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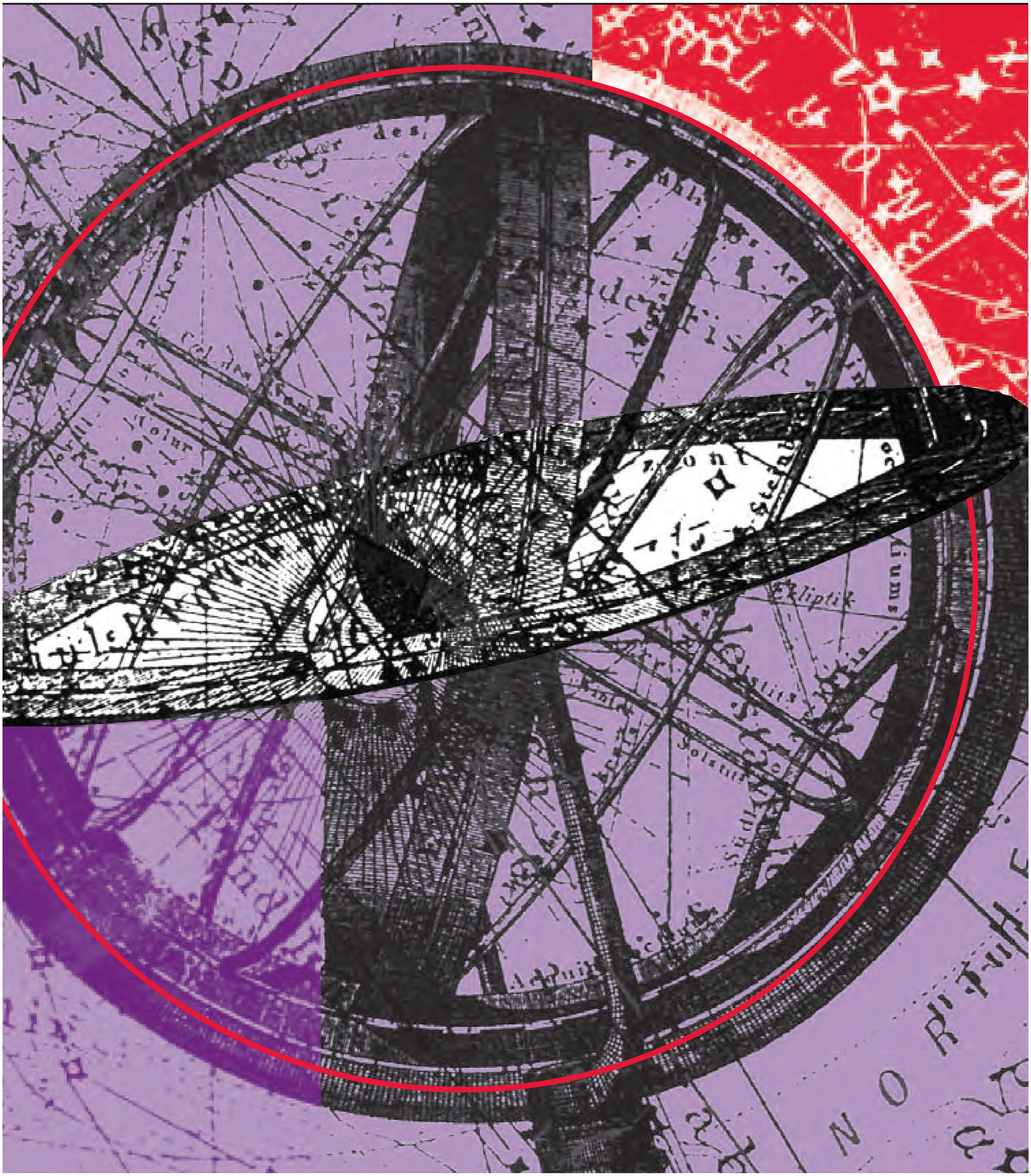

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UnLATCHing Mathematics Instruction for English Learners

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ABSTRACT:
Mathematics teachers find it challenging to meet the range of mathematical skill levels of their students. In many schools, this challenge is increased as teachers must also adapt instruction to meet the needs of English learners. Language Acquisition through Content Hierarchy (LATCH) professional development provides teachers with the skills and tools to integrate instructional strategies for English learners with mathematics content instruction. LATCH guides teachers to differentiate mathematics instruction to address the range of student abilities as well as provide access for English learners.

Many mathematics teachers come to professional development sessions with a basic understanding of how to teach content. Increasingly, teachers participate in professional development programs that provide awareness about second language acquisition with the intent that teachers will make connections between mathematics instruction and English learning theories. The purpose of such professional development activities is for teachers to use instructional strategies that will increase access to mathematics for English Learners (ELs). However, the theory of language acquisition is often seen as additive by teachers; just more layers of work added to their already burgeoning load. The issue at hand then, is to help teachers see how language acquisition strategies can be an integral part of content instruction. The Language Acquisition through Content Hierarchy (LATCH) model was developed to assist teachers in integrating content and language acquisition strategies and use them to differentiate instruction for English learners.

In multilingual classrooms, teachers of mathematics face two challenges: how to address the language diversity of their students; and how to address the diversity in mathematical understanding. This paper will address strategies to help teachers differentiate mathematics instruction for students with a range of mathematical and English proficiencies. The paper is divided into two parts. The first part focuses on the background and development of the LATCH model. Part two explores how LATCH can be used in staff development to help teachers differentiate instruction for their students.

Diversity in the Classroom

Language Diversity

Part of the reason English learners struggle in mathematics is that rather than being language free, mathematics uses language that is a highly compressed form of communication where each word or symbol often represents an entire concept or idea. In a literature text, readers can comprehend a passage if they are familiar with 85%-90% of the words. The other words and their meanings can often be gleaned through context. Mathematics problems, on the other hand, generally require the student to understand nearly every word as there is seldom enough context provided with the problem to assist with unfamiliar words or concepts. Another problem that English learners encounter is that sometimes they recognize a word, but the meaning they know for the word is different from the intended meaning and therefore does not help them understand the problem. An example might be this problem taken from the released items of the California High School Exit Exam.

Sally puts $200.00 in a cliff story. Each year the story earns 8% easy attraction. How much attraction will be earned in 3 years?

This particular version of the problem was created by replacing some of the nouns with synonyms. When the problem is understood in this way, the student has little chance of solving it and would likely just sit there or raise a hand and tell the teacher, "I don't get it." When the teacher would ask which words they don't understand, the student

has a difficult time answering because they know that:

a bank is a type of cliff, like the river bank

an account is a story, like when you give an account of an event

simple means easy, but this problem is neither simple nor easy

interest means attraction, because two people who are interested in each other have an attraction for one another.

But somehow, the problem still does not make sense. Without more context and vocabulary building, the student would not discern the intended meaning of the problem which was:

Sally puts $200.00 in a bank account. Each year the account earns 8% simple interest. How much interest will be earned in 3 years?

The issue here is not whether high school students should be able to correctly understand and solve the above problem as originally written. The issue is how to make mathematics problems accessible to all students so they have the opportunity to learn both the language and the mathematics.

The Natural Language Approach to language acquisition (Krashen & Terrell, 1983) states that the process of learning a second language often mirrors that used by a child to learn a primary language. Children first learn the names of common objects; items repeatedly introduced visually and physically. Learning through direct experiences with concrete examples provides a **context embedded** environment in that the words and their meanings are supported by physical objects or are otherwise familiar to the child. If students don't have the vocabulary or experiential background to understand interest bearing accounts in banks, then they need to be provided this information in a concrete manner that builds upon experiences that are familiar. In the above example, the teacher could discuss multiple meaning of words, use a simulation, or talk about who or where in their community people loan money for a fee.

Assigning an unfamiliar problem without any linguistic supports creates what Cummins would call a **context reduced** environment. In these cases, it is presumed the student has the experience and vocabulary necessary to understand the problem. Jim Cummins highlighted the importance of context in comprehension when he described the Socio-Linguistic Approach (1979) as including two sets of skills required for language proficiency. He calls the first set Basic Interpersonal Communication Skills (BICS). BICS refers to context-embedded communication that takes place in every day interactions between individuals. Greetings, discussions of the weather, relating what just happened on the playground are all examples of BICS.

The second set of language skills involves Cognitive Academic Language Proficiency (CALP). In the case of CALP, communication takes place in a context-reduced environment, or one in which cues, such as visuals, gestures, or a familiar topic are not present. The primary distinction between BICS and CALP rests in the extent to which the context is embedded in the communication.

Cognitive Academic Language Proficiency covers two broad areas: Cognitive proficiency and academic language. The former refers generally to mathematical reasoning including the " higher level of language development [that] includes comparing, classifying, inferring, problem solving, and evaluation" (Williams, 2001; p. 2). The academic language, as it applies to a mathematics classroom, is a broad term that encompasses the skills needed to succeed in school such as reading, writing, and the language skills required to communicate the reasoning behind a mathematical solution. It also includes the technical and specialized vocabulary and terms used in mathematics classes (Chamot and O'Malley, 1994). These higher order thinking and language skills are found in classrooms where the language is complex and the tasks are cognitively demanding (Collier, 1988; Egbert and Simich-Dudgeon, 2001). These environments can be very challenging for students who have yet to gain Cognitive Academic Language Proficiency.

Language minority students often appear to be English proficient and yet perform poorly in content areas because, while they have some proficiency in interpersonal or conversational English, they lack proficiency in the content specific vocabulary which often inhibits the development of academic skills (Cummins, 1979). As a result, students who lack English skills often find themselves falling farther and farther behind in mathematics. Thus, teachers find themselves searching for a variety of instructional strategies that will enhance learning for students at every level of English as well as mathematical proficiency.

Diversity in Mathematical Understanding

Many classrooms have as much diversity in student understanding of mathematics content as they do in language proficiency. This disparity is perhaps greatest in mathematical problem solving. This critical area of mathematics is emphasized in The Principles and Standards for School Mathematics (2000) set by the National Council for Teachers of Mathematics (NCTM) where it states, "problem solving is not only a major goal of mathematics, it is a major means of doing so" (p.4). In fact, mathematical problem solving should play a central role in the learning of mathematics (Hiebert, et al. 1996; Hiebert, et al. 1997).

George Polya (1957) published pioneering work in the area of problem solving with his book, "How to Solve It." He outlines four steps in problem solving in the text to include: 1) Understanding the Problem; 2) Devising a Plan; 3) Carrying out the Plan; and 4) Looking Back. For English learners the greatest challenge happens in the first step, as they will not be able to solve a problem they can't understand. Once the problem is understood, the second and most cognitively challenging step is devising a plan. Polya provides many suggestions on how to help students devise their own plan as he feels the plan must be their own if they are to learn problem solving. The following section looks at ways to help students, with varying mathematical skills, devise and carry out a plan for problem solving.

There is general consensus among mathematics educators that when students engage in problem solving, they progress from concrete to more abstract representations as their understanding increases (Stevenson & Stigler, 1992; Marzano, 1998; Good & Brophy, 2003; Shapiro, 2004). The Principles and Standards for School Mathematics (2000) discusses this progression and stresses the importance of allowing students to construct conceptual knowledge by building upon what they already know. Prior experiences provide a concrete base from which new, often more abstract, concepts can be developed.

Carpenter, Fennema and Franke (1996) identified this concrete to abstract progression in mathematics in their work with students in primary grades. They found that when given a problem to solve, students use a variety of strategies. Some students use more concrete strategies such as direct modeling, drawing a picture or diagram, or using simpler numbers, while others are able to use algorithms, variables, and write equations. The strategies that students employ depend on their understanding of the problem, the difficulty of the numbers, and the set of skills, understandings and prior knowledge they bring to the situation. In effect, as students gained more experience, direct modeling strategies gave way to procedures utilizing more abstract thinking.

Bridging Language Acquisition and Mathematics Content

Cummins' work (1994) provides a framework for language acquisition and how it interfaces with content area instruction. He proposed what have later come to be known as Cummins' Quadrants which graphically depict the four linguistic domains of English learners. An adaptation of these quadrants has been made for the LATCH model and appears in Figure 1.

According to Echevarria and Graves (2003), the "horizontal continuum represents contextual support, ranging from contextually embedded communication, wherein meaning can be derived from a variety of clues such as gestures, visual clues, and feedback, to context-reduced communication, which relies primarily on linguistic messages or written texts, which give few, if any, contextual clues (p. 43)". They also state that the vertical continuum relates to the cognitive demands of the task. Since cognitive demand can have a different connotation in mathematics instruction, this axis has been relabeled Concrete to Abstract to match the sequence noted by Carpenter, Fennema and Franke (1996). The Concrete end of the continuum includes solving a problem using manipulatives or drawings and is generally where the greatest number of students will have success. It is therefore the point of greatest access for students (Carpenter, Fennema, & Franke, 1996). Abstract solution strategies, such as writing equations or providing mathematical proofs, generally require the most previous knowledge and experience and therefore fewer students will be successful. In short, **for any given problem**, more students will be able to solve it using concrete strategies than abstract strategies. This does not mean that all problems using concrete strategies are easier than all problems using more abstract strategies, as the notion applies within a problem rather than across problems.

FIGURE 1

Language Acquisition and Content Quadrants

Concrete Solution Strategies

Quadrant A student
Lower in English and mathematics

Instruction: embed language development; increase concrete representations

Quadrant C student
Higher in English but lower in mathematics

Instruction: reduce language development; increase concrete representations

Context Embedded

Context Reduced

Quadrant B student
Lower in English but higher in mathematics

Instruction: embed language development; increase mathematical abstract representations

Quadrant D student
Higher in English and mathematical skills

Instruction: Reduce language development; increase abstract representations

Abstract Solution Strategies

**Adapted from Cummins (1994)*

An example of a problem employing concrete and abstract solution strategies is one where students must fill a container with exactly 4 cups of water. All the students can use is a 5 cup container and a 3 cup container. How can the problem be solved? This problem has two solutions and a variety of solution strategies. A more concrete strategy would be to use actual containers and have students reason through the problem using trial and error. Using this strategy, almost all students would be able to work through the problem. A more abstract solution strategy that would require greater mathematical background and skill would be to make a table of all possible measures one could get using these two containers. From this table, students could sequence certain steps and arrive at an answer. While this particular problem does not lend itself to deriving a formula, it does work nicely in making generalizations. For example, will the steps you used to solve the problem work with any 3 consecutive numbers, where you have containers in the size of the largest and smallest numbers and are trying to measure the middle number? If not, what are the next three whole numbers that will work?

The value in Cummins' quadrants is their ability to link language acquisition issues to those of content instruction. This interrelationship is extremely important because it describes the task set before most teachers. The quadrants have been used to train teachers in their generic form, modified form (filled in version), and even in a form adapted to mathematics instruction (Garrison & Mora, 1999). And while all of these help describe the problem, the LATCH model provides more direction on how mathematics instruction can be adapted to meet the needs of English learners.

The Language Acquisition Through Content Hierarchy (LATCH) model helps teachers take the Language Acquisition and Content Quadrants and define each area with specific instructional strategies. Through discussions in a professional development session, teachers will use the LATCH model to construct their own LATCH instructional tool. That is, by the end of the professional development session, they will identify specific context embedded instructional techniques that will be most effective for students just learning English (Quadrants A and B) as well as specific solution strategies that can assist students who are struggling in mathematics (Quadrants A and C). All of these strategies will build on the knowledge base of the teachers present and therefore be easier for them to implement. It has been our experience in leading this professional development that participating in the creation of this instructional tool provides an 'aha' moment for most teachers.

This professional development has been based on several underlying principles: 1) knowledge is retained best when it is built upon previous knowledge (Marzano, 1998; Good & Brophy, 2003), 2) students learn best that which they construct themselves, (Stevenson & Stigler, 1992; Marzano, 1998; Good & Brophy, 2003), 3) teachers know or can devise instructional strategies to meet the needs of English learners; and 4) teachers know or can devise multiple solution strategies to mathematical problems. We have resisted giving them a list of instructional practices and instead helped them to create their own. What follows is a description of the implementation of the LATCH model and the instructional framework used during the professional development sessions.

LATCH Professional Development

Building the English Language Development (ELD) Sequence

THE LEVELS OF LANGUAGE PROFICIENCY

Generally, the professional-development session has taken about 4 hours, though it can be expanded. The content of the session is:

30 minutes:	Introduction of Cummins Quadrants and Language Levels
90 minutes:	Participants Develop the ELD sequence
60 minutes:	Participants Develop the mathematics sequence
60 minutes:	Discussion of the newly constructed quadrants and lesson adaptations

We illustrate how the session unfolds by recalling one particular occasion. The first task in the session was to help teachers build a sequence of instructional strategies to assist students at all levels of English proficiency understand the mathematics problem. To accomplish this goal, teachers were divided into four groups, each to represent a level of language proficiency. For example, one group of teachers brainstormed strategies for Level 1 English learners, or students who are not able to communicate in English and need support in listening comprehension. Another group of teachers addressed Level 2 students who can understand basic English (BICS) but need assistance with vocabulary development and oral skills. The third group thought of instructional strategies for Level 3 students, or students who can speak and understand basic English but need help with academic tasks such as reading. The final group addressed strategies for Level 4 students who are at intermediate fluency in English but need support in advanced communication skills such as writing. Each group was given a list of learning characteristics that described students at that level of proficiency.

The task for each group was to think about mathematics problems they had used that were particularly difficult for English learners because either the vocabulary or the context was unfamiliar. Given the context of a problem, the group listed instructional strategies that would make it comprehensible to the students at the assigned language proficiency. For example, the group that represented Level 1 students listed strategies such as acting the problem out and using visuals while the group that represented Level 3 students might list having students repeat the problem in their own words, or reading the problem aloud together. Once each group completed the list of strategies, they were asked to sequence them from the ones that provided the most support for English learners (context-embedded) to the ones that provided the least support (context-reduced). During this part of the activity, teachers were actively engaged, describing and explaining strategies they knew or could imagine and then delving even deeper into the strategies as they had to sequence them. By the end of the activity, each teacher made a deck of note cards with their group's strategies in the agreed upon sequence. These decks were used in the next part of the activity.

Once the work in each language level group was completed, the teachers were reconfigured into groups of four that included a member from each of the language groups. The task of this new group was to sequence the cards from all the decks, starting with the Level 1 group's strategies which provided the most support for English learners (context-embedded) to Level 4 group's strategies which provided the least support (context-reduced). Many of the strategies appeared in more than one group and therefore the cards could be consolidated. The goal was to form a final list of 10-15 sequenced strategies to support the learning of EL students. The expertise of the class as a whole was evident as teachers not only had to explain the strategies from their groups but also had to relate them to the others that had been presented as they sought to find the location in the sequence for each strategy. When the groups were done, teachers took a gallery walk to see how others had approached the same task. Time was allowed for any group that wanted to re-order some of their cards. The final sequence of cards was affixed horizontally (along the x-axis) to a piece of butcher paper and reserved for later use. A whole class discussion of "which sequence was right" ensued and the teachers came to an appreciation that the sequence could shift depending on the understanding of the strategies and the nature of the problem itself. While the notion of a fixed sequence (such as the one represented by the order of operations in arithmetic) was not applicable, the trend toward decreasing levels of support for English learners was evident and easily recognizable.

Building the Math Sequence

Prior to establishing a hierarchy of skills in mathematics problem solving, teachers were given problems to solve in more than two ways. Once they completed this task, teachers were asked to share their solution strategies with the whole group. The intent of this activity was to have teachers exposed to a diversity of solution strategies that answer a math problem correctly and, more importantly, to have such strategies provide a context to assist the teachers in building a mathematics hierarchy.

Teachers were placed in the same groups that developed the sequence of ELD strategies, and were asked to make a list of all the solution strategies that can be used to solve mathematics problems. In addition to asking teachers to think back to the problem that they had just solved, they were also prompted to think about the students that they teach and the strategies that students use to solve other problems. Common strategies listed by the teachers included the use of manipulatives, writing a formula, and making a table.

When teachers select solution strategies to develop the mathematics continuum, the strategies identified by elementary teachers typically are different from those identified by high school teachers. This occurs because of the differences in the sophistication of their students, the types of problems students solve, and the instructional practices of the teachers. Even with these differences, there is still a general flow of solution strategies from those that are more concrete to those that require more abstract thought.

In helping teachers sequence solution strategies along the concrete to abstract continuum, we have been influenced by the ideas presented by the developers of Cognitively Guided Instruction (Carpenter, Franke, & Levi, 2003; Carpenter & Fennema, 1999), and suggest to teachers that solution strategies can be sorted into four categories: Physical Representations, Numbers, Variables, Generalizations/Proofs. The most concrete of these, physical representations, include the use of manipulatives and drawings. Some students at this level need to represent each number with physical objects to solve the problem. At upper grades, such students may need to make a diagram or other physical representation of the problem in order to 'see' the relationships. At a more abstract level, student will use numbers and arithmetic operations to represent and solve the problem. Students who can use variables to work with and solve the problem would fall under the next level of abstraction. The final level, generalization/proof, includes students who can go beyond the present problem and generalize the results to future problems. This continuum can be thought of as a sequence of strategies that a student might use to solve a problem.

In our session, each strategy was written on a note card and groups were directed to sequence them from the most concrete solution strategy to the most abstract. A common class list was then created to foster greater discussion and a fuller analysis of solution strategies. The justification for the placement generated rich discussions and also allowed groups to add strategies to their lists that they may have overlooked. Once the group had reached a final sequence, they were taped on the y-axis of the same paper as the ELD strategies. Figure 2 represents the completed grid of one group's work. Once the grids were constructed, the teachers were ready to understand how they could be used to guide instructional decisions.

Defining the Domains within the Context of Mathematics Instruction

With the LATCH grids built, the connections to Cummins' Quadrants become apparent. More importantly, practical applications of presenting mathematics lessons to ELs become clear to the teacher. Each of the four quadrants of the teachers' grid describes a different type of student with specific learning needs. Students in Quadrant A (upper left) are ones who struggle with both English and mathematics. They need strong linguistic support in order to understand the problem. The LATCH grid supplies instructional suggestions (Total Physical Response (acting out), Simplify language, Preteach Vocabulary. . .) that could assist in this process. The students in Quadrant A also need support in mathematics. Their solution strategies will likely be more concrete than others in the class. While it might not be the instructional goal for them to remain in this area, they will likely be more successful if they have the opportunity to initially use more concrete strategies such as direct modeling, drawing a picture, or using an invented algorithm.

Students in Quadrant B (lower left) lack proficiency in English, but have strong mathematical understanding. This mathematical background was probably built in their first language as this is the quadrant where recent immigrants who have had strong mathematics instruction in their native tongue are located. Quadrant B students may need strong instructional supports to understand the problem, but once they do, they can use more sophisticated strategies to solve it, a key difference from students in Quadrant A.

Quadrant C (upper right) students have greater proficiency in English, and while they may still need support, it will more likely be in reading and writing. This group of students does need support in mathematics, however. They will be more successful with concrete problem solving methods such as direct modeling and finding patterns.

Students in Quadrant D (lower right) are the ones who need fewer supports in English and are able to make abstract associations in mathematics. They will likely understand the problem at hand and can solve the problem in the specific as well as the general case. They may only need linguistic support in writing the justification of their solution.

How to Use the Language Acquisition through Content Hierarchy

The classroom teacher can use the grid to differentiate instruction for a classroom of students who are diverse in both English language proficiency and mathematical skill. Strategies to help students understand the problem are found along the language or x-axis of the grid. The mathematics content or y-axis indicates strategies that students are likely to use when solving a problem. In general, students should be allowed to solve problems using the methods that make sense to them, but should also be exposed to more sophisticated (or abstract) solution strategies so their thinking can advance. The end of the lesson debrief is an ideal place for this type of exposure. Here, the teacher can select students to share their methods of solving the problem with the class. In fact, a rich sharing of ideas should occur at the close of the lesson when students from each quadrant share their problem solving strategies with the other students. (Hiebert, et al. 1997; Stevenson & Stigler, 1992; Marzano, 1998; Good & Brophy, 2003)

For example, assume that a teacher asks the students to solve the following problem:

> *A farmer put all her ducks and sheep in a pen. When she counted the heads, she tallied 20. When she counted the feet, they added up to 54. How many ducks and how many sheep did she have?*

A teacher could use the LATCH grid to differentiate instruction as follows:

Differentiation for Quadrant A: The teacher could help the beginning English speakers understand the problem by using pictures of the animals mentioned in the problem. Even the word pen can be misleading as many English learners will think of a writing instrument. Pictures of an animal pen would also need to be included. A simplified version using 3 of each animal could be depicted visually and the students asked to determine the number of heads and feet shown in the picture. This would allow the students in A to visualize what the problem is asking, and to solve it initially by using a direct model strategy (counting actual heads and feet). From here, they could make their own drawings or charts to solve the problem with larger numbers.

FIGURE 2

CONCRETE

Direct Model

Draw a picture, diagram, table

Find a pattern

Solve using invented algorithm

Write number sentence

Solve using smaller numbers

Translation into primary language, Study Buddy

TPR, Voice Intonation, Act Out

Visuals, Pictures, Picture Dictionary

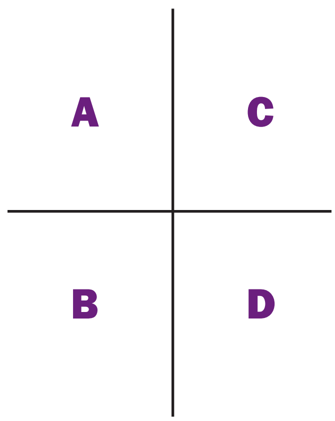
Student groups for language support, Think, Pair, Share

Change the problem context

Simplify language of problem, Discuss problem

Preteach Vocabulary, Word Wall, Math words

Students restate problem in own words



Graphic Organizer, Charts, Grids, Webs

What are we trying to find out?

Ask key questions – What do we know?

Teacher, students, read problem aloud

Explain reasoning through Journal Writing,

Students Write Their Own Problem

Teacher, Text selected problem in written form without review

which don't allow review

Isolated problems such as on a standardized test

Solve using standard algorithm

Use mental or relational math

Solve with variables

Graph an equation

Make generalizations

Write an equation or formula

Provide mathematical proof

ABSTRACT

Differentiation for Quadrant B: Students could be introduced to the problem using the pictures as in A, and once they understood what was being asked, could employ large numbers. Particularly adept students could be asked to make a table showing the results for all even numbers between 54 and 64 and asked to look for a pattern. They could demonstrate their thinking through a chart or equation.

Differentiation for Quadrant C: Students would likely understand the problem, but be at a loss on how to solve it. It could be modified for this group by reducing the numbers to 8 heads and 24 feet. If they still have problems, they should be encouraged to solve the problem through direct modeling or drawing pictures.

Differentiation for Quadrant D: These students will need little if any support in understanding the question. After they solve the problem as stated, they should be challenged to construct an equation that would always work, no matter how many sheep and ducks were in the pen.

An assumption in the content strand is that students working at a more abstract level can solve a problem using concrete methods as well. However, this is not always the case, especially among teachers who have not learned mathematics using the concrete models. For them, the sequence can be in reverse order. This brings up three important points:

1) when instruction fails to include the models that underlie a concept, the students will not necessarily develop them on their own.

2) teachers need to know and understand the concrete models that underlie concepts so they can help students to use them to create conceptual understanding.

3) the opportunity to use non-linguistic representations (ie. concrete representations) increases student achievement (Marzano, Gaddy & Dean, 2000). Therefore they should be included in mathematical instruction.

The professional development of the LATCH model described here allows teachers to draw upon their previous knowledge of teaching and mathematics to develop a personal instrument for instructional differentiation. This provides teachers with a meaningful tool to use in instructional planning and as a reminder of strategies at their disposal to meet the needs of all the students in the classroom. It can help answer the question heard by teachers across the nation, How can I teach mathematics to a student who is not fluent in English?

Field Test for LATCH Professional Development

The LATCH model was developed as an enhancement to the English Language Development Institute – Mathematics Content (ELDI-MC) summer professional development institute offered to Jr. High and High School teachers in Imperial Valley. The ELDI-MC curriculum was piloted in six sites across California, and a study was conducted to determine the effectiveness of ELDI-MC in increasing the knowledge of teachers about strategies to serve English Learners in the content area. All sites taught the same curriculum which consisted of English language development techniques and mathematics pedagogy to use in a pre-algebra course. The use of the LATCH technique was the major difference between the ELDI-MC curriculum taught at Site A and the other five sites. For Site A, LATCH was a half day session toward the beginning of the institute, but it provided a common language and context for later discussions of curriculum development and lesson modification.

A total of 120 teachers were pre-tested at the beginning of the 80 hour institute on their knowledge of instructional strategies for ELs. Test items posed common problems that might appear in a Pre-Algebra book and also asked teachers to elaborate on the kinds of modifications they could make to accommodate English learners. After participating in 80 hours of professional development provided by the respective institutes, these participants were presented similar problems in a post test. A teacher's score was determined by a count of the viable EL strategies that they offered in each test question. Table 1 shows the mean pre and post scores for each of the six sites. While this measure was not designed specifically to determine the impact of the LATCH model, the growth shown by teachers from site A (where LATCH was implemented) was the highest among the six sites. Using a matched-pair t confidence interval, the estimated mean difference in test scores is 4.285 points per site, with a margin of error of 1.528 for 95% confidence, i.e. the 95% interval is (2.757, 5.813). These two results, site A with the highest gain and the gain being outside the confidence interval, suggest that the LATCH model is an effective tool for helping teachers understand how to modify instruction for English learners. While the growth for teachers at Site A was significantly different (p-value $< .001$), further research should be conducted to determine if the results are consistent across groups and to document which aspects of LATCH improve teacher understanding.

TABLE 1: ***Pre- and posttest results for ELDI-MC Institutes.***

Site	N	Pre Test ELD	Post Test ELD	Change
Site A *	17	7.53	13.59	+6.06
Site B	23	5.39	8.3	+2.91
Site C	24	3.88	8.67	+4.79
Site D	23	5.04	7.26	+2.22
Site E	24	5.04	10.33	+5.29
Site F	9	5.78	10.22	+4.44

Conclusion

This paper presented a response to the challenge faced by mathematics teachers of how to address the range of both mathematical and linguistic proficiencies of their students. By using the Language Acquisition through Content Hierarchy (LATCH) instructional tool, teachers identify strategies that integrate both mathematical and linguistic development. These strategies can be used to differentiate instruction and therefore increase access to powerful mathematics instruction for all students, including English learners.

We believe the LATCH model can be readily adaptable to mathematics professional development sessions. If the teachers or the mathematics professional developer do not have a strong background in English Language Development, it can be co-presented with someone who does. It should be stressed, however that both facilitators be present and participate throughout the session in order to highlight how both ELD and mathematics can be integrated. Also, a LATCH session can be an excellent format to offer a joint professional development session between teachers who work primarily with language learners and mathematics teachers. The session draws upon the expertise of each group and can initiate rich discussions and increase understanding.

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