates in the Appendix. Other languages may also have cognates with English through shared Latin, Arabic, and Greek roots and affixes. Work with someone who knows the languages your children speak, including families, to develop a similar list of cognates.

Visual Aids

As you provide ongoing, special, focused experiences, use visuals and home-language support whenever possible (Clements & Sarama, 2014; Sarama & Clements, 2009). Write vocabulary words in English and in children’s home language with accompanying pictures. This will be a reference for the adults as well as for the children when they are engaged in both number and literacy learning.



Beyond Vocabulary

Help students see multiple meanings of terms in both languages (and watch for conflicts between the two languages), and address the language of mathematics, not just the “terms” of mathematics. Building on the resources that bilingual children bring to mathematics is also essential (see “Funds of Knowledge: Cultural Riches” below). Further, bilingual children can often see a general mathematical idea more clearly than monolingual children because, after expressing it in two languages, they understand that the abstract mathematical idea is not “tied” to given terms. Knowing a stop sign as “eight” or “ocho” or “hachi” sides helps children understand that the *concept* of eight is not tied to one specific word. In general, then, “talking math” is far more than just using math vocabulary.

Learning mathematics is not just about naming numerals and shapes, it’s about thinking and reasoning. And like other domains of development, learning math is facilitated through listening, speaking, and conversational turn-taking within the context of a caring relationship. Learning also occurs in the context of play and exploration.



Gesture

Many areas of mathematics lend themselves to the use of gesture, both from teachers and from children (e.g., geometry). Gestures can help teachers demonstrate and reify mathematical concepts for all children, but particularly for DLLs (Echevarria, Powers, & Short, 2006). Gestures can similarly help both teachers and DLLs describe mathematical ideas to one another during mathematical discussion (Shein, 2012).

Funds of Knowledge: Cultural Riches

All cultures have “funds of knowledge” on which to build (Moll, Amanti, Neff, & Gonzalez, 1992). These might be based on budget management, medicine, farming, carpentry, religion, childcare, etc. Work with your children’s families to bring these reference points, stories, and resources into your class.

Recommendations from Research: The National Academy of Sciences

Research has identified seven practices or guidelines for educating DLLs/ELs up through elementary school age, not specific to mathematics but important to all learning (National Academies of Sciences, 2017). We present these below, with our own suggestions specific to early math.

1. Provide explicit instruction in literacy components.
Emphasize the development of children’s phonemic awareness, phonics, oral reading fluency, and reading vocabulary. These practices can be implemented through reading books that have a mathematical narrative thread (e.g., Three Little Monkey’s for PreK) or rich, open-ended story problems (e.g., “how many pattern blocks of one shape will make the next larger shape” for Kindergarten) (see also Andrews & Trafton, 2002).
2. Develop academic language during content area instruction.
Here, “academic language” is defined as knowledge of specialized vocabulary (e.g., “take away” and “minus” indicate subtraction) and grammatical structures (e.g., “How many altogether?” suggests addition), language function (e.g., “How do you know?” as part of proof and refutation), and discourse structures (e.g., “Do you agree with his/her solution?”) – all of which serve the purpose of acquiring new knowledge and skills, and sharing and receiving information.
3. Provide visual and verbal supports to make core content comprehensible.
Determine when it is appropriate to “tell” or directly provide students with information versus engaging them in the creation of information and high-level questioning and discussion.
4. Encourage peer-assisted learning opportunities.

See: PALS (Peer-Assisted Learning Strategies; Calhoun et al., 2007) for recommendations on creating opportunities to talk about content in pairs or small groups.

5. Routinely capitalize on students’ home language, knowledge, and cultural assets.

Empirically supported examples included in this report:

- Storybook reading in the child’s home language.
- Providing opportunities for children to participate in conversational exchanges during instruction that permits some interpretation to take place.
- Providing definitions of words for targeted vocabulary in the home language.

6. Screen for language and literacy challenges and monitor progress.

Consider an example of the importance of screening and monitoring. Language is critical for children to develop and demonstrate math understanding. For example, if a teacher may ask a child who is DLL or EL a math question and the child gets it wrong, it may be because the child doesn’t understand the math, or that the language used got in the way. This practice reminds teachers that language is very much a part of math, and that both dimensions need to be monitored in order to accurately monitor and assess DLLs/ELs’ math understanding.

7. Provide small-group academic support in literacy and English language development for students.

Ensure that any intervention or extra support is implemented daily for at least 30 minutes in small groups of three to six children who have similar levels of mathematical competence. There may be advantage in including native English speakers to provide models of more advanced English language usage.

Appendix

Spanish Cognates (from Clements & Sarama, 2007/2013)

A

activity = actividad
 addition = adición
 algorithm = algoritmo
 analyze = analizar
 announce = anuncia
 appropriate = apropiado
 attribute = atributo

B

balance (scale) =
 balanza
 baseball = béisbol
 basic = básico
 bills = billetes

C

calendar = calendario

cancel = cancelar
 capacity = capacidad
 cent = centavo
 centimeter = centímetro
 chapter = capítulo
 circle = círculo
 classify = clasificar
 collection = colección
 color = color

column = columna
 combination = combinación
 comparability = comparabilidad
 compare = comparar
 complete = completar
 cone = cono
 confirm = confirmar
 copy = copiar
 correct number = número correcto
 correspondence = correspondencia
 cost = costo
 count = cuenta
 cube = cubo
 cylinder = cilindro

D

data = datos
 decide = decide
 decimal = decimal
 demonstrate = demostrar
 denomination = denominación
 destination = destinación
 determine = determinar
 different = diferente
 digits = dígitos
 directions = direcciones
 discussion = discusión
 divide = divide
 dollar = dólar
 double = doble

E

eliminate = eliminar
 equal = igual
 equality = igualdad
 estimate = estimar
 exercise = ejercicio
 expanded = expandida

experiment = experimento
 explain = explica
 explore = explorar
 explorer = explorador

F

false = falso
 favorite = favorito
 figure = figura
 form = forma
 fraction = fracción
 fruit = fruta
 function = función

G

geometry = geometría
 grams = gramos
 graph = gráfico

H

horizontal = horizontal
 hour = hora

I

ideas = ideas
 identify = identificar
 imagine = imagina
 independent = independiente
 individual = individuo
 information = información
 interpret = interpretar
 inverse = inverso
 irregular = irregular

J**K****L**

lesson = lección
 line = línea
 liquid = líquido
 liters = litros

M

machine = máquina
 manipulatives = manipulativos
 memorize = memoriza
 minuend = minuendo
 minus = menos
 minutes = minutos
 move = mover
 movements = movimientos
 multiples = múltiplos
 multiplication = multiplicación

N

notation = notación
 not necessary = no necesario
 number = número

O

objects = objetos
 operation = operación
 opposite = opuesto
 order = orden
 ordinal = ordinal

P

pair = par
 paper = papel
 parentheses = paréntesis
 parts = partes
 pattern = patrón
 pentagon = pentágono
 pizza = pizza
 planted = platada
 points = puntos
 polygon = polígono
 portion = porción
 practice = práctica
 predictions = predicción
 prerequisite = prerequisite
 priority = prioridad

probability experiment
=
experimento de
probabilidad
problem = problema

Q

quadrilateral =
cuadrilátero
quantity = cantidad

R

range = rango
rational basis = base
racional
record = recordar
rectangle = rectángulo
regular = regular
relation = relación
remove = remover
repeat = repite
represent = representar
report = reportar
rest = resto
results = resulta
rhombus = rombo

round (of a game) =
ronda
route = ruta

S

scale = escala
separated = separado
sequence = secuencia
sign = signo
solution = solución
sphere = esfera
standard = estándar
statue = estatua
strategy = estrategia
subtrahend =
sustraendo
sum = suma
symmetrical = simétrico
symmetry = simetría

T

temperature =
temperatura
thermometer =
termómetro
total = total

trace = trace
train = tren
trapezoid = trapecio
triangle = triángulo

U

unison = unison
units = unidades
to use = usar

V

value = valor
vertical = vertical
vice versa = viceversa
vocabulary =
vocabulario
volume = volúmen
volunteer = voluntario

W

X

Y

Z

zero = cero

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