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"Making X relevant" : increasing English language learners' self-efficacy and deepening the understanding of math through motivation to learn

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"Making X Relevant"

Increasing English Language Learners' Self-efficacy and Deepening the Understanding of Math through Motivation to Learn

A Thesis submitted in partial satisfaction of the requirements
for the degree of Master of Arts

in

Teaching and Learning (Curriculum Design)

by

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2008

The Thesis of Jaime Torres Cuevas is approved and it is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

2008

DEDICATION

This work is dedicated to the Torres Cuevas family who has supported me throughout my educational career, to my partner Deidrik Jacobs for being able to cope with my stress and for all your love and support, and finally to my SIB family especially Erica Heinzman, Kim Moerman, and my students without whom this would not have been possible. You all are my inspiration.

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ABSTRACT OF THE THESIS

"Making X Relevant"

Increasing English Language Learners' Self-efficacy
and Deepening the Understanding of Math
through Motivation to Learn

by

Jaime Torres Cuevas

Master of Arts in Teaching and Learning (Curriculum Design)

University of California, San Diego, 2008

Bernard Bresser, Chair

Many students come to think of math class with negative connotations because they do not see the relevance of math to their out-of-school settings. "Making X Relevant" uses English Language Learners' (ELLs) interests to foster self-efficacy and deepen their understanding of mathematics through oral and written explanations and authentic context. Multiple strategies such as pre and post surveys and tests, teacher questioning, written explanations, oral presentations and student work were used to assess the effectiveness of "Making X Relevant".

"Making X Relevant" was successful in fostering students' self-efficacy by increasing their level of confidence on their content knowledge and deepening their understanding of math. This was demonstrated through their success in class, or improvement in oral explanations and/or written form. They were able to use reasoning and the procedures chosen to accomplish given tasks. Not all students succeeded in passing the unit content exam, but all felt that they had increased their self-confidence and understanding of math and could see the relevance of the content to out-of-school settings.

I. Introduction and Overview

Picture yourself as a high school student who has just migrated to the United States. You find yourself in a new country, culture, school, and classroom where your mother tongue is not spoken. All the books you have been given are full of words that do not make sense, but yet you are still required to participate, complete the work, and pass the tests.

As you try to make sense of what is happening, you find yourself confused and frustrated because you cannot understand a word the teacher says. Furthermore, the posters, sentences and drawings you see in the room do not relate to you and you become even more frustrated as you realize that the material being covered in class has no relevance to your interests, experiences, and out-of-school settings.

As a teacher of all levels of high school mathematics at the School of International Business, I am aware that there has been much research on curriculum reform nationwide with the intention of providing students more access to the content. However, there has not been enough emphasis on improving instruction for English Language Learners (ELLs) who are becoming a majority in our public school system (NCELA, 2006; NCLR, 2008). Many of these ELLs may not have had the opportunity for a formal education before leaving their home country. Unfortunately, they encounter a school and curriculum that is not able to fulfill their needs, and they find themselves discouraged and frustrated.

Migrant and immigrant students face many challenges, among them, the challenge to become fluent in the language of their new country. However, it is difficult to overcome the language challenge, especially if the ELLs are not provided with the appropriate supports.

Recently, No Child Left Behind (NCLB) demanded that all students have equal opportunity for education. However, "prior to the NCLB, the ELL population was often overlooked" (NCLR, 2008, p.1). ELLs are still not being provided with the appropriate support in order to have equal access to education, as teachers are lacking the professional development to teach ELLs (NCTE, 2006).

It has been my experience that ELLs, along with their parents, are frustrated when they perceive no progress in their learning. ELLs begin to resent being in their classes, to the point that they lose motivation to learn. The ELLs view of school deteriorates and many see the classroom as a "place where they have to be." Often they come to believe that school is a place where the things they learn are irrelevant to their lives and are of no use in the real world.

As a mathematically inclined individual I have never seen math as an obstacle. Showing up to math classes during high school and in college was never a concern. On the contrary, I always looked forward to the challenge. Now, as a math instructor, with six years of teaching experience, I have come upon many students who enjoy the challenge of math, but I have encountered far more students whose first words are "I hate math," or "I am not good at math," or "I do not get it, why even try." Furthermore, while in class, many students cannot wait for the bell to ring so they can leave the math classroom.

It was not until one of my students posed the following question: "Mr. Torres, can you please tell me when am I ever going to use this in real life?" I began to see teaching mathematics differently. Looking back and thinking about this question, I realized that many of my previous students have felt this way, especially if they are trying to learn English as a second language. English Language Learners not only face the challenge of learning English, but also take on the challenge of learning the academic content of every class.

It is without a doubt that education opens doors to many opportunities. It is also evident that no child should be denied the opportunity of education no matter their background, race, ethnicity, sexual orientation and religion. Every student, including English Language Learners, should have equal opportunity to access and deeply understand the content in every course.

II. The Need for Deeper Understanding of Math

Research on students' motivation to learn, explanations about math procedures, and their necessity to be able to solve math real-life applications, suggest that using authentic contexts and out-of-school application lessons rather than contrived book exercises will increase their self-efficacy and deepen their understanding of mathematics. Students in my algebra and geometry math classes have admitted to only memorizing steps when taking math tests because they have failed to deeply understand the content. Memorization of content does not allow students to apply the skills learned in the classroom to out-of-school situations and settings.

International Results

Due to the fact that many U.S. students lack a deep understanding of math, the U.S. fails to place among one of the top 26 nations who take part on the Trends in International Mathematics and Science Study (TIMSS), and the Program for International Student Assessment (PISA), two assessments that measure students' achievement in mathematics and science. Peter Kloosterman (2004), a math professor at Indiana University, stated that the United States has been "below the international level at the high school level because of the U.S.'s curricular focus on having students complete a larger number of less challenging problems" (p. 1). Kloosterman also claims that the U.S.'s poor results on the PISA are due to the curricula that focus more on solving problems using drills and practice, rather than focusing on skills that are needed to solve realistic everyday problems. Unfortunately, drills and practice only enable students to memorize steps to a solution, while providing explanations of their reasoning to realistic everyday problems provide students with the opportunity to become "active participants in their learning by the use of language and the interaction with others" (Wink & Putney, 2002, p.89).

A report issued by the National Research Council (NRC) stated that if major changes do not occur in our education system, the nation's needs for mathematically skilled teachers, scientists, engineers and other professions will not be met. R. James Milgram, a math professor at Stanford University, quoted in the New York Times, stated that "there's increasing understanding that the math situation in the United States is a complete disaster" (Lewin, 2006, November 14). It is evident that there needs to be a drastic change in our math courses and math programs in order to improve our math comprehension. At the same time, we need to make math more appealing to students. Students want to see the relevance of the content learned in class. One of the English Language Learner geometry students emphasized this point when he asked: "¿Mr. Torres, me puede decir cuándo tendré que usar estas matemáticas en my vida?" ("Mr. T, can you please let me know when we are going to use this math in the real-world?").

If students are asked to speak and write about math in authentic contexts that use real-life applications which require the implementation of classroom content, they tend to view math classes and content as relevant, useful, and enjoyable. Perceiving math class as an enjoyable experience will facilitate student engagement in discussing and solving problems, and simultaneously increase student achievement. Increasing student achievement will provide a greater opportunity for the improvement of our national standings in mathematics.

Reaching proficiency in mathematics is one of the goals of the No Child Left Behind law passed in 2001. Individuals involved in content areas such as English, Science and Mathematics have felt pressure to show improvement, and to show that action toward improvement has been taken. According to the National Center for Education Statistics' National Assessment of Education Progress (NAEP) report (2007), NCLB's pressure seems to be working as math scores have shown improvement. However, the NAEP report only shows significant improvement in 18 states, with California absent from the list. These negative factors demand a change in the way California classrooms are run, especially since there has been constant growth in our English Language Learner (ELL) population. There is no doubt that the nation's math education program needs to significantly change, especially since our student population continually increases in diversity with Hispanics becoming the largest minority groups in the nation and "the number of ELL of students in the U.S. schools has more than doubled over the past fifteen years" (NCELA, 2006, p. 1).

National Mathematics Results

The 2005 National Assessment of Educational Progress (NAEP) report shows that 46% of fourth grade English Language Learners scored "below basic" in mathematics. This is of a great concern to math instructors as the ELLs are scoring at the lowest possible level. Additionally, 71% of middle school ELLs scored in the "below basic" level, which is even more alarming. The NAEP analysis shows that

51% of eighth grade ELLs are behind their Caucasian counterparts.

According to the NAEP report of 2007, there is much progress to be made in the mathematics classroom. The 2007 report shows that student scores have increased nationwide in comparison to the 1990 scores, but the fact that 71% of eighth grade math students are only at the basic or above basic level is still cause for alarm. It would be ideal for our math students to reach a proficient level which currently includes only 33%, or to ultimately reach an advanced level in mathematics, which currently is barely 1% (NAEP, 2007). Raising math test scores has become an urgent matter as the "2006 Economic Report of the President"(2006, p 50) suggested that test scores are important at the individual and national level because studies have shown that higher test scores are associated with more years of schooling and higher wages. The report adds that high school students with higher tests scores are more likely to attend and graduate from college. Graduation from higher education institutions provides better opportunities to earn higher wages later in life.

Recently, scores have become a greater concern since the ELLs are the nation's fastest growing group of students. According to the National Council of La Raza statistics, there were 5.1 million public school students classified as English Language Learners in 2004-2005. Richard Fry, a senior research associate at the Pew Hispanic Center, stresses the importance of closing the gap as he states that "measured achievement matters as it affects socioeconomic success later in life" (2006, p. 2).

The national findings of the Texas Instruments Math Month Survey (2006), a telephone survey where 1000 U.S. teenage students were asked about their career goals, showed that four out of five teenagers believe math is important to achieve their goals of becoming doctors, scientists, executives and lawyers. However, only half plan to take advanced math classes beyond their schools' minimum requirements.

Further information is provided by Susan Ohanian (2007), a fellow at the Education Policy Research Unit at Arizona State University and at the Vermont Society for the Study of Education. Ohanian, the author of *The Folly of Educational Standards* suggested that we have to look at the statistical projections of the U. S. Bureau of Labor for 2010 which state that "22% of jobs will require four years of college, 9% of jobs will require an AA degree—some technical training" (2007, p. 2). Referring to the 2007 NAEP report on scores and the 2006 Economic Report of the President on the importance of test scores, it can be inferred that if students do not have adequate test scores, including in math, it is more likely that they will not graduate from college and thus be left out of high skill and high paying jobs. Ohanian also agrees that there are many jobs left for those who only obtain a graduation diploma from high school with lower skills, but that the problem is that those jobs do not offer a living wage.

Ohanian's statement shows that without the proper education, students will be forced to take jobs that will only provide them with minimal salaries. In order to be able to compete in the top percent of the job market, students must see higher education as a priority. Viewing higher education as a priority means that students must consider mathematics and higher mathematics as necessary, and be willing to go beyond the school's or district's minimum requirements.

Helping students become critical thinkers is one of the major objectives of the mathematical field. Another objective is to create intelligent human beings who can communicate, explain, and transfer the skills learned in the classroom and apply them in their everyday lives.

State Results

Classroom instructional methods and philosophies must be reevaluated in order for our students to improve state achievement results. Current scores indicate that although fourth and eighth grade students show promising results in mathematics, many students are in the below basic category on the 2007 Standardized Testing and Reporting (STAR). Stronger math scores may be achieved by creating a change in how we conduct math instruction in the classroom. Results from the School of International Business survey that focused on students' views about math demonstrate that students believe math is too difficult and that math is simply another requirement for graduation. Furthermore, the 2007 NAEP test results show that Hispanics and African Americans in California score lower than their Caucasian counterparts with an alarming 56% below basic (see Table I). Scores show that Hispanics scored 31 points below their Caucasian counterparts.

Table 1: 2007 NAEP math average scores by race/ethnicity in California

			Percentage of Students in California		
	Average scale score	**Below Basic**	**At or above basic**	**At or above proficient**	**At Advanced**
White	**287**	**22 %**	**78 %**	**39 %**	**8 %**
Black	**253**	**62 %**	**38 %**	**10 %**	**1 %**
Hispanic	**256**	**56 %**	**44 %**	**10 %**	**1 %**

Between the two groups that are in dire need of progress, I have decided to focus on the Hispanic population, because research has shown that it is a growing population in need of intervention (NCELA, 2006; NCLR, 2008). National scores suggest that crucial intervention is needed to help our ELL population increase their understanding of mathematics if we expect them to reach a basic or proficient level. Furthermore, within the Hispanic student population we also find a large number of English Language Learners (ELLs), who must receive additional and even more appropriate educational support if we expect them to increase their English and math skills to reach the above basic or proficient level.

It is evident that ELLs are failing to reach such levels when they are compared to their non-English Language Learner counterparts (see Table 2). There is a notable 42% difference in scores in the below basic level alone.

Table 2: 2007 NAEP ELLs and Non-ELLs math and achievement-level results

Percent of ELL Students in California				
Average scale score	**Below Basic**	**At or above basic**	**At or above proficient**	**At Advanced**
241	**74 %**	**26 %**	**5 %**	**1 %**
		Percent of Non-ELL students in California		
278	**32 %**	**66 %**	**29 %**	**5 %**

Additionally, the STAR 2007 results have shown that the SIB math students are performing at basic, below basic or far below basic in their geometry skills. Out of the 43 freshman tested, 47% tested at below proficient level and 33% tested at below basic level. Out of the 36 sophomores, 56% of them tested at below proficient level and 31% tested at below basic level. These scores justify the need for a change in current curriculum since it is the desire of parents, administrators and teachers to see students perform at a proficient level, if not at an advanced level.

Classroom Findings

Readying students to be able to use math skills to real-world applications is a critical goal of most math courses. Research (Tharp et al., 2004) has revealed that students who come from diverse backgrounds, such as most ELLs, benefit from instruction that delivers material in a context more compatible with their prior knowledge and their backgrounds. Content compatibility tends to increase students' participation and their learning. Bayer (1990) supports this claim by stating that "the more meaningful the task is to the student, the more motivated the student will be" (p. 20). Conversely, if students are exposed to a curriculum that does not provide incentives to learn, it has been my experience that students will only memorize the content, but will not be able to understand and apply it to out of school settings.

Bolstering a solid student commitment toward math education is a challenge that needs to be addressed. When asked in a resent survey if they would stop taking math classes if given the choice, 19% of SIB students strongly agreed and 20 % somewhat agreed. The lack of commitment to higher math can deprive individuals of future opportunities. The 2000 Principals and Standards for School Mathematics states (NCTM, 2000): "those who understand and can do mathematics will have opportunities that others do not. Mathematical competence opens doors to productive futures; a lack of mathematical competence closes those doors" (intro, ¶ 2).

Students' inclination to stop taking mathematics can create a problem if they choose a professional career. Students, who view math as another class that they are required to pass in order to graduate, often find themselves reliant on memorization without a deep understanding of the content. In 2002 Eeva Reeder, a high school math teacher, stated that memorization deprives students of the opportunity "to learn and improve life skills such as self direction, managing complex projects, collaboration in teamwork, information gathering and clear communication" (Reeder, 2002, p. 2) which are essential tools to succeed in the work force.

Mr. A, a business teacher at SIB, observed that students lack basic skills (personal communication, January 14, 2008). Mr. A administers a basic skills math test to his students each term and analyzes the results. Students' 2007 fall scores showed that many of them were not able to recall and apply the skills learned in the classroom. Mr. A's test results demonstrated that SIB students, many of whom are English Language Learners, were not able to apply the skills learned in their previous math courses (Basic Math and Algebra 1). The results of the test also demonstrated that students do not understand math content, but are rather simply doing what is necessary, such as memorizing in order to pass their math classes.

It is possible that students are not motivated to understand the applications because, as Bransford, Brown and Cocking (2000) state, they "do not see the usefulness of what they are learning and they cannot use that information to do something that has an impact on them" (p. 61).

A “math importance” survey (see Appendix, page 138) administered to SIB math students showed that they are well aware that math will play a crucial role in their future goals, but just as the students in the Texas Instruments survey, the majority of the SIB math students are not willing to take more than the requisite courses.

Many students are only willing to fulfill the district and school’s math requirements in order to graduate, without foreseeing that higher math is required to meet their future goals. A future goals survey administered during the fall of 2007 at SIB showed that 72 out of 110 math students (65%) plan to attend a community college or four year university and are aware that math is a requirement for acceptance. However, students’ awareness of the importance of math for their future goals does not seem to be connected to motivation. When students were asked if they are motivated to do mathematics on their own, only one third (33%) of them agreed. It has been my experience that students want to complete their requirements, and when they are asked if they intend to take higher math classes, they always reply that they are finished with math and do not intend to continue their studies.

It has been my experience for the past six years that students who come through my door routinely ask, “Why do I have to take this math class?” and “Why do I have to know this math?” It became even clearer to me that students do not enjoy math class since a majority of them have expressed their belief that math will never be helpful in their daily lives and out-of-the classroom experiences. In an attempt to provide some relevance, I proceed to explain the importance of math in terms that they understand. I tell them that math plays an important role in our daily lives such as going to the store and buying candy, going to the mall and shopping for clothes, and going out for dinner with family. I also mention that if any of them want to become engineers, architects and mathematics instructors, specific topics such as solving multiple step equations are necessary.

My students' questions and a statement by Deci about motivation put their view into perspective for me. According to Deci (1995), "Self-motivation, rather than external motivation, is at the heart of creativity, responsibility, healthy behavior and lasting change" (p. 9).This helped me to better understand my students' view of math: if one does not see the purpose or the benefits of it, why even try? I also recognize that students' lives are busy and complicated; they are survival agents like the rest of us. They tend to want to know only that which is necessary to survive. If students do not connect the relevance of their classes to real-world experiences, they tend to close their minds to the possibility that they may eventually need the skills. It is our duty and responsibility as educators, to offer proper support to all students so that they have a fair chance at education, even if we must modify current curriculum to include students' interests and auxiliary real-world applications.

Conclusion

Students' beliefs about the lack of relevance of their math skills and their application to real world experiences, poor understanding of math content, and lack of motivation to learn has affected international, national, state and school test results. These results demonstrate that a change in curriculum needs to occur to help students increase their understanding about the application of mathematics in the classroom, to out-of-school settings. Furthermore, students' memorization of steps versus content understanding drives educators to redefine or invent new approaches in teaching mathematics to help students increase their self-efficacy and to obtain a deeper understanding of math. Fortunately, there is abundant research available on oral/written communication techniques, and on creating authentic contexts for learning which incorporate motivational methods and strategies that will foster self-efficacy, deepen students understanding of mathematics content, and increase intrinsic motivation to learn.

III. Review of Content Research

There are numerous studies on how to increase intrinsic motivation in students (Bandura, 1997; Brophy, 2004; Deci, 1995; Lepper, 1988). Researchers have focused on the sources of intrinsic motivation and how instructors utilize them in the classroom. Through strategies such as collaborative learning (Gutierrez, 2002; Manouchehri, 2004), and focusing on communication (Borasi et al, 1998; Burns & Silbey, 2000), and authenticity (Brophy, 2002; Palmer & Major, 2001; Cranton, 2006), instructors have sought to promote students' motivation to learn and deepen their understanding of mathematics, not only in mainstream classrooms, but in sheltered courses where majority of students are classified as English Language Learners (ELLs) as well.

Because that the majority of my students are ELLs, helping them to develop strong oral and written communication in authentic mathematics contexts is a crucial component in ensuring that they learn the mathematics standards. Collaborative learning and competent oral and written communication in authentic mathematics contexts are intended not only to facilitate ELLs' motivation to learn, but also to support the acquisition of mathematical and academic language and content. In teaching ELL students to become effective communicators of problem solving procedures, primary language can be used as an asset allowing students to demonstrate their understanding of the content and its relevance to out-of-school settings. The use of primary language assists the learning of a second language (Cummins, 1991; Snow, 1990). In addition, collaborative learning "broadens the collective pool of knowledge that the group can use to solve problems" (Bayer, 1990, p.13). Hiebert et al (1993) state that classrooms need to use collaborative learning because it provides "a rich environment for developing deep understanging of mathematics"(p. 43). Using authentic contexts based on real-life situations, rather than contextualized textbook knowledge (Garcia & Pearson, 1994), and including "students' experiences and background increase participation, satisfaction and learning" among students (Yamauchi, 2005, p. 119). Using students' own experiences facilitates their engagement in completing assigned tasks.

Motivation to Learn

Traditionally, researchers have focused on the difference between intrinsic and extrinsic motivation factors (Deci, 1995; Brophy, 2004; Lepper, 1988). According to Brophy (2004), extrinsic motivation is driven by factors outside the individual such as "prizes, praise and grades" (p. 163). Unfortunately, extrinsic forces diminish motivation in students if they are not utilized properly. Deci (1995) argues that in order for extrinsic motivators to work there must be a clear understanding of the expected goals and outcomes. He asserts that if the connection between them is missing, the end product will be a lack of motivation. If students, including English Language Learners, fail to see the purpose of their actions they tend to experience apathy and therefore avoid the task. In contrast, intrinsic motivation promotes student motivation to learn.

Brophy (2004) defines motivation to learn as "the quality of students' cognitive responses involving attempts to make sense of information, relate previous knowledge and master the skills that the activity develops" (p. 16). Similarly, Deci and

Ryan (2000) define intrinsic motivation as "doing something because it is inherently interesting or enjoyable" (p. 55). Research by Lepper (1988) showed that when students are intrinsically motivated they tend to spend more time and use multiple strategies that require more effort, which enables students to process information more deeply.

Additionally, research has also demonstrated that in order for students to be optimally motivated to learn they must "see schooling and education as personally relevant to their interests and goals" (McCombs, 1991, pp. 117-127). Capitalizing on this research, Brophy (2004) points out how providing a goal for learning increases student motivation to learn. In such an environment students are driven to accomplish the purpose or end result rather than seeking an arbitrary reward. Brophy (2004) observes that in order for the learning experience to be effective and worthwhile, major instructional goals must include the "knowledge, skills, attitudes, values and dispositions" (p. 33) that the teacher wants students to acquire.

It is the teacher's responsibility to make curricula's goals clear, challenging, and attainable in order to foster students' motivation to learn. As research (Bandura, 1998; Gutierrez, 2000; McCombs, 1991) suggests, intrinsic motivation can be enhanced by increasing students' confidence, and providing peer learning opportunities and real-life applications of the math standards and content. Bayer (1990) proposed that collaborative learning helps students "construct knowledge beyond what they could do independently" (p. 20). We are challenged when we learn from each other through interaction and exposing ourselves to other ways of thinking and finding solutions to tasks. Gutierrez's (2002) studies have demonstrated that the use of ELLs' primary language in group discussion offers students the opportunity to deepen their understanding of content. A deeper understanding of content creates a continuous leaning cycle in which students have more opportunity to become competent in new skills and content. Students who reach a high level of competency tend to increase their self-efficacy. Conversely, students who have a high level of self-efficacy tend to spend longer time on tasks as well as reach a higher level of competency which fosters confidence.

Studies (Bandura, 1998; Lepper, 1988) have indicated that students who experience a high level of self-efficacy tend to spend more time on tasks. Spending more time on tasks can provide students with the opportunity to become competent in their retrieval of knowledge and skills, thus increasing their motivation to learn.

Self -Efficacy

A component that affects competency in students is the level of self-efficacy they possess. Self-efficacy, according to Bandura (1994) is achieved when "[students have positive beliefs] about their capabilities to produce different levels of performance that exercise influence over events that affect their lives" (p.1). Bandura (1994) believes that students can create a strong sense of self-efficacy through mastery experiences provided in social settings. If students encounter success in given tasks, and see peers that successfully reach the same goals, their belief in self-efficacy increases. In 2006, Margolis and McCabe declared that students' self-efficacy can be increased by assigning moderately-difficult tasks, using peer modeling, teaching specific learning strategies, capitalizing on students' interests, allowing students to make their own choices, encouraging students to try, giving frequent and focused feedback, and encouraging accurate attributions (pp. 218-227).

Research (Bransford, 2000) has shown that competency can be promoted in learners. Deci (1995) declares that for a "[student] to become intrinsically motivated to learn they need to perceive themselves as competent" (p. 66). Students who see themselves as competent tend to spend more time and effort on challenging tasks which further promotes competency. Bransford (2000) refers to students' competence in a subject as a state of expertise. Students become experts when they have to "acquire a great deal of content knowledge that is organized in ways that reflect a deep understanding of their subject matter" and "are able to flexibly retrieve important aspects of their knowledge with little attentional effort" (p. 31).

The ability to recall and apply the appropriate knowledge to deal with uncommon situations increases students' level of confidence. Research shows that when "[students] succeed at reaching a goal or activity, they tend to be more competent" (Deci, 1995). However, to achieve competency, according the National Council of Teachers of English (NCTE) (1996), bilingual learners should be allowed to use their primary language because "the development of competency is most effective when teachers build on their first language" (p. 36). Additionally, bilingual learners need to be provided with academic content-area knowledge and academic English. The NCTE (2006) recommends that in order for bilingual students to increase their self-efficacy, teachers must use academic language in mathematics. The NCTE recommends that "programs should be learner-centered because learning is construction of knowledge by the student" (CELT, 1998). When students are invested in the construction of their knowledge they are more willing to take risks, and feel more capable of achieving challenging goals.

Bandura (1994) has found that the stronger a student's self-efficacy, the higher the goals they will set for themselves. When students feel capable of achieving challenging goals, students feel more secure and therefore their competency and self-efficacy levels increase. Brophy (2004) stated that self-competency will lead students to pay more attention and spend more time on a given task because they view it as fun and enjoyable.

Due to the indicator for expertise, which is seen by Bransford (2000) as the amount of time spent learning and working in a subject area to gain mastery, students will be able to recall appropriate strategies to deal with different situations such as problem solving in mathematics. The fact that students perceive spending more time on a given task as enjoyable offers students the opportunity to see math as fun and achievable. Additionally, self-competency causes "[students] to seek new challenges… and experience these challenges as intrinsically motivating" (Brophy, 2004, p. 185). Therefore, increasing and maintaining students' competency level triggers an increase in self-efficacy and intrinsic motivation to learn and promotes deeper understanding of the content in a mathematics course.

Understanding content deeply is increased by students' sense of self-efficacy and competency in their skills, and it also requires that students have the opportunity to experience different methods, procedures, and points of view to reach success on a given task. A teaching strategy where students have the opportunity to experience other points of view is collaborative learning.

Collaborative Learning

Students' intrinsic motivation increases when they feel a high level of self-efficacy (Bandura, 1998). Furthermore, a high level of self-efficacy provides students with the opportunity to reach competency through their own and others' experiences of success on a given task. In a class where group and/or pair work is constantly implemented, collaborative learning is a crucial component where constant communication and explanation must happen. Vygotsky's (1978) theory of cognitive development states that during the process of development, students tend to be active participants in their learning through the use of language and peer-interaction. Vygotsky's (1978) research showed that students were able to solve problems even if the problems were beyond their development level, when they were guided by an expert. As a result of this partnership, the novice student has the opportunity to internalize the new information and is able to use it independently in the next problem solving situation. This theory is important to take into consideration when applied in a sheltered classroom where the majority of the students are classified as ELL 1-2 or ELL 3-4. These classifications signify that the students have not achieved scores indicating fluency on the California English Language Development Test (CELDT). Thus to maximize collaborative learning, non-ELLs are seen as experts in the English language and the ELLs are seen as novices. In this collaboration the non-ELLs are given the opportunity to increase their self-efficacy by taking the role of experts and help ELLs with the language by translating if they speak both languages, whereas the ELLs (novices) see the expert position as a goal to achieve, and are thus motivated to learn.

Studies done by Gutierrez (2002) and Manouchehri (2004) show that arranging students in pairs or groups has positive outcomes, especially if students are encouraged to use their primary language. Gutierrez claims that teachers need to build on students' primary language and allow them to communicate in such ways as to convey mathematical concepts. Furthermore, if the concept of the content is already known, then the teacher's focus should be to "help develop students' knowledge of the language of the content" (Gutierrez, 2002, p. 1053). Manouchehri (2004) discovered that students in small and large groups were engaged in tasks longer and answered and posed more questions throughout the duration of the task. Manouchehri's results would predict Vygotsky's (1978) theory of cognitive development. Students develop their knowledge when guided by an expert through what Vygotsky refers to as the "zone of proximal development." Additionally, it has been my experience that recently migrated ELLs students, who had formal education in their native countries, generally have strong math knowledge and their main challenge is to learn English. Conversely, the majority of non-ELLs who have lived in the United States for a longer period of time have stronger English skills, but their math knowledge may be minimal. Using students' primary language reinforces the ELLs' math knowledge previously learned in their native countries, while creating a collaborative environment where they become the experts with a strong bridge for new skills and knowledge to be acquired, such as academic English.

Studies focused on team learning processes and phases of adult education carried out by Dechant, Marsick, and Kasl (1993), and Brooks (1994), demonstrated that teams created new knowledge and relied on previously learned information and ideas to push themselves to come up with new ideas and improve their current understanding of concepts and tasks. Bayer (1990) stated that "individual group members faced with conflicting viewpoints attempt to clarify, analyze, synthesize, speculate and evaluate the conflicting points of view" (p. 12) as they try to come to an agreeable solution (p. 12). Similarly, Lumsden, (1996) cites Ted Nassbaum, stating that when students are faced with challenging tasks "they tend to motivate one another to accomplish the group goal" (p. 3).

Collaborative learning allows students the opportunity to develop their cognitive, social, and communication skills. Collaborative learning is a tool that when used appropriately increases self-efficacy and the intrinsic motivation to learn. Brophy (2004) found that in classrooms where collaboration is practiced, students are likely to experience stronger intrinsic motivation to learn than when involved in learning activities that only require interaction with the teacher.

Collaborative learning is a crucial component of a classroom in which English is not the primary language because "working in groups has the potential to offer gains (either concrete or conceptual) to [students] who differ in linguistic proficiency" (Gutierrez, 2002, p. 1055). A classroom with English Language Learners provides the teacher the opportunity to be creative in developing collaborative groups. To create an effective learning environment in which every individual is challenged and motivated to learn, students' English language skill levels must be taken into consideration. Language balanced groups can be created by pairing students according to their levels of English language proficiency. For example, by pairing an ELL 1-2 with and ELL 3-4 gives students the opportunity to use their native language while they are discussing procedures of a problem. Students with a greater math knowledge learned in their native language will benefit by focusing on learning the academic language, while the students with greater English skills will benefit by concentrating on learning the content. The use of collaborative learning communities offers students the opportunity to see different views, but it can not be done without the use of written and/or oral communication.

Communication

Collaborative learning becomes most effective when both written and/or oral communications are employed. Mead's study (as cited in Bayer, 1990) shows that "cognitive development occurs, then, through the incorporation of other's viewpoints into our own thought processes" (p. 12). Written and/or oral communication is critical, especially in sheltered classrooms where students come with a wide range of background knowledge. However, ELLs face unique challenges when in terms of learning content in a math classroom because one of the major issues is that our ELL's are different in many ways and "some come to our schools with a strong academic background, while others have had deficient schooling or none at all" (Leiva, 2008). Some students come to the classroom with minimal academic communication skills. In addition, ELLs are "expected to master content in English before they have reached a certain level of English proficiency" (NEA, 2008, p.1). Not only are ELLs expected to master the content in English, but they are also tested in math and English content before they reach a proficiency level. Additionally, as Haynes (2008) states, ELLs come from countries where the formation of numbers, the use of mathematical punctuation, systems of measurement, minimal content standards for mathematical knowledge, and the use of manipulatives, are different. Mathematical terms do not always translate well, and thus ELLs need to acquire academic language while simultaneously acquiring the content at the same time. Furthermore, ELLs must acquire "vocabulary skills, and mathematical syntax, semantics and discourse features" to effectively function in the math classroom (Díaz-Rico & Weed, 1995).

Research on strategies to improve ELLs' English proficiency level establishes the importance of opportunities for peer-to-peer interaction and student-to-teacher communication. Written and/or oral communication in the content areas is crucial as the "learning process consists of interaction between persons for the purpose of developing and sharing meaning" (Khisty, 2008, p. 280). Khisty's research (2008) shows that it is important for teachers to pay attention to "classroom discourse, that is, what is said and how it is said" (p. 280). Díaz-Rico and Weed (1995) state that students need to be encouraged to think aloud about mathematics and share with their peers the process to solutions (p. 138).

Communication in the math classroom, especially in the form of written and/or oral explanation, is a technique that provides students with opportunities to observe how other students think and resolve a given task. Researchers of math learning have found that explaining math concepts benefits students (Cobb et al, 1997; Hilbert & Wearne, 1993; Khisty, 1995; Lampert, 1990; Wood, 1999). Mathematicians themselves believe that "a mathematical theory is not to be considered complete until you have made it so clear that you can explain it to the first man you meet on the street" (Hilbert, 1900, ¶ 4). University of Edinburgh mathematics professor, Michael Atiyah, a professor of topology and geometry and 2004 Abel Prize winner, testified to this idea when he stated that “when you understand [math] well, you address it, and eventually can present it in a way that [makes] it look much more understandable” (Reaussen & Skau, 2004, ¶ 1). Communication, explanation and interaction in the classroom can be in oral or written form. According to the NCTM, such communication allows “ideas [to] become objects of reflection, refinement, discussion and amendment” (NCTM, 2000, p. 59).

Oral communication according to Hatano & Inagaki (1991) offers students the opportunity to gain a better mathematical understanding as they work to convince their peers about different points of view. Chapin and O’Connor (2003) state that “students talking about mathematics concepts, procedures and problem solving helps them understand more deeply and with greater clarity” (p. 7). The fact that students have to explain and convince others about their procedures and their rationalization offers them the opportunity to develop their own understanding of the content. Student-teacher oral explanations can be used as an assessment tool by using open-ended questioning as the student will be required to “describe the steps that he or she used to complete the problem” (Fennell, 2006). Peer-to-peer and teacher-to-student oral explanations are another strategy to identify early misconceptions about previous or current content. Using students’ oral comments, the teacher can adjust the lesson and clear any misconceptions about the content.

Written explanations, especially in journal writing, are another powerful method of communication in the math classroom as they “help students stretch their thinking and make sense of problems that can sometimes leave them confused and frustrated” (The Importance of Communications in the Mathematics Classrooms, (n.d.). Pros section, ¶ 2). Having the opportunity to make sense of confusing and frustrating concepts gives students the chance to ask questions, get clarification, keep track of their reasoning, and better understand the content. Additionally, written explanations in the math classroom can help students "consolidate and reflect on their thinking, and clarify their thoughts about the content." (NCTM, 2000, p.60) Student writing in math can therefore be used to extend the mathematical conversation and interaction in the classroom as students' awareness of their own thought processes, strengths, and weaknesses develop.

Written and oral explanations are crucial components in an English Language Learner (ELL) classroom. Research (Snow, Burns, & Griffin, 1998) shows that ELL students benefit from having the freedom to communicate and explain in their native language because supporting literacy and language skills in the first language provides a base for successful literacy development in the second language. The National Council of Teachers of English supports the idea that validating and supporting students' native language empowers them, resulting in academic benefits (1997).

Communication such as written and oral explanations in a collaborative learning environment also provides the opportunity to have an authentic context where students' interests and past experiences are imbedded into the curriculum. The teacher can use students' backgrounds, prior knowledge and nationalities to incorporate content that relates to students' interests.

Authentic Context

It has been my experience that students tend to pay more attention to content when they see their interests embedded in the curriculum. In order for the learning to be authentic one must take into consideration the content, but it is more important that the instruction and curriculum is student-centered. Brophy (2004) suggests that teachers should make curricular and instructional adjustments in order for students to find them interesting and enjoyable because a majority of the curriculum is chosen to suit what society wants students to learn, without taking the students' opinions or needs into consideration.

Cranton (2006) suggests that as teachers plan their lessons and curriculum in mathematics, they must take the sequence of the curriculum, and relatedness to real-world applications, and students' interests, autonomy, and choice into consideration to foster and maintain the intrinsic motivation to learn. Parker Palmer (as cited by Kreber in 2007) argues that "learning is enhanced and supported by teachers who generate community between themselves and their subject, between themselves and students, and eventually between students and the subject" (2007, p. 2). Becoming an authentic teacher appears to be a developmental process that relies on experience, maturity, self-exploration and reflection.

It is the responsibility of the teacher to get to know the students and "find out what topics they want to learn about and what activities they enjoy doing and incorporate them into the lessons as much as possible" (Brophy, 2004, p.12). Incorporating ELLs' interests provides a platform that is valuable for communication in mathematics as each student comes with different experience and background knowledge. Through their explanations, students have the opportunity to learn and appreciate each other's points of view, learn different procedures to solve tasks, and allow their teacher to assess their prior knowledge of the content, thus enabling their teacher to refine the curriculum accordingly.

Incorporating students' interests into the curriculum can transform a classroom into an enjoyable learning venue where students have a sense of motivation to learn. James (1998) claims that engaging students' interests is fundamental for learning, especially if we have an expectation of going beyond surface knowledge and avoiding simple memorization of information. Students' interest can be fostered by showing them that what they are learning is also relevant to their lives and educational goals. Brophy (2004) communicates that Means, Jonassen and Dewyer (1997) were able to increase students' interest and motivation to learn by using texts that incorporated material connected to the content and to students' lives. As a result, research suggests that teachers can enhance students' existing motivation to learn by adapting the curriculum to their individual interests. Research (Garcia & Pearson, 1994) showed that authentic tasks based on real-life situations motivated students and enhanced their performance. Also, Ruiz-Primo & Shavelson (1996) suggest that it is important to provide authentic contexts [for mathematical problems] using real-life situations to enhance meaning and relevance for students. One of the main concerns in the math classroom is that students want to see the content relevance and applicability of learned skills to out-of-school settings. This provides the opportunity for teachers to incorporate real-world based problems into the curriculum.

A study of underachieving high school students of a middle class community in a suburb of a large metropolitan area done by Portal and Sampson (2001) provided evidence that a modification of the curriculum to include real-life math problems was essential in order to increase student achievement and motivation to learn. Haehl (2001) conducted a study of matching math skills to real-life applications by using math exercises, and found that students can incorporate skills in real-world applications while focusing on concepts.

Lastly, it is imperative that teachers are sensitive to the ethnic and cultural make up of the class to provide every student with accessibility to the content, and success in student goals to foster their intrinsic motivation to learn. Vygotsky's (1998) sociocultural theory of learning suggests that all higher psychological functioning such as one's ideas, beliefs, thoughts and problem solving skills are learned through social interaction in our communities and social settings. Yamauchi (2005) states that "when educators incorporate more of what students expect and know from their home and community experiences, student motivation and learning may increase" (2005, p. 105). Incorporating students' prior knowledge and cultural awareness into the curriculum is a powerful tool to make students feel that they belong to the classroom community, and to facilitate collaborative learning settings where oral and/or written communication is essential.

Unfortunately, there are many schools in the U.S. that have realized that the knowledge acquired in the classrooms has not been transferred to out of school settings (Hierber et al., 1997). In efforts to reduce the lack of transfer of knowledge, the National Council of Teachers in Mathematics (NCTM) (1980, 1991) has suggested an approach to teaching mathematics through problem solving which simulates real life and has connections to real-world applications. These recommendations provide teachers with the opportunity to use and pose authentic problems to foster intrinsic motivation to learn the mathematical content. Authenticity supports teachers to make learning more accessible to every student by providing curriculum with students' interests imbedded in the content and choosing problems that show the relevance of math skills to out-of-school settings. Osawa's research (2002) based on real-life applications shows that out-of-school setting problems help students learn the utility of mathematics, and everyday mathematical activities tend to "remain vivid in [students'] memories" (p. 92). Thus, according to research, students' competency and motivation to learn increases when they see their interests imbedded in the curriculum as well as the relevance of their knowledge as they succeed in real-world math applications.

Students experience the relevance of mathematics content to out-of-school settings and can actively apply students' knowledge, skills and processes when teachers have more freedom to choose and modify the curriculum. Cindy Boyd, as quoted in Lumsden (1996), states that giving assignments that have real-world application show students that math can be enjoyable and also facilitates the deeper understanding of mathematical concepts. However, the majority of the curriculum currently implemented in classrooms does not take into consideration students' experiences and interests and lacks tasks with opportunities for collaborative learning, oral and written explanations, and authentic contexts.

Summary

As research has demonstrated, extrinsic motivation has either a limited or detrimental effect on student motivation to learn. Therefore, instructors need to foster intrinsic motivation by focusing on abilities such as competency. Students' level of competency influences their self-efficacy. Through collaborative learning, students are exposed to different styles of acquiring a solution, and can see others' ideas and methods of solving problems. Through communication about mathematics such as written and oral explanations in primary and secondary languages, which are crucial in sheltered classes, students have the opportunity to explain and see different ways of finding solutions to math problems. Through authentic learning practices, teachers create relatable classroom contexts. Authentic contexts have students' interests imbedded in each lesson to provide relevance to out-of-school settings.

Teachers must use students' interests and past experiences in collaborative settings. Teachers must also use oral/written communication and make the curriculum authentic to the students in order to increase students' intrinsic motivation to learn mathematics. Intrinsic motivation inspires students to spend more time on tasks and challenge themselves to deeply understand the content and its relevance and use to out-of-school settings.

IV. Existing Curricula Review

Intrinsic and extrinsic motivations have been a focus of research in learning. Deci (1995) states that self-motivation is at the heart of creativity, responsibility, healthy behavior, and lasting change. He adds that "intrinsic motivation is the process of doing and activity for its own sake" (p.9). In order for students to develop intrinsic motivation and completely engage in the learning of content, especially in mathematics, the majority of them wants to see and understand how the subject relates to them and believe that it somehow will be helpful in out-of-school settings.

This review of current curricula will address the following considerations:

- Do the lessons offer motivation to learn the skills and concepts?
- Do the lessons provide opportunities for collaborative-learning and explanations of rationale and chosen procedures?
- How is the role of the teacher defined?
- How is flexibility for teachers and creativity for students encouraged?
- Are there multiple opportunities to make "x" relevant to real-world applications and out-of-school settings?

With the purpose of providing evidence to answer the above questions, I have chosen to review four existing curricula which have been implemented at SIB School in recent years. The first curriculum chosen, and current adoption of SIB, was *Geometry Concepts and Skills* (McDougal Littell, 2003). The second textbook I reviewed was *Mathematics 2 (Geometry),* (CPM Educational Program, 2000), a curriculum based on collaborative learning and explorations. The third text I examined was *Discovering Geometry, An investigative approach,* (Key Curriculum Press, 2003).

This curriculum is based on an investigative approach of exploring and understanding geometric concepts. Finally, the fourth curriculum I reviewed was *Geometry* (Holt, 2004). Holt's curriculum provides students with examples and situations where math is found in the real world.

Geometry Concepts and Skills by McDougal Littell.

Within *Geometry: Concepts and Skills* (McDougal Littell, 2003) one finds a curricular focus "on key concepts and topics that provide a strong foundation in the essentials of geometry" (Littell, 2003, p. ii). This textbook includes a study guide where students can find a short preview of the chapter, a readiness quiz and hints on how to learn vocabulary through visualizations. There is uniformity within the layout of each lesson: an introduction includes bold vocabulary words, examples include step-by-step solutions, and exercises provide students the opportunity to practice skills. As a student opens up the text book, the first page gives information about the authors. The next section is a table of contents which includes a breakdown of sections and topics covered in each chapter. A table inserted to the left of each chapter contains student help tips, application highlights and internet resources. Within the "Student Help" column students find reference pages on study techniques, vocabulary, further reading, skills review and tests tips. Below the "Applications and Highlights" column, students find reference pages leading them to problems based on real-life applications. The "Internet" column includes references to online problems that require students to access them using technology. This textbook provides English language learners access to content by the use of visuals such as pictures, photos and diagrams, but sometimes the sentence structure such as "If an angle is inscribed in a circle, then its measure is half the measure of its intercepted arc" is a bit complex and hard to understand.

This textbook attempts to motivate students to learn the skills and concepts of each chapter through written bullet points of goals, including real-world connections such as: "[You will] understand how the Braille alphabet works" (p. 1). The *Geometry: Concepts and Skills* textbook looks promising as it starts with an introduction consisting of a real-life situation highlighting how professionals such as engineers, architects, or surveyors use geometry skills. Unfortunately, the textbook seldom includes problems that require students to apply the concepts and skills in simulated real-life problems. The short introduction, highlighted vocabulary words and examples fail to build motivation to learn the skills and concepts.

The division of each chapter section into two mini-lessons with checkpoint exercises offers students the opportunity to practice the concept studied, but lacks an opportunity for collaborative learning unless the teacher specifically assigns the exercises as team work. Furthermore, each exercise section does not take into consideration the opportunity for explanations in either written or oral form. Students are merely asked to solve problems without the need to discuss solutions in teams or pairs. Each section culminates with exercises in which students are to review vocabulary and basic skills. Students are given directions in each section such as to "simplify" or "evaluate" without the opportunity to choose unless the teacher directs students to choose their own problems to be completed. Therefore, *Geometry: Concepts and Skills* does not support autonomy.

Students are given plenty of exercises through which, if they choose to, they can become competent in the skills and concepts being studied. While there are anywhere from thirty to fifty exercises to complete, in my judgment as a geometry teacher only ten percent of problems are classified as critical thinking problems. These problems may or may not include the opportunity for students to apply and connect the use of the skills in out-of-school problems. When the opportunity is offered, it is usually a problem that requires one short simple explanation (see Figure 1). These exercises only require students to provide a simple answer. They do not provide opportunities for questioning which, according to Chapin (2003), "force students to analyze, synthesize and generalize" (p. 132).

Water Resources **In Exercises 15–17, use the diagram.** A structure built with rocks is used to redirect the flow of water in a stream and increase the rate of the water's flow. Its shape is a right triangle.

15. Identify the side opposite $\angle MNL$.

16. If the measure of the upstream angle is 37°, what is the measure of the downstream angle?

17. It is generally recommended that the upstream angle should be between 30° and 45°. Give a range of angle measures for the downstream angle.

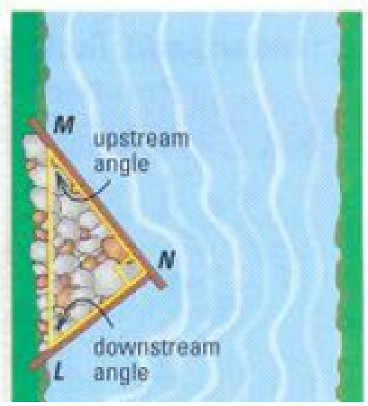


Figure 1: Water resources.

Throughout the lessons, the role of the teacher is to present vocabulary, skills, and the process of their application. It is also the teacher's responsibility to make students aware of multiple approaches to solutions, if there are any. Creativity is rarely encouraged, as the directions to the exercises are very direct and only a few problems are designed to foster critical thinking. These types of open-ended questions, as mentioned above, are important components of group collaboration. Additional resources include a wide variety of teaching techniques and tools with plenty of opportunity to be creative in the teaching approach, but these resources lack the opportunity to make the content relevant to students or incorporate their interests. As Brophy states, teachers should "find out what topics students want to learn about and what activities they enjoy doing, then build these into the curriculum as much as possible" (2004, p.12) in order to increase students' motivation to learn. *Geometry. Concepts and Skills,* by Prentice Hall, does offer students the opportunities to see the skills being applied to real-world problems. The real-world problems are limited to one or two exercises out of the fifty provided, and most of these exercises are problems with which the students do not identify.

The geometry textbook does a satisfactory job of providing ELLs with the skills and concepts needed to succeed in the course, but falls short in providing opportunities for collaborative learning and written and oral explanations in its use of interesting real-world applications. As well, the textbook does not make content relevant to students' out-of-school settings, which would increase students' motivation to learn.

Mathematics 2 (Geometry) by CPM.

The *Mathematics 2 (Geometry)* (CPM Educational Program, 2000) curriculum is designed to be studied in a collaborative environment where communication and peer interaction are required. According to the Teacher's Edition, students are to "investigate new situations, discover relationships, and figure out what strategies to use to solve problems" (p. III).

Mathematics 2 (Geometry) intends to captures students' interests in every lesson. Its opening sentences provide an explanation of the objectives students are to learn and the required previous knowledge and the open-ended questions students must keep in mind as they explore the problems. The opportunity for oral and written explanations is clearly provided as each section instructs students to work, interact, and explain approaches to solutions with their group at their own pace. Each exercise provides teachers with the flexibility to be a facilitator and assign appropriate time to group work. Group members can decide among themselves who will take the roles of recorder, presenter, timer, and writer. The instructor's role is clearly defined as a facilitator, which consists of circulating around the room, asking open-ended questions, assessing the students, and offering help as required. Creativity in this curriculum is always encouraged as students are asked to explore solutions and come to agreement on them. If desired, the teacher can ask the team to create and solve their own problems to check for understanding.

Mathematics 2 (Geometry) provides motivation to learn through collaboration and opportunities for students to work through explanations, but falls short of providing students the opportunity to become competent. Each lesson covers a topic which is explored by the group. Once the group has agreed to the solution, the group is free to continue and apply the concept. Unfortunately, there are not enough exercises for them to work through to become competent, as there are only six to ten exercises with more than eighty percent of them reviewing previously covered skills and topics.

The majority of the problems chosen for this curriculum are based on real-world applications, but often they are text dense and could be as confusing and difficult to solve for ELLs. The text could decrease English language learners self-efficacy due to the difficulty of sentence structure and complex academic language of the problems.

Although sample problem RC-29 from Unit 1 (page 20) provides step by step instructions (see Figure 2), it has been my experience that problems such as this tend to frustrate ELL students because the wording is confusing. The sentences are too long and too complex. Furthermore, if students do not have the resource page required and are not successful in finding the first answer, there is no opportunity to continue as the second question depends on the success of obtaining the first answer. It was my experience that while implementing the CPM curriculum, the students became confused, frustrated, and many gave up. Students were even more frustrated with the fact that there was not much opportunity to apply the concept.

The practice section of the CPM curriculum employs a spiral effect. The spiral technique includes problems from all the concepts previously covered. It has been my experience that the spiral effect of the *Mathematics 2 (Geometry)* tends to frustrate students and according to Brophy, when "[students] are faced with challenging tasks and they have low skills [students] tend to have anxiety" (2004, p. 11). The spiral approach used in the *Mathematics 2 (Geometry)* curriculum succeeds in providing students with the motivation to learn, autonomy, collaborative-learning, real-world applications and creativity to solve problems, yet it fails to provide the opportunity for students to feel a sense of competency and thus it leads students to feel frustrated, anxious and unmotivated to continue to learn.

RC-29. For the next three problems you will need a copy of the resource page "Rectangles, Parallelograms, and Triangles."

a) What is the name of figure A? Give the length of each side and the area. Imagine you are talking to a 4th grader who is just learning about area. Explain to her how to find out the area without actually counting the squares.

b) Draw a line segment between (2, -8) and (9, -2). Shade the region in the rectangle that is below this line and find its area. How is the shaded area related to the area of the rectangle?

c) Draw a rectangle in the box on your resource page. Make one pair of opposite sides horizontal and the other pair vertical. Label the horizontal sides "b" for **base** and the vertical sides "h" for **height.** What would be the formula to find the area of a rectangle?

d) In the rectangle you just drew, connect one pair of opposite corners to make two triangles. Explain why adding the segment shows us that the formula used to find the area of a right triangle is $\frac{1}{2}bh$, where b represents the **base** and h represents the **height** of the triangle.

Figure 2: CPM Collaborative learning problem.

Discovering Geometry: An Investigative Approach

The main goal of the *Discovering Geometry's* (2003) curriculum as stated in the instructor's manual on page xvii is to "achieve deep understanding by connecting new ideas to old ones in personal ways." This textbook content is presented in an investigative style. Students must collaborate to discuss interesting questions while using hands-on investigations to produce the formulas and symbolic representations of the lesson.

This curriculum claims that each lesson includes an investigation that students can perform with minimum direction from the instructor, and eventually carry out independently. Students are exposed to different ways of solving a problem by discussing it with their teammates. Ms. M, an SIB math teacher who has had experience teaching this curriculum, stated in an interview that "If students are self motivated, then this book would offer them a great opportunity to access the content" (M. M, personal communication, Dec. 6, 2007). However, as cited in the Needs Assessment section, students are not self motivated to learn, especially when it comes to mathematics courses.

The *Discovering Geometry* textbook does a respectable job of introducing vocabulary by using a bolded text. It also makes use of easy-to-understand sentence structure from which the ELL students can benefit. Students get a boost of confidence when they can understand what is being communicated. Group work is consistently emphasized in each lesson as students must discover and explain the formulas and symbolic representations with little or no help from the teacher. Students are provided with the opportunity to hear, discuss, and come to an agreement on the solutions to the discovery tasks.

Although this curriculum is focused upon group discoveries, it falls short of providing opportunities for developing competency and increasing students' self-efficacy. The discoveries of each lesson demand extended time in discussion because there is only one main task, and the opportunity to practice related skills, formulas and symbolic representations is limited. Furthermore, each lesson only provides ten extra exercises at the end of each lesson which do not provide enough opportunities for students to become comfortable with the content learned. If students do not feel comfortable using the skills learned, their self-efficacy will not be fostered and a sense of failure, anxiety and/or stress may be created. Students who doubt their capabilities tend to avoid difficult tasks and their self-efficacy will be affected (Bandura, 1994).

The role of the teacher in this curriculum is to organize teams in which students have the best opportunity to be active participants, provide the materials required for the investigations, make sure that students are on task, and to ask open-ended questions or provide prompts that assist students to engage in instructional conversation. To the contrary, this curriculum lacks the opportunities for instructor creativity and authenticity. Each lesson's discovery is somewhat dependent upon the previous investigation. Since the curriculum is highly dependent, if one of the parts is not administered because the instructor attempts to tailor instruction to the authentic context of their particular classroom, students will be completely puzzled. Therefore, in order for students to be successful in discovering the formulas or symbolic representations of the task, the teacher must fully follow the pacing and arrangement of this curriculum.

Furthermore, the investigation chosen for each lesson tends to be based on real-world problems to which students do not relate. Colleagues at my school who have had used this textbook agree that our students tend to get frustrated. They believe that our students do not feel connected nor relate to the material being covered (personal communication, November 30, 2007).

Geometry by Holt

The *Geometry* curriculum published by Holt, Rinehart and Winston in 2004 attempts to answer the question "Where are we ever going to use this math?" by providing students with examples and situations of instances where math is found in the real world; for example, finding geometry in natural art and how it is used in professional world. According to my students seeing the relevance of the content is a stronger incentive to become more interested in the subject.

The textbook provides plenty of opportunities for students to carry the book home and take the initiative to learn the content by themselves. A section entitled "You Can Begin Now" provides an opportunity for autonomy, as the section is dedicated to providing students with explanations and step-by-step instruction to create an end product based on the topics of the chapter. "You Can Begin Now" encourages students to work independently by providing examples of real-world applications where the concept has been used already, such as the Mayan calendar based on geometric patterns.

The opportunity for a strong sense of self-efficacy is provided through various exercises at the end of each section where one can apply the concept(s) studied in the lesson. However, unless the instructor specifies it, each student can work independently and thus collaborative learning and communication is not a component. A section entitled "Communicate" prompts students to think critically as it provides open-ended questions a student must respond to. Once again, however, unless the instructor assigns it as a team task, the directions are written so that each student answers these questions alone and the opportunity for discussion and explanation is minimal.

As an instructor of this curriculum one has the freedom to become a "jack of all trades," if desired. One can become a facilitator by assigning exercises as group-work tasks. The teacher can take the role of direct instructor, or simply be an observer/tutor by assigning specific exercises that will only require students to resolve single step arithmetic operations based on algebra I content.

"Looking Beyond" is a section following the exercise section. As the title suggests, this section requires students to look beyond the classroom activities by offering ideas to put into practice that apply the concept covered in the lesson. Creativity and autonomy are the goals of this task which can be based on out-of-classroom situations and real-world applications. "Looking Beyond" provides students with the relevance factor most of them need and desire in order to increase their motivation to learn.

While "Looking Beyond" provides students with the opportunity to be creative in their answers, it also offers them with the "x" factor, or relevance. Students realize, through the exercise, that the concepts learned in the lesson do have applications outside the classroom. However, many of the problems are challenges that ELLs have a hard time completing. The grammar and syntax are for the most part too foreign to them. The problem is based on a concept most ELLs have never seen or heard of: the Richter scale. It is hard for them to find it meaningful if they to do not have any idea or background knowledge about the concept.

Summary

Reviewing the four previous curricula that have been used in San Diego City Schools indicates that each textbook has advantages that can make learning mathematics an enjoyable experience, yet all of them lack aspects that persuade ELLs to reach a higher level of motivation to learn. Whether it is the lack of opportunities for collaborative learning, interactions, authentic contexts, or the lack of relevance to the real-world, none of these textbooks fully succeed in fostering ELLs' motivation to learn. Additionally, all the books fall short of providing ELLs the appropriate scaffolding to be successful in reaching a deeper understanding of geometry. My project will focus in creating a curriculum that will incorporate all of these characteristics along with students' interests to foster and/or increase students' motivation to learn by "Making X Relevant" to real-world applications and out-of-the classroom experiences.

V. "Making X Relevant"

Introduction

"Making X Relevant" is a curriculum designed to provide each English Language Learner (ELL) the opportunity to be an active participant, in math class. It focuses on two main goals. The first goal is to increase English Language Learners' self-efficacy, and the second goal is to deepen their understanding of mathematics through written and oral explanations, and authentic context.

Achieving Goal 1: Increase Self-efficacy

As a result of this project I want my students to become successful at solving math problems and explaining their procedures in order to increase their self-efficacy. Bandura (1994) believes that students can create a strong sense of self-efficacy through mastery experiences provided by social models. If students encounter success in given tasks and they see peers that successfully reach the same goals, their self-efficacy increase. Additionally, self-efficacy causes "[students] to seek new challenges… and experience these challenges as intrinsically motivating" (Brophy, 2004, p. 185). Lepper (1988) has shown that when students are intrinsically motivated they tend to spend more time and use strategies that require more effort, which enables them to process information more deeply. Competency, motivation and self-efficacy depend on each other, creating a continuous cycle. In "Making X Relevant", students' success in explanations of solutions to real-world problem increases competency.

Margolis and McCabe (2006) state that to increase self-efficacy educators must use moderately-difficult tasks, peer models, teach specific learning strategies, capitalize on students' interests, allow choice, encourage students to try, give frequent focused feedback, and encourage accurate attributions by the students. In the implementation of "Making X Relevant" students are presented with the following activities and techniques to foster and/or increase their self-efficacy (see Figure 3).

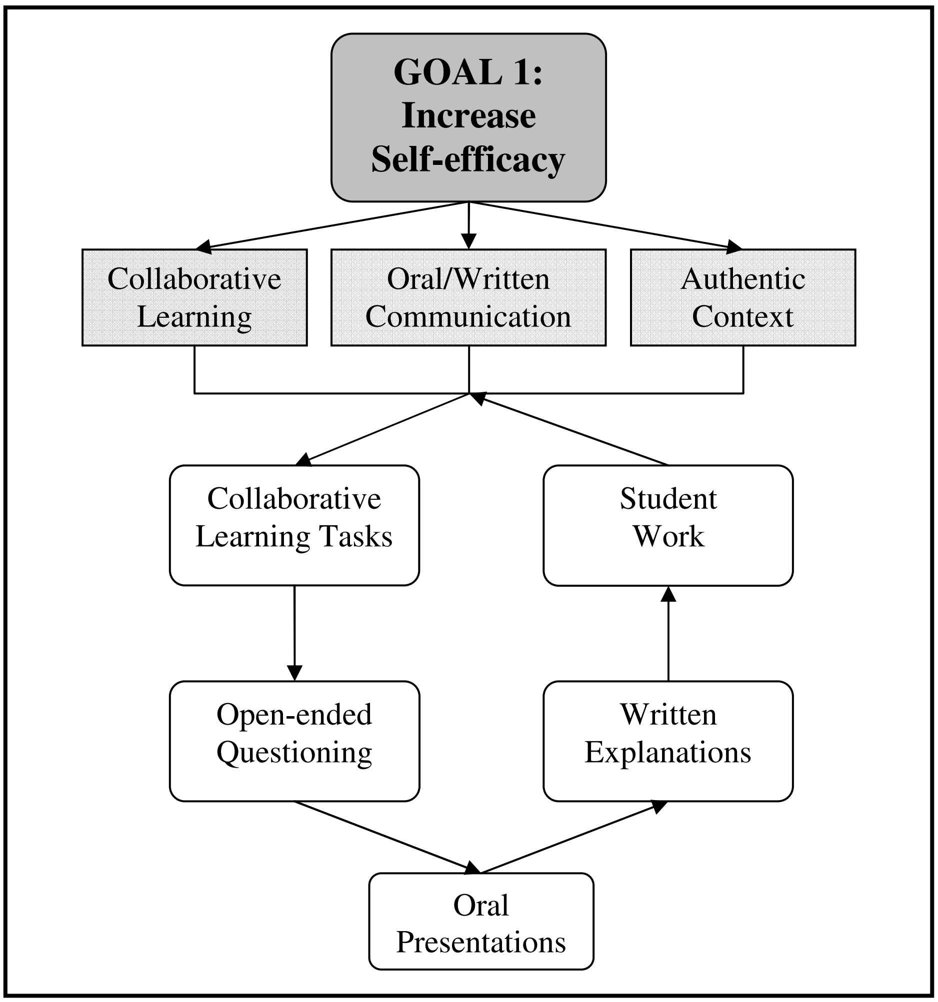


Figure 3: Techniques and activities to increase self-efficacy.

Collaborative Learning: Throughout the implementation of "Making X Relevant" students work in collaborative settings in which Margolis and McCabe's (2006) techniques are implemented to improve self-efficacy. While in collaborative learning pairs or teams, students are provided with specific learning strategies, and are expected to respect, to encourage each other, and be active participants. Students work together to solve moderately difficult tasks based on their own interests, and each individual is encouraged to try. Groups are encouraged to choose, present, and give mathematical explanations using academic language. Success in achieving a group task and making explanations increase all team members' self-efficacy.

Teacher open-ended questioning: Open ended questioning is used throughout the implementation of "Making X Relevant." While working in teams, students are assigned moderately difficult tasks that include manipulatives (hands-on projects). These tasks are purposely planned to challenge students and provide the educator with opportunities to ask open-ended questions. Teams' answers to the questions present opportunities to encourage accurate student attributions and thus increase students' self-efficacy.

Oral Presentations: Students are expected to share their procedures, reasoning and findings on given tasks. Students are given the opportunity to use their native language when presenting explanations because all the students are classified as ELLs 1-2 or ELLs 3-4, and more proficient English speakers take the role of translators. While in teams, students share their ideas and approaches to solving tasks. The opportunity to see others succeed on moderately difficult tasks promotes learning among peers. Individual oral presentations not only offer a venue to see different ways of solving a given task, but they also present the opportunity to validate students' efforts. Validating students' attributions and successes increases their self-efficacy.

Written explanations: I offered students adequate time to practice newly introduced and learned skills to reach a level of competency. Written explanations are done individually, in pairs or teams, depending on the difficulty of the task. While in pairs or teams, I encouraged students to support and respect each other, as they share and discuss procedures within the group. Students are also expected to work together to solve goal oriented challenging tasks. Students are expected to come to an agreement on a written procedure that will be shared with other teams and/or the whole class. Students choose their own procedures and receive frequent explicit feedback from the instructor to help them succeed on the task. Success on assigned tasks increases students' self-efficacy (Margolis & McCabe, 2006).

Student work is collected throughout the implementation of "Making X Relevant" to assess students' improvement. Students are assigned moderately difficult tasks, but are offered specific learning strategies to support them. Students are presented with choice and provided with frequent, positive feedback. The ultimate goal of student work is to succeed in building their final project, a 3-D model house, and by providing successful written and oral explanations.

GOAL 2: Deepen the understanding of Mathematics

. In "Making X Relevant", deepening the understanding of geometry is defined as the students' success in making content clear so that they can address the math procedures, explain the process and eventually present it (Hilbert, 1900). The activities that contribute to the accomplishment of this goal include written and oral explanations, warm-ups, collaborative learning tasks, academic language acquisition exercises, journal writing, and the inclusion of students' interests, manipulatives, hands-on projects and real-applications (see Figure 4).

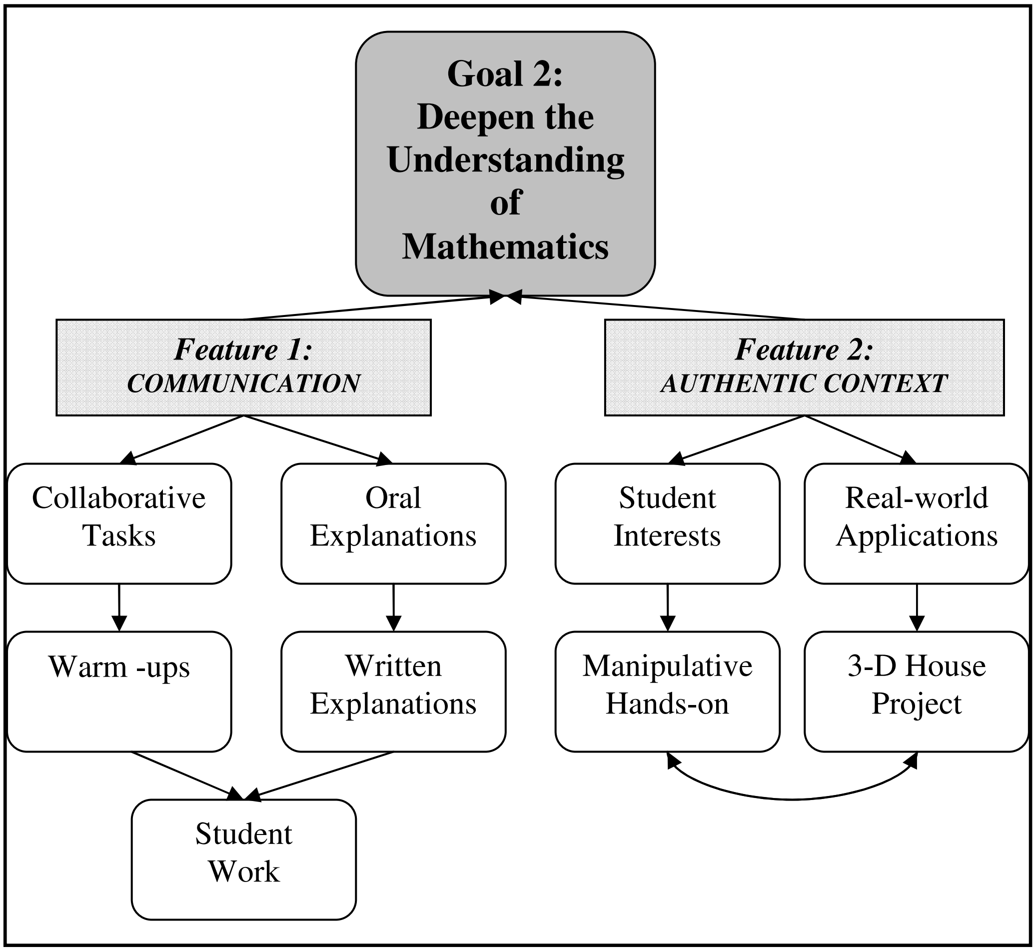


Figure 4: Techniques and activities to deepen the understanding of math.

Achieving Goal 2: Deepen the Understanding of Mathematics

Features

Communication provides a crucial gateway to deepening the understanding of geometry because communication in the classroom "can help make implicit ideas explicit" (Hiebert et al, 1997, p. 45). "Making X Relevant" relies on written and oral explanations as vital techniques to help students internalize and deeply understand the content. I encouraged students to use their native language as they are classified as ELLs 1-2 or ELLs 3-4. When explanations are offered in their native language more proficient English speakers are given the opportunity to take on the role of translators, especially with students of Vietnamese and Middle Eastern descent.

Authentic contexts which take form of projects based on students' interests and real-life application are fundamental to provide students with relevance of class content to out-of-school settings. The use students' prior knowledge "increases the chances that school-related activities are more meaningful [to them]" (Bayer, 1990, p. 26). Authentic contexts are used to motivate students to learn mathematics.

Feature 1: Written and Spoken Explanations:

Communication takes an important role in "Making X Relevant" because, as Khisty (1995) states, communication offers English language learners a platform for peer-to-peer and student-to-teacher interaction for the purpose of developing and sharing meaning. Through written or oral explanations, students are more likely to become aware of their understanding of the content. Additionally, as Bayer (1990) states, "Peer interaction in a problem-solving process promotes cognitive development and the use of critical thinking strategies" (p. 12). Lee and Luykx (2005) found that in collaborative tasks designed to enhance understanding of content; "the more English-proficient bilingual students [assisted] their less English-proficient peers in their home language" (p. 430). Students are allowed and encouraged to use their primary language in their written and oral explanations. Interaction and explanations are facilitated, encouraged and required throughout the implementation of "Making X Relevant." Through writing and speaking about procedures and reasoning, students demonstrate their understanding of the standards on the area of common and uncommon polygons, and the surface area of three dimensional shapes; more specifically, a house's surface area. Students are provided with the following techniques to deepen their understanding of the content.

Collaborative Learning Groups: The groups are created by the instructor and consist of an equal number of English Language Learners (ELLs) and native English speakers when possible, to offer students the opportunity to help each other with the language component. Bayer (1990) agrees with Franklin (1996) about the idea that knowledge is constructed and reconstructed in the discourse among people doing things together (p.154). The groups' main goals are to respect and encourage each individual to become active participants in the learning of the content. The use of primary language is seen as an asset rather than an obstacle because students who "come to school with a solid foundation in their mother tongue develop stronger literacy abilities in the school language" (Cummins, 2003). Peer-to-peer interaction and oral communication is a required component as students are given group tasks that will culminate in written and oral presentations of their findings and solutions. Peer-to-peer communication allows students to further develop oral skills and offers multiple views and approaches on solving a common task. While peer-to-peer interaction is taking place, the teacher continues to circulate, and facilitates communication by asking open-ended questions, such as "How are you going to attack this task/problem?", "How did you decide how to approach this problem?", "Can you explain your reasoning/procedure?" and "How did you come to this/that conclusion?" Through student-teacher oral interaction, the teacher assesses the understanding of content and encourages proper use of mathematical terminology.

Warm-ups: Each day students are provided five to seven minutes at the beginning of the lesson to answer a prompt based on previously learned content. The warm-ups are used as prompts that solicit use of academic vocabulary and written explanations of student reasoning. Jasek (2003, p.53) claims that warm-ups improve math performance among Hispanic/Latino students, and provide another opportunity to practice academic vocabulary. Warm-ups also provide a venue for student-to-teacher written explanations where the teacher can identify the gaps in knowledge of previously covered content. Additionally, warm-ups offer a valuable insight on misconceptions of covered content, opportunities for review, and connection to the prior knowledge. Finally, warm-ups also allow students time to make meaning of their knowledge.

Oral explanations: Students are exposed daily to academic vocabulary. Academic vocabulary consists of key words that are essential to the understanding of the content such as: polygon, concave, convex, area and surface area, which is essential in the understanding of math content. Students are taught to use the texts' headings to get the main idea prior to reading, word walls, sentence writing, note making, and lesson summarizing. The purpose of these strategies is to increase and strengthen learning independence, peer-to-peer oral communication, as well as student-to-teacher oral and written communication. Through these communication venues, the teacher is able to assess individual understanding of content and identify gaps in previous knowledge. Explicit direct instruction on methods and procedures used to solve geometric problems with appropriate academic language is provided by the teacher, reiterating the proper terminology and requiring students to use academic language rather than everyday language, such as congruent versus the same, equilateral versus same sides. Academic language acquisition is seen as the appropriate use of math terminology when communicating task solutions and explanations. Students become effective group members, proficient communicators of their ideas, procedures, and approaches to given tasks with proper use of academic language.

Writing explanations: Students are required to maintain a daily journal which includes vocabulary words, warm-ups, notes, summaries on daily topics, and questions and/or inquiries about mathematical content. Students communicate their understanding of content in written form by answering open-ended questions that facilitate peer-to-peer interaction and conversations such as "What would you have to do to find the area of your house?" One of the most effective ways for students to make content relevant to their lives is to take situations they encounter outside of the classroom setting and incorporate them into the curriculum. Cranton (2006) suggests that as teachers plan the lessons and curriculum in mathematics, they must take into account, students' interests, autonomy, choice, and relatedness to real-world applications in order to foster and maintain intrinsic motivation to learn.

Student work is collected throughout the implementation of "Making X Relevant" to track students' understanding of math content. Students are expected to provide full, correct explanations of their chosen procedures and reasoning on assigned tasks. Students are expected to build a 3-D house and present a written and oral report to access deep understanding of the content.

Feature 2: Authentic Context

Authentic context is crucial in "Making X Relevant" because it provides students with the importance and motivation to learn the content, as well as providing them with the relevance of the content to their out-of-school settings and experiences. Yamauchi (2005) states that "when instructional context is changed to be more compatible with student's background, their participation, satisfaction, and learning tends to increase" (p. 119). In "Making X Relevant" an authentic context is created by the inclusion of students' interest and past experiences, manipulatives, hands-on projects, and real-world applications.

Inclusion of student interests: The "Math and me" survey (see Appendix, page 137) assesses students' interests which will be imbedded in the content to make it more relevant and motivating. Lesson plans include students' background and experiences in order to provide them with the importance of the skills, procedures, and applications of the content. Class projects capitalize on students' interests to provide opportunities to increase students' self-efficacy.

Manipulatives and Hands-on Activities: Students are provided with different strategies to gain a deeper understanding of the content such as 1" by 1" construction paper squares and a 12" by 12" square platform to help facilitate the understanding of the meaning of area. Students use cardboard shapes of common polygons such as squares, rectangles, parallelograms, rhombuses, trapezoids, circles and construction square papers to find and understand area formulas. Successful team projects are used as peer models. Assigned tasks allow students to make their own choice and frequent focused feedback is provided by the instructor to increase self-efficacy. Furthermore, the construction of their house offers an opportunity to use interaction, communication, and the manipulation of three-dimensional objects in order to explore the mathematical ideas and concepts covered in the unit.

Real-world Applications: World, community, and out-of-school problems are used to provide students with the opportunity to observe the relevance of the content. Success in applying their skills learned in the classroom increases self-efficacy. Additionally, inviting community members, such as engineers and architects, to be guest speakers on the importance and implementation of mathematics in their field furnishes a strong connection to real-world applications.

The final project combines students' interests and skills learned in the classroom. Students must apply the skills learned in the classroom to create their own problems and solutions based on the given topics, tasks, and/or projects. Students have the task of drawing their own house's blue print which they will use as the basis to find the total area of the floor of the house. Using the blue print of their house, students use formulas and knowledge of common and uncommon shapes to explain in both written and oral form the process used to find the total area.

Finally, students are required to build a three dimensional model of their house, which will be used to find the surface area. The house project incorporates area as the x factor of "Making X Relevant." Students have the knowledge of common and uncommon shapes and their understanding of area formulas as tools to use to find the total area of the surface area of the house. This project can be taken further by making x the total amount of sheetrock, paint or wood needed to build a real house.

"Making X Relevant" is a curriculum designed to foster self-efficacy and deepen the understanding of mathematics through interaction and authentic context. Students are introduced to multiple strategies that will offer the opportunity to strengthen their prior skills, increase their academic vocabulary, and see the relevance of mathematics in multiple settings, whether in school classrooms or in their daily lives. "Making X Relevant" supplies teachers with a more authentic approach to teaching the concepts of the area of polygons and surface area of common three dimensional shapes while using written and oral communication as tools for assessment, and deepening understanding of the content.

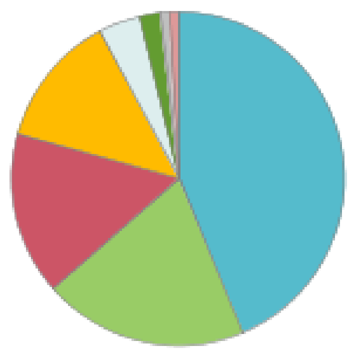
The activities and evaluation tools used throughout the implementation of "Making X Relevant" are described in detail in the Appendix.

VI. Implementation and Revision of “Making X Relevant”

School Setting and Demographics

“Making X Relevant” was implemented in a small school setting located in an urban Southern California area where 83% of the student body qualifies for free and reduced lunch. Hispanics made up two fifths of the student enrollment. A the time of the implementation because of the large Hispanic enrollment (see Figure 5) and high percentage of English Language Learners (ELLs), courses were created to meet the needs of these students.

SIB STUDENT ETHNICITY



Ethnicity	This School	State Average
Hispanic or Latino	44%	48%
Asian	20%	8%
African American, not Hispanic	16%	8%
White, not Hispanic	13%	29%
Filipino	4%	3%
Pacific Islander	2%	<1%
Multiple or No Response	<1%	3%
American Indian or Alaska Native	<1%	<1%

Source: CA Dept. of Education, 2006-2007

Figure 5: SIB student ethnicity.

State test results demonstrated that the district's students scored below average in the subject of mathematics. For example, only one quarter of the district students were proficient in geometry (see Figure 6).

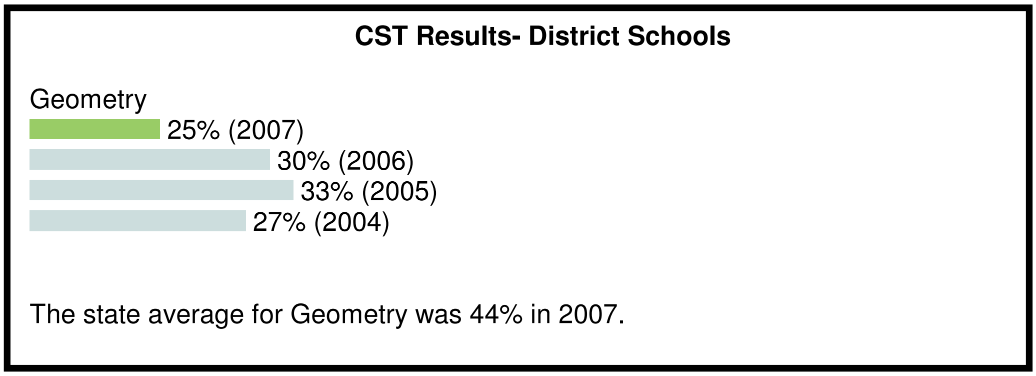


Figure 6: 2007 CST results.

Surveys seemed to demonstrate that students fail to apply the skills learned in the classroom to out-of-school settings because students see the content learned in the classroom as irrelevant to their lives. "Making X Relevant" was created to foster self-efficacy and deepen the understanding of geometry through written and oral communication and authentic context.

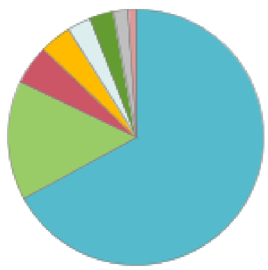
Throughout my high school teaching career, I have encountered numerous students who come into the math classroom with certain preconceptions of math, saying things like "I hate math" or "If am not good at math, why even try?" or "When am I ever going to use this stuff?" In order to attempt to address these concerns, I created "Making X Relevant", a curriculum that includes the goals of using authentic contexts and providing relevance to mathematics content by connecting it to real-life situations.

Over the past four years, grants from the Bill and Melinda Gates Foundation have provided the opportunity for the transformation of comprehensive schools into small learning communities where personalization is a key component. The transformation into small schools provided the opportunity to create a cohort, where I have the same students in a sheltered math class and an advisory period. Spending time with math students in my advisory period, I was able to obtain valuable information such as their interests, learning styles, and level of English acquisition (most are ELL 1-2 or ELL 3-4) based on the CELDT (The California English Language Development Test). Being classified as an English Language Learner (ELL) means that one has not reached a score of fluency on the California English Language Development Test (CELDT).

The small school is on a 4x4 accelerated schedule, a schedule that allows students to have four ninety minute periods, five days per week, providing the opportunity to complete eight courses in one school year, instead of the traditional six courses. At the School of International Business, a school located in a rural central area of San Diego whose main goal is to prepare student to be productive citizens with a global perspective and business quality skills, students were offered the opportunity to enroll at a nearby community college through a dual enrollment program.

Language was another diverse aspect of the SIB. There were over eight languages spoken and more than 60% speak a language other than English at home (see Figure 7) with Spanish being the most spoken language, followed by Vietnamese, Filipino, Arabic, and Cantonese among others.

Home Languages of English Learners



Language	This School	State Average
Spanish	67%	85%
Vietnamese	15%	2%
Filipino (Pilipino or Tagalog)	5%	1%
Arabic	4%	<1%
Cantonese	3%	1%
Farsi (Persian)	3%	<1%
All other non-English languages	2%	<1%
Rumanian	<1%	<1%
Mixteco	<1%	<1%
Mandarin (Putonghua)	<1%	<1%

Source: CA Dept. of Education, 2006-2007

Figure 7: SIB home language of ELLs.

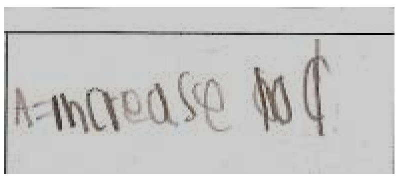
I chose to focus “Making X Relevant” on students whose math background was as diverse as their English language skills. One of the major obstacles for this class was the fact that most of the students could hardly communicate in English, much less understand directions provided in geometry problems. The majority of my students come from poor, rural communities outside the U.S. where children may have to work to help the family, and education is not seen as a priority. Additionally, many did not have the opportunity to attend school beyond the early primary years. As one student stated: “Solamente fui al tercer grado y no lo acabé maestro” (Teacher, I only went to third grade and did not finish the year). Given that these students’ knowledge of school behavior was relatively new, simply getting the students to be participants in “Making X Relevant” was a challenge of its own.

Preparation of Implementation

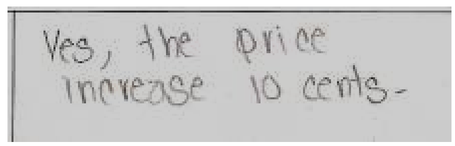
In order to determine students' math skills and English language levels, I gave them a math test in the early stages of "Making X Relevant" Shown below is a question with some of the students' answers (see Figure 8). The answers did not respond to the question being asked because they did not understand it.

Q: The price was $1.00. Now it is $1.10. By what percent did it increase?

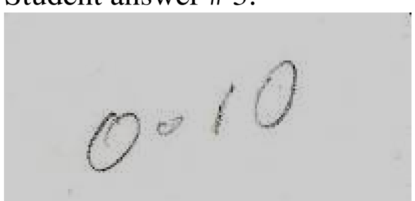
Student answer #1:



Student answer #2:



Student answer # 3:



Student answer # 4

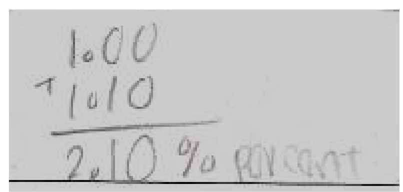


Figure 8: Student answers on practical math test.

After analyzing their responses, I realized that my students possessed very diverse levels of English skills, and most of them were not able to understand the question. Not being able to answer the question properly is also influenced by the lack of academic mathematical vocabulary. Thus, in order to provide them with a better opportunity to answer, I concentrated on academic vocabulary acquisition during the pre-implementation stage of "Making X Relevant."

Strategies used in Preparation for Implementation

While discussing students' English language challenges with other teachers I was referred to and advised by the Strategies for Literacy Independence across Curriculum (SLIC) program advisor. The SLIC program supports ninth and tenth grade students who scored below grade average level in reading through an intervention class that taught them the literacy skills and strategies for reading grade level academic texts. These skills and strategies were also used by their content teachers at SIB and include both reading and writing strategies (see Appendix, page 209). The goal of the SLIC program is focused instruction that assisted students in becoming successful in their content area learning, and led them to academic independence. As a result of my conversations with the SLIC coach, the following techniques were introduced in the pre-implementation stage of "Making X Relevant" in order to increase ELLs' ability to understand the mathematical content and to accelerate their English Language skills.

Visual Vocabulary was one of the techniques that had the greatest effect on students' academic vocabulary acquisition and knowledge. Visual Vocabulary is a technique where math vocabulary words help the student gain instant comprehension by the creative way in which it is written. This technique was implemented with the goal of increasing and strengthening students' vocabulary, as well as improving their written and oral communication skills. Students were able to use mathematical vocabulary even when they spoke in their native language. They used the English pronunciation within Spanish oral explanations such as: "el área de este "square" es "side by side", El "área" de este "quadrilateral" es "length times width" porque es un "rectangle"

(The area of this square is side by side, the area of this quadrilateral is length times width because is it a rectangle). Students' use of their native language and the incorporation of the new vocabulary helped them correlate the new content to their prior knowledge, which strengthens their internalization and understanding of the content. I implemented this technique for several weeks prior to the implementation of "Making X Relevant".

The Visual Vocabulary technique allowed students to write the words in four columns. The first column contained the word; the second column had the word's definition as it is given by the text; in the third column students had the opportunity to write the meaning in their own words and in their own language, if desired; and in the fourth column students were asked to include examples (see Appendix, page 150). The Visual Vocabulary strategy was used every time new content terminology was introduced and students were asked to write these words in their journal, (introduced in chapter five). Students were enthusiastic about the Visual Vocabulary, as they were able to write the meaning in their own words along with picture drawings as examples. Students were even more enthusiastic about the opportunity to use their vocabulary journal during quizzes and tests.

***The Word Wall**,* a section of the classroom used throughout the preparation and implementation of "Making X Relevant", displayed key terms and vocabulary from each lesson, and was very helpful to students as they realized that when a word appeared in the content, they could refer to the wall to read or remember the meaning of key words. The Word Wall was present every day for the entire implementation of "Making X Relevant." The Word Wall was used in conjunction with Visual

Vocabulary every time a key word was found in the textbook or was described by the teacher as crucial to the lesson's topic. Words were presented, their definitions discussed and then written in the journals. Throughout the implementation, whenever words appeared in the content, I reiterated their importance in communicating our procedures and final results. I also highlighted the importance of the words in warm-ups, used the wall as a form of communication, and referred students to the word wall often throughout the project. Students were also able to refer to the wall when quizzes and various tasks were given.

Journal Writing was an ongoing project throughout the implementation of "Making X Relevant" in which students responded to prompts, took notes, and summarized the covered content at the end of each lesson. In this journal, students also had the freedom to write down any questions with which they needed further assistance. Students were also asked to provide explanations of topics in their own words with the additional freedom to use their primary language. Writing journals were used daily as means of communicating students' understanding. Interestingly enough, students continued to use their writing journal even after the implementation of the "Making X Relevant" curriculum was completed because they saw the practicality and benefits of writing to their understanding of the content. The fact that students continued to use the writing journal proved that this technique was very useful for the students' individual learning.

Warm-ups occurred daily. As students entered the math classroom they were provided with three questions based on basic arithmetic skills, previous content knowledge, and critical thinking. Warm-ups provided students time to settle down and prepare to do mathematics. At the beginning of the implementation of "Making X Relevant" students resisted having to do warm-ups every day, but after explaining that warm-ups were tools to help clarify any misconceptions about the previous day's content, students were more willing to engage in the learning.

Practice time allowed students to practice previous and newly learned skills, which is imperative to the success of understanding geometry and providing self-efficacy while solving real life problems. Practice time was the main stage of the lesson in which students required constant oral communication in order to come to an agreement about solutions to given area problems. Practice time was given at the end of every lesson. During practice time, students were expected to work in pairs or in groups, depending on the difficulty of the task. At the beginning of the implementation, students were shy and unwilling to volunteer their answers, but with my encouragement and constant positive feedback such as: "You have a great idea, go ahead share it with us", and "Good job, can you share your answer with the class?" they became more willing to share. Students reacted positively to the opportunity of completing the task while in collaborative learning groups as they had the opportunity to observe others' procedures, approaches and explanations to assigned exercises.

Students' willingness to volunteer and present their findings to the entire class in their native language provided strong evidence that practice time did contribute in fostering self-efficacy and communication skills in mathematics.

Questioning Techniques

Open-ended questioning was a crucial component of "Making X Relevant," as I wanted to provide students with the opportunity to discuss the connection of the work done and content learned in the classroom to real world applications. I posed open-ended questions at the beginning of each lesson and provided groups with "set discussion periods." To facilitate the reading of this thesis I have translated to English the question I asked in Spanish:

- How would you solve this problem?
- How would you use this math out of school?
- How did you come to that answer?
- Can you show me how to solve the problem?
- What information is given to help us solve the problem?

I have realized throughout my teaching experience that students need guided time to discuss the question and come to an agreement. Set discussion time was used at the introduction of every concept to provide students with the opportunity to use their prior knowledge and exercise their critical thinking skills. Once again, at the beginning of the implementation, students were a bit hesitant to participate. However, after a few lessons, they were all fully engaged in the discussions and eager to share their findings.

Implementation

I implemented “Making X Relevant” with my sheltered class at the end of the winter semester of the 2007-2008 school year. My class consisted of fifteen females; eleven Hispanics, two students of Middle Eastern descent, one Vietnamese student and one Haitian. There were also eighteen males; fourteen Hispanics and four Vietnamese. In order for the students to be prepared to do collaborative learning, I began my class with a “getting-to-know-you activity.” This activity asked students basic and personal questions that they would feel comfortable sharing with the entire class (see Appendix, pages 141,142). This activity not only provided students with the opportunity to share something important about themselves, but it also provided them with the opportunity to reduce their anxiety about sharing, presenting, and talking in front of the class. According to Krashen’s theory of second language learning (1994), if students have low anxiety, high motivation, or high self-confidence, they will most likely have a low affective filter. The low affective filter provides student with the opportunity to have high motivations, high self-efficacy and low anxiety while learning. Having low affective filter allows acquisition of more information and provides a greater opportunity for learning.

The main goal of the “getting-to-know you activity” was to create a safe environment in the classroom, provide opportunities for verbal interaction and set up a platform to foster self-efficacy (Herrell & Jordan, 2008). Students hesitated to volunteer and speak in front of the class, so I decided to model my own introduction in which I made sure to include every student by asking how to say “hello”, “welcome”, and “good afternoon” in their own language. After my introduction, several of the more social students volunteered, and I provided encouragement and focused, positive feedback to maintain their self-efficacy. After the volunteers, the rest of the class followed. This activity culminated in a short debriefing about class interaction and work ethic expectations. We agreed that all students were expected to participate, whether in pairs, group tasks, or individual and group presentations. In these settings, each student should be responsible for their own work.

The “Making X Relevant” curriculum sought to provide students with the opportunity to view math as relevant to their non-academic lives. In order for me to create activities that would engage every student, I gave a survey (see Appendix, page 137) to learn information about the students; where they were coming from and what their interests were. I created this survey in order to develop moderately challenging tasks that included students’ interests and to increase students’ self-efficacy. From the survey I found that the majority of the students enjoyed English class because “La clase es my divertida, el maestro nos ayuda y aprendemos nuevas cosas” (The class is fun, the teacher helps us and we learn new things). They also like science classes because they explored, did experiments and do fun activities. Additionally, I also found that 65% of students’ fathers worked in construction. Using this data, I decided to design the project around building a house and I implemented the curriculum in the textbook chapter about area with the following prompt:

“What kind of mathematics would you need to know to build a house?”

In order for students to come up with the answers to this question, I organized them in pairs and then in groups because, according to Dechant, Marsick, and Kasl (1993), and Brooks (1994), individuals in groups tend to challenge themselves to create a product no matter the level of the challenge. Having students share their answers with the class provided evidence that there are multiple methods and approaches to solve a problem. I proceeded to chart their ideas on the board and we found that many of the students had the same ideas, such as: “we need to know geometry, engineering and construction”. From the charted answers we were able to come to the consensus that we required math skills and concepts to build our house. Finally, the class discussed the responsibilities of each individual when collaborative interaction was taking place and came to the agreement that just being present is not being an active learner, and each student would be expected to participate and be accountable for their own written work. Each student would be required to fully participate in given tasks by sharing their ideas and discussing solutions to the problems. Accountability for their own written work provided students with another venue for student-teacher communication and interaction. We also discussed the aspect of native language. I told them that they were encouraged to use their native language, but that translations would be required. Encouragement of the use of their native language was done with the goal of making them feel comfortable, increasing their self-efficacy and deepening the understanding of the new content.

Introduction to Collaborative Learning

With the responsibilities of each student in mind, students were asked to solve the first “hands-on project”: “Who’s got the correct picture?” (see Appendix, page 144). Students were given fifteen minutes to complete this challenging task and during that time I facilitated their interaction by asking questions in English and Spanish such as: “Cómo van a resolver el problema?” (How are you going to start to solve this problem?), “Qué se necesita para completar este proyecto?” (What is needed to complete this task?) and “Cuáles son las estrategias que están usando?” (What strategies are you using?). This task was assigned with the goal of encouraging and allowing everyone to make choices on how to solve the task to increase their self-efficacy (Margolis & McCabe, 2006). The open-ended questions provided a gateway to access students’ prior knowledge which was used to tailor succeeding lessons. I observed that every student was involved in trying to answer the question whether by reading the cues, working out the problems, or getting the popsicle sticks needed to complete the task. Four out the six teams were successful in solving the puzzle which was to create an octagon with four squares attached to it (see Appendix, page 145). I used teams as peer models to share and discuss the procedures used to accomplish the task with the goal of increasing the teams’ self-efficacy. Questioning teams who did not succeed on the task, I found that the reason some groups did not finish in time was mainly because they were hesitant to interact and ask each other questions. I designed these tasks to provide students with a safe environment conducive to conversation, learning and increasing their self-efficacy in the math classroom.

After a class discussion I realized that I could have spent more time prompting the teams with more open-ended questions, offered more guidance and more encouragement for the teams that did not interact as well. In the second hands-on activity, pairs were provided with a 12” by 12” square platform, scissors, glue and construction paper. Students were given the task of creating their own tile design as it would be used to cover the floor of the main project, the house. I chose to emphasize the use of tile since many of my students come from Latin countries, where wall-to-wall carpets are not used. Tile work is far more popular in stucco houses and thus would be more authentic and relevant to their experiences.

The creation of the tile design was purposely chosen to provide students with a platform for interaction and to offer the opportunity to ultimately make a joint decision about their design. Students were given the choice to make a tile design that would represent their own creativity to increase their self-efficacy. While students were involved in the discussion of their designs, I circulated around the room and posed open-ended questions such as “Por qué decidieron escoger este diseño?” (Why are you choosing this design?) Some of the groups replied that they chose their design because “it looks pretty”, “Nos gustaron los colores” (We liked the colors), and “It just came to them”. The open-ended questioning was a strategy used to initiate student-to-teacher oral communication and to share and assess prior knowledge, an opportunity to provide focused feedback and encourage accurate student attributions to increase students’ self-efficacy.

The tile activity provided the opportunity to discuss the differences and similarities between two students’ work. Throughout this activity every student was engaged, by drawing, cutting paper, or gluing figures to the platform I provided. After 20 minutes, two pairs were chosen as peer models to present their tiles because they had created polygons classified as concave and convex (see Figure 9). Choosing student work was purposely planned to encourage accurate attributions and increase students’ self-efficacy. Student Tile 1 contains a concave polygon because extending a line from one of the star’s sides will intersect the interior. Tile 2 contains convex polygons because there are not polygons whose extended sides will intersect the interior.

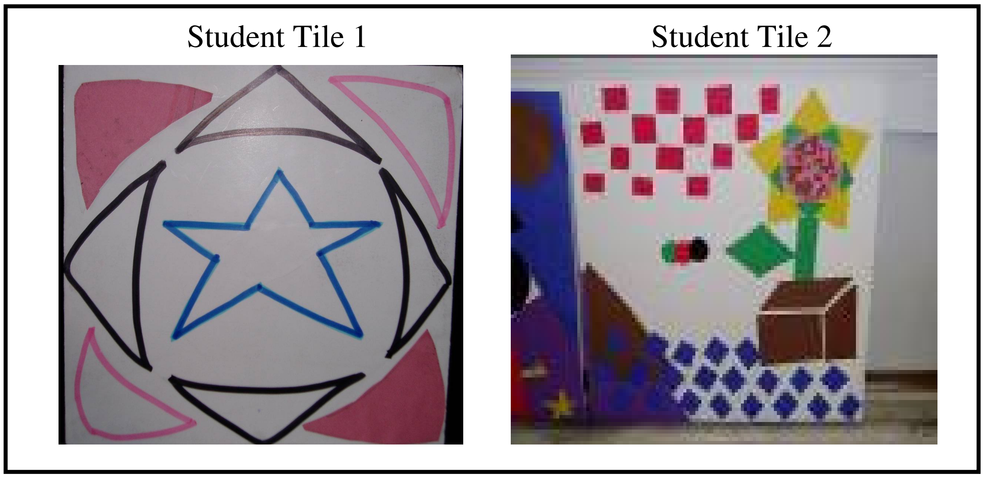


Figure 9: Student tile samples.

Implementing teacher should be aware of the possibility that students might not be able to create these polygons and be prepared to use his/her own examples. After discussing the tiles, I demonstrated how to use the Strategies for Literacy Independence across Curriculum (SLIC) in order to write the words of the day, a summary on similarities and differences between convex and concave polygons, a procedure about how to create a tile and a sentence about where we would find and use these geometric shapes. In order for the students to learn to summarize, I provided sentence starters such as “A polygon is convex when…”, and “a polygon is concave when…” to facilitate understanding of the content. Reflecting upon the activity and looking at the students’ final products, I realized that I should have made the task directions clearer as I wanted them to design a tile that they would actually use to tile their room. I observed every student engaged in the task, but when we discussed the practicality of using their design to cover their floor, many of them said they would not use their final design because their room would be "too busy". In future implementations, I would have students create two tiles, one for fun and another with the requirement that they would design so the tile would be both practical and usable in part of their final house design. Writing the procedures and answering open-ended questions provided students with the opportunity to internalize the information and content covered in class. At the end of the lesson, students were asked to go home and put area tiling to practice by providing a drawing and a written procedure on using their tile to cover the floor of one of their rooms. Using the room provided the out-of-school application and provided an answer to the following question: "How many tiles would it take to cover the floor of your room?" The total number of tiles is the x factor of "Making X Relevant" with authentic context. Although the tile activity was moderately easy, it was specifically created to allow students to work together, make choices and to encourage each individual to be an active participant which are techniques employed by Margolis and McCabe (2006) to increase students' self-efficacy.

Vocabulary Tools and Procedures

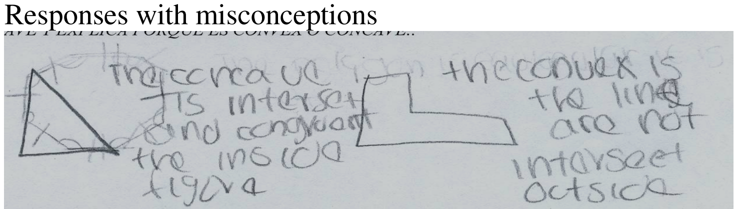
The students' floor tile designs were used as peer models for this lesson. Students were given two problems as a warm-up, which had to be turned in after five-to-seven minutes. The warm-up problems asked students to classify geometric figures as concave or convex and explain their reasoning. The warm-up was an opportunity to transition their thinking to mathematics as well as a way to recall previously learned content. Warm-ups were also used as a vehicle for written student-to-teacher communication with the goal of providing frequent focused feedback and encouraging accurate attributions to increase self-efficacy and deepen the understanding of math. After the warm-up was collected, three volunteers were chosen as peer models to explain their thought processes in front of the class. Volunteers were chosen with the goals of providing students choice about wiliness to share, peer modeling and to expose the class to different learning strategies to increase their self-efficacy. Simultaneously, volunteers were given the opportunity to explain their chosen procedures which according to Atiyah (2004) is a way to show deep understanding of the content.

Having students explain their solutions to the warm up provided the other students with evidence that there is more than one way to acquire a solution and offered the opportunity for students to demonstrate their understanding. I purposely chose three volunteers, two of whom made common mistakes, (see Figure 10) to clear misconceptions and misunderstanding of the content. In the first response, the students provided correct explanations and examples of concave and convex polygons, whereas in the last two examples, students provided correct polygons, but switched the definitions of concave and convex.

Question: Draw a polygon that is concave and a polygon that is convex and explain what makes them concave or convex.

Correct Response

Responses with misconceptions



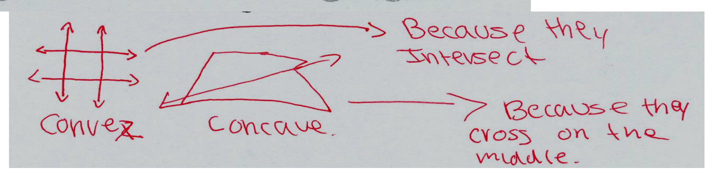


Figure 10: Warm-up explanation samples.

I used the students' own work to provide the correct definition of convex and concave polygons. A polygon is convex if the line that contains a side of the polygon passes through the interior, and a polygon is concave if a line that contains a side passes through the interior (Geometry: Concepts and Skills, p. 411). Although I used the student tile to correct the misconception, I took the time to encourage accurate attributions to maintain students' self-efficacy by stating that "the polygons looked great, but we needed to focus on the vocabulary definitions". Student oral and written presentations not only let the teacher correct any misconceptions about previously learned content such as differences and similarities of concave and convex polygons, but also created a platform where students were not afraid to make mistakes and ask for help, thus fostering a safe environment conducive to learning.

From their homework assignment, I chose two floors that met the criteria of equal angles, i.e. rectangle or square, and another polygon that did not meet the criteria as peer models. I asked students to discuss the similarities and differences. As students were given collaborative learning time, I encouraged peer-to-peer interaction by asking open-ended questions such as "Que me pueden informar de las dos figuras?" (What can you tell me about the two shapes?) "Que es similar?" (What is the same?), "Que es diferente?" (What is different?). To facilitate their engagement and interaction I provided the following sentence starters, "The shapes are the same because…" and "The two shapes are different because…." As students began to engage in conversations, many of them decided to use their primary language to discuss the similarities and differences as they were making their final statements, and I was able to help them with translations. I provided sentence starters with the goal of facilitating content learning, and encouraged native language communication to foster self-efficacy and deepen the understanding of content. Students were quick to point out that, mathematically speaking, the square had "lados iguales" (equal sides) and "ángulos iguales" (equal angles) and the rectangle had "Angulos iguales pero dos lados mas largos" (equal angles but two longer sides). I created this activity to provide students with the opportunity to draw their own conclusions about the differences and similarities between a square and rectangle. Giving them the opportunity to take ownership of the content offered them a venue to feel confident and more motivated to learn. Ownership of the content also provided them with a stronger sense of understanding.

After the discussion and sharing of ideas in pairs, in teams, and finally as a whole class, I introduced them to new academic vocabulary which replaced the word "same" with "congruent", "equal angles" with "equiangular" and "equal sides" with "equilateral". The goal of replacing the mentioned words was to make students aware of academic language and vocabulary. I followed the introduction of academic vocabulary with the sentence starter: "The similarities between a square and rectangle are…." This was followed by adequate time for them to use the SLIC strategies of using academic vocabulary to become independent learners. I provided time for them to use the SLIC techniques and write their own summaries in their journals about the similarities and differences between equiangular and equilateral polygons (equiangular are polygons with equal angles and equilateral are polygons with equal angles). The SLIC techniques were used to provide students with choice and specific learning strategies to increase their self-efficacy and deepen the understanding of geometry. Providing time for students to write the correct definitions was crucial because knowing proper vocabulary was important to understanding the procedures of finding the of area common shapes.

Reflections and Revision

To implement "Making X Relevant" I provided students with polygons and practice time to internalize the concepts of the lesson by answering the question: "What type of polygons are these?" At the end of the lesson, I realized that it would have been more beneficial for students to share answers. However, due to time constraints, we were unable to share. I decided to save time by teaching them specific learning strategies by providing a step by step solution. I realized that next time I would have to reduce the amount of practice problems I assigned. The out-of-school assignment provided them with choice as the task was to collect, take pictures, as some students suggested, and draw five places where one finds regular polygons and five places where equiangular polygons are used. This assignment provided students with the opportunity to see the relevance of the use of polygons in real-life applications and motivate them to learn. However, because most of them do not have a digital camera, they were not able to bring pictures. I realized that to make this more effective and engaging for students, next time I would borrow cameras from the school and have the students borrow one from me.

Oral Presentations and Geometric Shapes

The warm-up problems asked students to identify regular, equiangular, and equilateral polygons, and provide written explanations for the reasoning. As I circulated around the room, I noticed that students were a bit hesitant to use the academic vocabulary and continued to use the words "equal angles" and "equal sides" as opposed to "equiangular" and "equilateral". This time I decided to provide the solutions to the warm-up problems with the intent of modeling the use of academic language. Reflecting upon the decision of providing solutions to the warm-ups and how it was helpful to students, I would definitely incorporate this change in future implementations.

Using their tile design homework assignment and out-of-school examples as peer models to increase self-efficacy, I assigned a collaborative learning task. The task was to come up with a description of how they would use a tile of their choice to cover a flat surface. Students were challenged to come up with two procedures to deepen their understanding of geometry. As students discussed the given task, I observed that most students were having difficulty coming up with a description. Noticing this, I had to stop the discussions and give step-by-step directions, but still provided praise for accurate attributions such as "nice effort" and "good start" to maintain students' self-efficacy. After talking to the class, I found out that they were having difficulty with the task because they were confused. I needed to be more specific and direct with my directions and assigned tasks. I took the time to acknowledge my error in front of the class to show them that everyone makes mistakes. Showing them that I also make mistakes made students realize that, as Francisco stated: "Se vale hacer errors verdad maestro" (It's allowed to make mistakes, right teacher?) I agreed with Francisco but made sure that I encouraged accurate team attributions and also conveyed the importance of trying and not giving up in order to foster their self-efficacy. After our discussion on mistakes, I provided examples with sentence starters such as: "In order for us to cover the floor with tiles we must measure….."

After group discussion, I gave students more time to agree upon a procedure and I provided each group with time to present their descriptions. Student descriptions were planned with the purpose of sharing knowledge among peers, and facilitating ownership of the content. I proceeded to introduce the topic of the day: Finding the measure of angles in a polygon and procedures to find the area of common shapes such as rectangles and squares. I gave students time to use their SLIC techniques and journal write. Journal writing helped students to make sense of and clarify content for deeper understanding by asking specific questions such as "what is the first step in finding the measure of one angle in any polygon?." The topic of the journal entry was focused on the process of finding the number of tiles needed to cover their chosen surface. Students were given the opportunity to explain, in written form, their understanding of common shapes and their proper classifications. The out-of-the-classroom assignment provided the link to make x relevant; the number of tiles needed to cover a new chosen surface. I assigned students the task: choose and draw a room from their house and find the number of tiles needed to cover it.

Area of Common Geometric Shapes

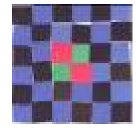
The warm-up problems were based on their out-of-school assignment. Students were asked to describe in writing the procedure to find the number of tiles needed to cover their chosen room. After sharing out, I presented the class with selected student drawings to discuss differences and similarities, specifically between squares and rectangles. The task required student to share their ideas, compromise on them and present to the class. As students discussed the differences and similarities, I challenged the teams by posing open-ended question such as, "How can you justify your statement?" The challenge was purposely given to them to deepen their understanding of geometry. I also provided positive and constructive feedback to maintain their self-efficacy. After seven minutes of discussion, I went to each pair and asked them to be ready to present one difference and one similarity. After a few minutes of peer-to-peer discussion, students were eager to share their ideas and as a class we made a list of differences and a list of similarities. I charted a list of students' differences and a list of similarities to provide the whole class the opportunity to agree and disagree on answers. A given answer was kept on the list if no team disagreed, and if any team disagreed with a given answer, the provider of the answer was offered a chance to explain their reasoning and to convince the class to keep the answer. This technique was purposely chosen to make content more understandable by having students explain their reasoning. I intervened only when student reasoning needed assistance. For example, some student kept saying that the area is the number of squares needed to go around the figure. I proceeded to explain to group the difference between perimeter and area. I gave students time to write the final lists in their journals while a rectangle and a square were projected on the wall. Authentic context was introduced in a hands-on activity (see Appendix, pages 155, 156) when students were provided with a 6”x 6” foam board square, a 6”x 12” foam board rectangle, glue, and 1”x 1” construction paper square. Pairs were challenged to come up with two different ways of finding the number of tiles needed to cover each figure. I challenged the teams to come up with two approaches to the solution to increase opportunity for understanding. Each pair was required to write out their approach and give an oral presentation about their discussion, reasoning and final results. Student presentations of their solutions were very surprising, with the two most popular answers being:

1. Add the number of squares.
2. Multiply the number of squares on the bottom by the number of squares on the side. (See Figure 11 and Figure 12)

After sharing procedures and answers, the class was involved in a discussion about the concept of areas of squares and rectangles. Within this class discussion I was able to clear the misconception that perimeter of a polygon is not the same as the area of a polygon while providing focused feedback and encouraging accurate student attributions to increase their self-efficacy. I explained that perimeter was the number of squares used to go *around* the figure, and area was all the squares needed to fill the *inside* of the figure. After the discussion I still saw some students struggling to see the difference and took the time to explain the concepts in a one-to-one basis to foster self-efficacy. Reflecting upon this day, I believe that it would have been more beneficial and productive to discuss the concept of perimeter before covering the concept of area. I would have asked student to use string and find the amount needed to outline the square and provide students with real-world examples such as amount of grass versus fencing of a garden. The perimeter is the outline of the square, whereas area is the space taken by the square.

After a class discussion, students were introduced to formulas of area; square area is side times side $(S \times S, or\ S^2)$, rectangle area is length times width ($l \times w$), and students were asked to explain why the formulas work. I offered students time to practice these formulas by referring them to the textbook where I assigned 20 simple problems. I decided to assign the exercises as pair work to provide them with interaction time. While pairs worked on their assignment, I took the time to spend a few minutes with each pair and ask the pair a few open-ended questions such as: "How do you classify those shapes and why?" to check for understanding. I also asked them to share their reasoning on the procedures they used to find the area. Sharing of the solutions and procedures was purposely embedded in the lesson to foster self-efficacy and provide more opportunities to deepen the understanding of the concept of area.

SQUARES



Student Work Sample 1:

Find the number of paper squares needed to cover the provided shape.
Encuentre el número de cuadros de papel necesarios para cubrir el cuadrado.

1) How many squares of paper did you use to cover the square.
¿Cuantos cuadros de papel fueron necesarios para cubrir el cuadrado?

36 squares

2) Explain the process you used to find the number of tiles needed.
Explica los pasos que empleaste para encontrar el numero de mosaicos que usaste.

We fill the entire square
with the little squares
& then we multiply side by Side -

Student Work Sample 2:

Find the number of paper squares needed to cover the provided shape.
Encuentre el número de cuadros de papel necesarios para cubrir el cuadrado.

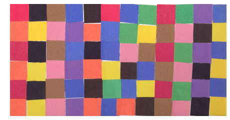
1) How many squares of paper did you use to cover the square.
¿Cuantos cuadros de papel fueron necesarios para cubrir el cuadrado?

36 Squares.

2) Explain the process you used to find the number of tiles needed.
Explica los pasos que empleaste para encontrar el numero de mosaicos que usaste.

I put the gluc in the square.
I counte the square

Figure 11: Team solutions on area of squares.



RECTANGLES

Student Work Sample 3:

Find the number of paper squares needed to cover the provided shape.
Encuentre el número de cuadros de papel necesarios para cubrir el rectangulo.

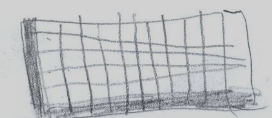
1) How many squares of paper did you use to cover the rectangle.
¿Cuantos cuadros de papel fueron necesarios para cubrir el rectangulo?

12 x 6 = 72

72 squares

2) Explain the process you used to find the number of tiles needed.
Explica los pasos que empleaste para encontrar el numero de mosaicos que usaste.

I multiply 12x6 = 72



3) How would you calculate the number of tiles you need to cover the floor.
Como encotrarias el numero de mosaicos que nesecitas para cubrir el piso de tu cuarto.
PLEASE EXPLAIN/*FAVOR DE ESPLICAR.*

6 X 12 = 72
We measures the paper or cardboard and I get 12 and other side is 6 and we multiply 6 x 12 = 72

Student work Sample 4:

2) Explain the process you used to find the number of tiles needed.
Explica los pasos que empleaste para encontrar el numero de mosaicos que usaste.

The Rectangle is 2 square, a Squre has 36 little squares. We add 36+36 = 72

3) How would you calculate the number of tiles you need to cover the floor.
Como encotrarias el numero de mosaicos que nesecitas para cubrir el piso de tu cuarto.
PLEASE EXPLAIN/*FAVOR DE ESPLICAR.*

6X12 = 72
36+36 = 72

Figure 12: Team solutions on area of rectangles.

Pair work on the 20 practice problems proved to be useful as I saw that the majority of the students were helping each other. The ELL 3-4 students helped the ELL 1-2 students by translating the questions, but both agreed on one solution and procedure. I provided constructive criticism, encouraged accurate student attributions, and continuously asked more open-ended questions such as: “Pretend I am a first grader, how would you explain this concept to me?” to foster self-efficacy and deepen the understanding of the content. I asked these open-ended questions with the goal of guiding their reasoning on the right path to solutions, but gave them the freedom to choose their own procedures. These techniques forced students to push themselves by spending more time and preparing more detailed explanations in order to show their understanding. Students collaborated very well and demonstrated understanding of the concept of area. It was not until they were challenged to find the length of missing sides given the area that they stopped working. I did not anticipate that they would need direct instruction on finding missing lengths by using the inverse step solution process, the process where one uses the given data and performs the opposite arithmetic operations to find the missing side, length, or width. A typical problem would be: If the area of a table is 45 meters and the length is 15 meters, what is the measure of the width? From this experience, I realized that in the next implementation, I would have to include a few problems on finding missing lengths when area is provided and model with direct step-by-step instruction. Practice time in pairs and summary writing time was also given with an emphasis on finding the area of common figures.

Appropriate time was allocated for pair practice and journal writing as pairs were prompted with the question: "How would you calculate the number of tiles you need to cover the floor of your room?" Students were very creative with their answers as they used drawings to illustrate their reasoning. I have enclosed some student work examples, but have omitted names to ensure student privacy (see Figure 11 and Figure 12). Student work on area of squares on Figure 11 provided counting the squares as procedure, very simple, but the student work sample on Figure 12 on area of rectangles was more creative, stating that the rectangle is two squares and shows a graphic representation on how to find the squares using multiplication (12 x 6). Students were allocated time to write a summary about finding the area of squares and rectangles to internalize and deepen the understanding of the concept. The out-of-class-assignment included the "Making X Relevant" factor, asking students to create a blueprint of the floor of their house, calculate the area (x factor) of a room of their choice, and provide a written report on their procedure.

Shape Dissections

The warm-up problems asked students to demonstrate their previous knowledge and skills on finding the area of squares and rectangles by writing explanations of their procedures and rationale to deepen the understanding of previously covered content. I collected the warm-ups and used them as a tool for assessment of understanding of previously learned content. Students' answers varied, but were very simple and to the point. A majority of them were able to explain the concept of area, for example: "Area is the number of little squares needed to cover the shape." Others described their procedure using formulas such as, "To find the area of a square we multiply side by side" and "For a rectangle, we multiply the length by width." I used the warm-ups as another opportunity to provide focused feedback and encourage accurate student attributions such as "great job", "work well done", and "nice start" to increase students' self-efficacy.

In groups and using the blueprints of their houses as peer models, students were asked to discuss and write the procedure used to cover the entire floor of the house with tiles. As I circulated around the room, I found myself answering the same question over and over again: "How do we do this?" It was then that I realized that I should have modeled how to find the area of my own house which would have saved time because, once again, I was not explicit enough in my directions. Discussing and sharing procedures on finding the area of their blueprints, facilitated peer-to-peer interaction and exposed students to different approaches on finding area. After a whole-class sharing of students' procedures, students were introduced to the strategy of dissection of polygons. Direct instruction on dissection of polygons and figures was administered with the goal of reinforcing and modeling proper use of academic language such as, "a star is a concave polygon because when any side is extended it crosses the interior of the figure." Conversely, a square is convex, equilateral and equiangular. Additionally, the dissection process facilitates finding the area of any blueprint as it cuts uncommon polygons into common shapes such as rectangles and squares in order to simplify the task and increase students' chance of success.

Following direct instruction of dissection, students were provided with three house blueprints to practice dissection and finding the area of common geometric shapes. Giving students house plans turned out to be a good decision, but was not challenging enough, as they were finished with their dissections quickly; I still took the time to give frequent focused feedback to increase their self-efficacy and deepen their understating of the content. Looking back at the lesson plan, I realized that it would have been a bit more challenging to introduce and have them try to form their own problems at this stage of the implementation. Journal writing time was allocated to describe and summarize the process of dissection and explain why it would be useful in finding the total area of any figure with the goal of providing another opportunity to internalize and deepen the understanding of the content. The out-of-school assignment made x relevant by asking students to find the total area of their houses' blueprint and write a report on the process including vocabulary words learned in previous lessons.

Inclusion of uncommon shapes

The warm-up challenged students to create their own procedure of how to find the area of a stop sign (see Appendix, page number 171). An authentic context was used when I asked students to design a pentagonal, hexagonal, or octagonal hot tub to be included in their house blueprint. Teams were required to discuss the question: "What do you need to do to build a hot tub in your house?" As I walked around the room, I noticed teams were coming up with different explanations and I used group presentations as peer models with the goal of providing students with an opportunity to see different approaches to the same problem. Students decided to dissect the figures into trapezoids, rectangles and triangles (see Figure 13). The first stop sign was dissected into two trapezoids and one rectangle, the second sign was dissected into six triangles, which were shapes previously covered. These dissections were not helpful in finding the area because they did not provide the lengths needed to find the area of the shapes.

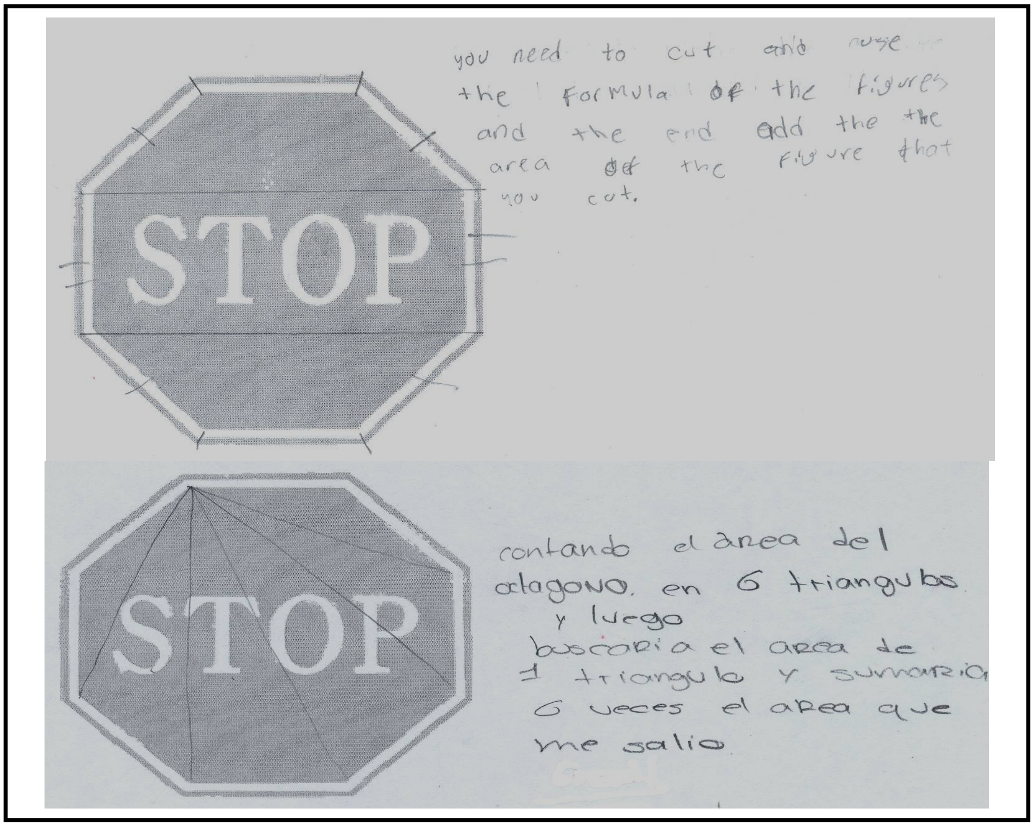


Figure 13: Team dissections of a hexagon.

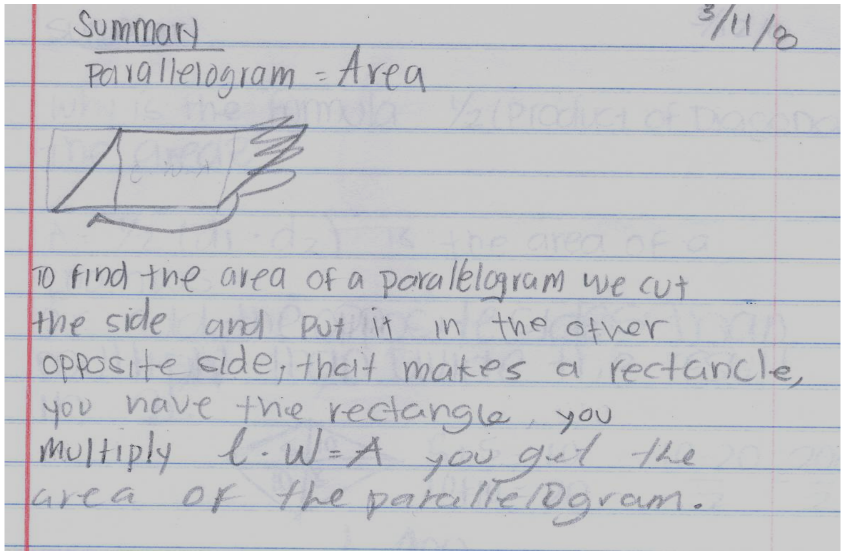
These dissections provided me with the opportunity to start a class discussion about finding the area of shapes that are not very practical in construction. Using their dissections as peer models, we discussed the practicality of their dissections in finding the area. Most of the students referred to previously learned content as they mentioned that we already knew how to find the area of rectangles, trapezoids and triangles. Encouraging accurate student attributions to foster their self-efficacy, I challenged them to use these procedures to find the area of their dissections. Many of the groups were unsuccessful because the rectangles and triangles they created did not provide the correct length, width and height. The dissections were not very practical.

After sharing procedures with the whole class and coming to an agreement that their dissections were not very practical, I gave step-by-step direct instruction and modeled how to find the area of uncommon shapes by using dissection, while taking the time to acknowledge student attributions to foster self-efficacy. Students were provided with hands-on materials including foam board, scissors, glue and activity sheets to find the area of triangles, parallelograms, trapezoids, rhombuses and circles (see Appendix, pages 158-175). Appropriate journal writing time focused on procedures to find the area of uncommon shapes to facilitate deep understanding of the concepts (see Figure 14). Once again, I provided students with the following sentence starter: “To find the area of any figure, we must first dissect the figure into…..” I assigned an out-of-school assignment which required students to choose and draw their own hot tub design. Students were also assigned to write a procedure on finding the space (area) needed to add the hot tub to the blueprint of their house.

How to summarize procedures on finding area

The warm-up required students to find and explain the procedure to determine the total amount of material needed to build one hundred hexagonal canopies, making content relevant (see Appendix, page 185). Students surprised me with their written explanations as majority of them used dissection of a canopy into six triangles, finding the area of one triangle by multiplying the answer by six, the number of triangles in the hexagon, and then multiplying the answer by 100 (see Figure 15)

Student Work Sample 1:



Student Work Sample 2:

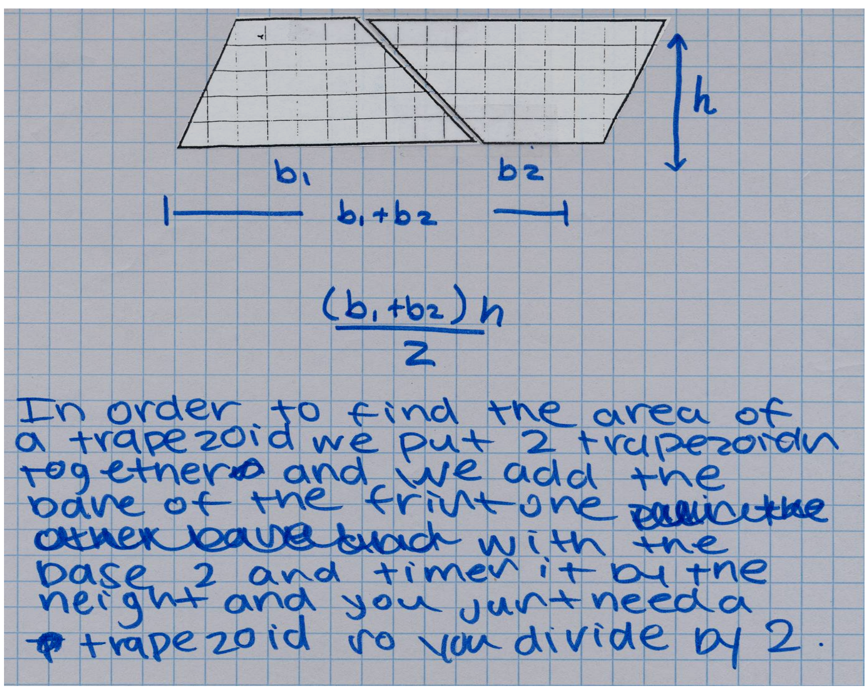


Figure 14: Student summaries on finding the area of parallelogram and trapezoid.

Student Work 1:

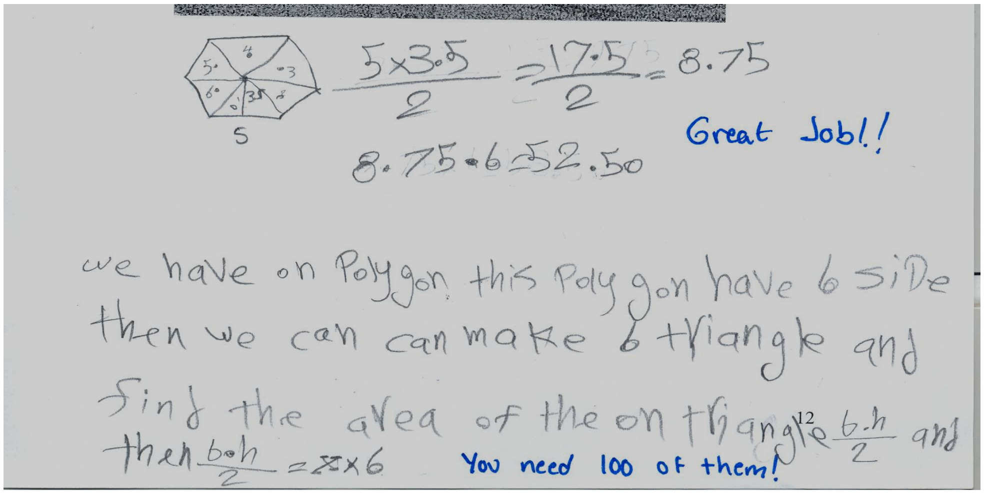
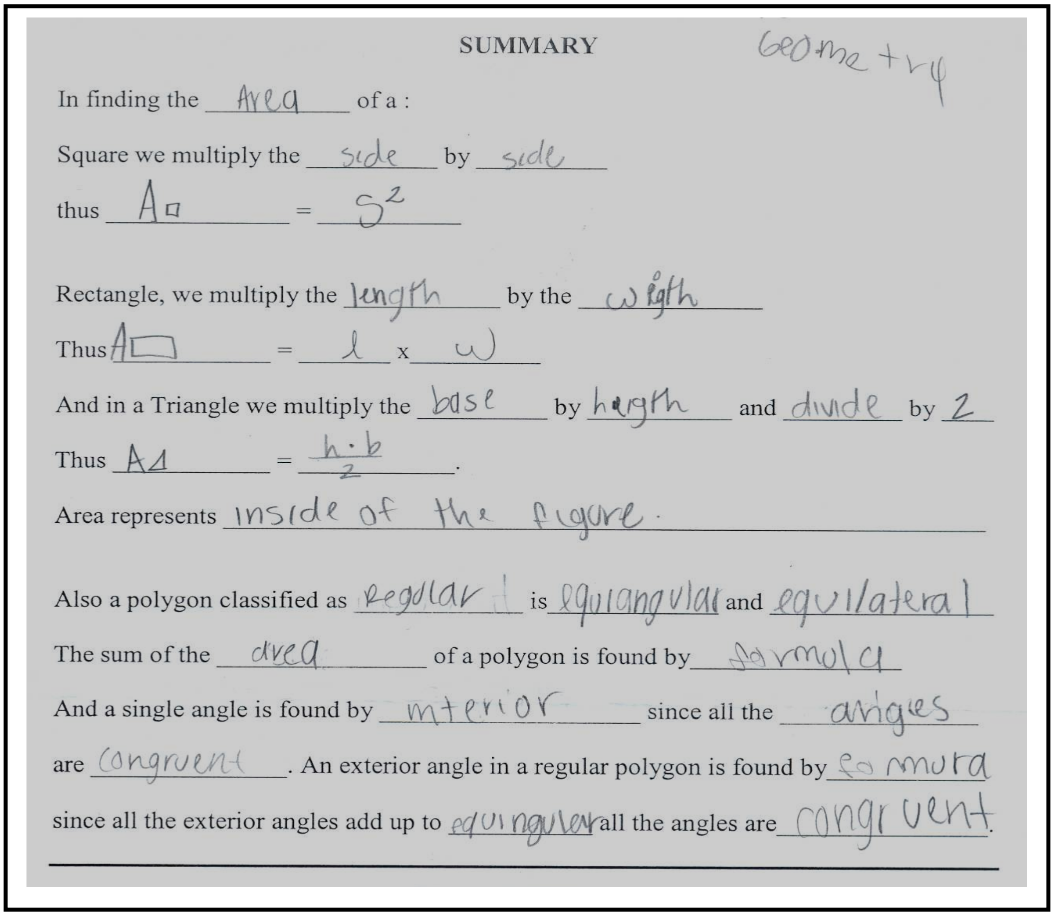


Figure 15: Canopy student work.

It was evident from their explanations that they were able to use the dissection skills covered in previous lessons. I allocated adequate time to independently summarize the procedures on how to find the area of common and uncommon shapes by providing students with a “summary scaffold”. The student work summary sample (see Figure 16) showed that the student understood most of the content, but there were still some concepts that needed to be reviewed such as “the concept of polygons and the measure of interior angles”. The summary diagram was created to provide students with the opportunity to assess their own understanding. I proceeded to have a class sharing session to validate students’ attributions and correct any misconceptions on the area of squares and rectangles. I encouraged accurate attributions and had students support and/or clarify their answers to provide the opportunity to increase self-efficacy and deepen understanding of the content.



SUMMARY Geometry

In finding the Area of a :

Square we multiply the side by side

thus A□ = S²

Rectangle, we multiply the length by the wigth

Thus A▭ = l x w

And in a Triangle we multiply the base by height and divide by 2

Thus A△ = h · b / 2.

Area represents inside of the figure.

Also a polygon classified as regular is equiangular and equilateral

The sum of the area of a polygon is found by formula

And a single angle is found by interior since all the angles

are congruent. An exterior angle in a regular polygon is found by formula

since all the exterior angles add up to equinguler all the angles are congruent.

Figure 16: Student summary.

Working in teams, I asked students to answer the following prompt: “In which cases of finding area are formulas more effective to use versus common sense?” After I provided the prompt, students were not engaged because they said that “it was difficult for them to classify a math problem as being able to be solved using common sense.” I decided to stop team discussions and provide direct instruction with problems where common sense was more efficient than using formulas. One example is finding the area of a square with side length of five inches versus a problem where the area of the square is given and one needs to find a missing side length. I reiterated that using formulas and plugging in the given information would make solving such problems easier, but careful reading and understanding of the problem is necessary to extract the given information. Interaction time was allocated for students to discuss the question and present their findings both in oral and written form in order to provide them with an opportunity to use their work as peer models and increase self-efficacy while deepening the understanding of geometry. Team discussions were implemented here to challenge students to agree and compromise on the most efficient method. In this discussion, each student was given the opportunity to explain his/her approach and convince the members of the team to choose his/her approach. I designed this exercise to provide students the opportunity to explain, in English or their native language, their reasoning. Explanations of their reasoning allowed students to find missing information or misconceptions about the content. I circulated around the room and provided frequent feedback, encouraged each individual and encouraged accurate attributions to foster self-efficacy and deepen the understanding of the content. The majority of the teams decided that they would always use formulas, even if it was just to remind themselves of how to find the area of the appropriate given shape, but especially when they were given word problems.

The teams also agreed that they would use formulas if they were given the area and had to find a missing measure such as length, width, base, or height. Time was allocated for students to review their house blueprint and make changes or corrections, if needed. Students were asked to make presentations highlighting the procedures and important concepts on finding the area of polygons to facilitate the deepening of content understanding. The out-of-school assignment challenged the students to make x relevant by providing a step-by-step procedure with geometric figures, drawings, and algebra equations, to find the total area of a house's blueprint including a hot tub, a front yard and if possible, a backyard. This assignment required students to be explicit in their explanations in order to facilitate a deeper understanding of the area content based on their own interests.

Building 3-D Shapes

The warm-up included various figures and required students to discuss the procedures to find the area. The goal of the warm-up was to reinforce and assess students' understanding about dissection of space into common and uncommon shapes (see Appendix, pages 160, 161). Volunteers were selected as peer models to present their methods and reasoning on finding the area of the figures. After the warm-up was discussed as a whole class, I selected a student's house blueprint to initiate a class discussion on using the process of dissection, and how to use it to find the total area of the floor plan of a house. I purposely planned to use a student's house to foster self-efficacy, as it was used as a peer's work. Team interaction was initiated when teams were asked to discuss the following question: "Now that we have the floor plan, we know figure dissection, and know how much area is needed, what would one need and have to do to build the house?" Throughout the seven minutes allowed for team interaction, I circulated around the room clarifying the goal of the task and posing open-ended questions such as "what shapes can you dissect this figure into?" I gave frequent feedback and allowed them to make their own choices about their ideas for class sharing to foster or maintain students' self-efficacy (Margolis & McCabe, 2006). Students came up with a variety of interesting ideas including: "you need to be a contractor”, “you need to be a carpenter”, “you need materials”, “you need wood”, “you need drywall”, and “you need to build rooms”. Teams were asked to share their answers. It was based on their answers that I decided to make area more relevant to out-of-school settings and real-life applications by asking an airport engineer to come and give a presentation on the importance of geometry in constructing the Central Japan International Airport in Nagoya, Japan. After listening to the presentation, students were charged with motivation. The presentation made the subsequent lessons more interesting as most of the students were engaged in every task. They were engaged in the lesson because according to them, “Las matemáticas si se usaban y eran necesarias fuera de la escuela” (Mathematics were really needed and used outside of school).

Using the idea of the construction of buildings, I decided to concentrate on building one room at a time. I introduced students to three dimensional figures. Students were given cardboard, scissors, glue, and rulers. In pairs, students were asked to complete a hands-on project which made x relevant by requiring pairs to find the total amount of drywall needed to build a three dimensional room. This project was purposely planned to provide students with the opportunity to implement previously learned content and obtain a deeper understanding of area while using real-world applications. Pairs were asked to write a report and orally present their procedure. The written and oral reports reinforce the understanding of the content. Time for summary writing was also allocated. Their out-of-school assignment required students to make X relevant in their out-of-school settings as it challenged them to find the area of three dimensional shapes of their choice.

Surface Area (I)

Some days, warm-ups were not given as time was allocated instead to answer homework questions, and answer any questions and clear up any misconceptions such as the area of trapezoids and rhombuses, about which student tended to get confused and frustrated**.** Using the three dimensional room made in the prior lesson as models, pairs were provided with sufficient time to review their approach. Teams were asked to present their procedures and reasoning to find the total amount of drywall, wood, or materials needed to build the room. The purpose of the presentation was to expose students to different peer approaches to solving the same problem and to deepen the understanding of area. After pair presentations, students were introduced to nets, which are two dimensional drawings of three dimensional shapes, and the concept of surface area. Team collaboration time was allocated to practice the concept of finding the surface area of prisms and pyramids with the goal of deepening their understanding of surface area. Journal writing required students to use academic vocabulary, procedures on finding surface area, summarize the lesson and record questions. I responded to their journal questions in a whole class discussion, keeping students' names anonymous to prevent any decrease in self-efficacy. Answering the questions clarified any misconceptions and provided more opportunities to obtain a clearer and deeper understanding of surface area. Student questions such as "Maestro, ¿cómo se dibuja la net de un cuadrado? (Teacher, how do you draw the net of a cube?), "¿La piramide regular tiene cuatro caras iguales, verdad?" (Does a rectangular prism have four equal faces?), and "¿Cómo encontramos el area de la superficie de una piramide triangular?' (How can we find the surface area of a triangular pyramid?)

showed me that they needed more practice on using nets, which I allocated to deepen the understanding of surface area. In the next implementation I would include more objects found in the classroom or at home for them to draw in two dimensions. I would spend another period drawing nets and the measurements and provide more detailed direct instruction. The out-of-school assignment (see Figure 17) made x relevant by asking students to use nets to draw and find the total surface area (X) of their bedroom with a written description of their reasoning and procedure.

Student work 1

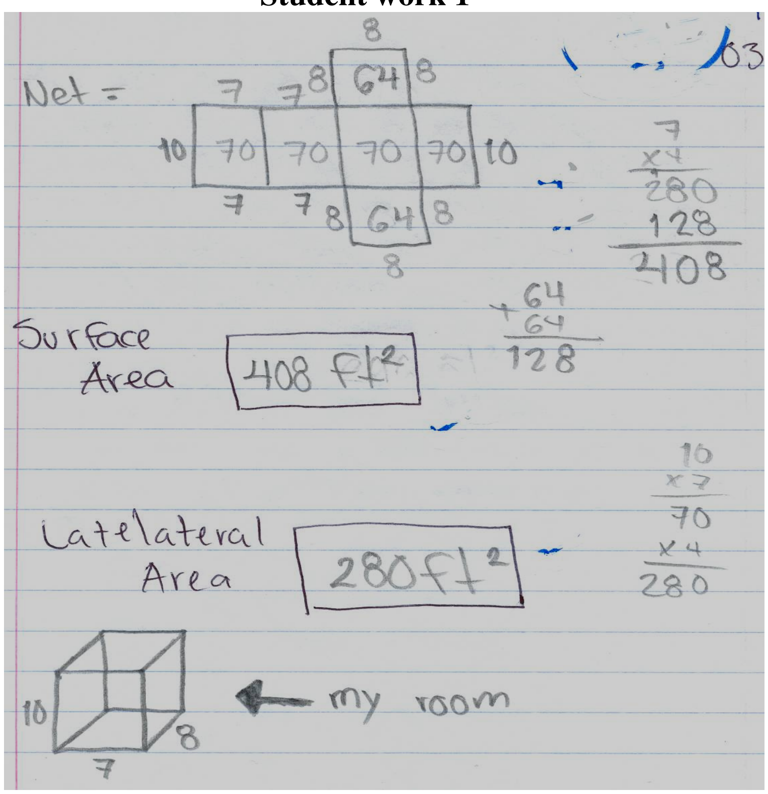


Figure 17: Student work on surface area of his room.

Surface Area of a house (II)

Warm-up problems required students to draw the net and explain the procedure of how to find the amount of paper needed to make a box of cookies with dimensions of 20 inches in length, 5 inches of width, and 20 inches of height. This warm up was specifically chosen to connect content to real-world applications. While in collaborative learning teams, each team was given a cube, a rectangular box, and a cylinder and was asked to draw a net, write a procedure, and find the total surface area of each polyhedron. After agreeing upon a procedure, with teacher's focused feedback to increase self-efficacy, teams were asked to make group presentations of procedures on finding the total surface area of their objects. Using the concept of surface area, students were asked to estimate the height of their house and find the total surface area. I asked the students to estimate the height of their house to challenge them to find the surface area. Peer solutions were shared with the class to increase self-efficacy and deepen the understanding of surface area. Journal writing time was allocated for students to write down the process to find the surface area of their house. The out-of-school assignment was to actually measure the height of their house, find the actual surface area, and provide a written report the process, procedure and results. This task was assigned with the goal of juxtaposing their findings to their estimations to increase self-efficacy and deepen the understanding of content.

Surface Area of our neighbors' house (III)

The warm-up problems made x relevant by asking the students to find the amount of plastic material needed to make 500 music CDs with diameter of 16 cm. As I reviewed their warm-ups, I realized that I needed to spend more time reviewing how to find the area of circles, but I was unable due to time constraints. Students felt this rush, as one of them wrote, “Do not get very well circles” Students were given the opportunity to choose another student’s house to find the total surface area, write the procedure and the explanation. This task was chosen to deepen the understanding of area. I gave students the choice of using English or their native language to share their knowledge and procedures. Many students decided to share in their native language which allowed more English proficient students to be translators. Giving student the choice to use their native language was done with the goal of increasing self-efficacy. The out-of-school project was intended to prompt students to use all their previous knowledge and work such as blueprint, area procedures and explanations to build their own three dimensional house model. Students were given the opportunity to build their house in pairs or individually. In the case that they chose to build the house in pairs, one house was sufficient, but both students were required to turn an individual written report of their procedure (See Appendix, pages 196-200).

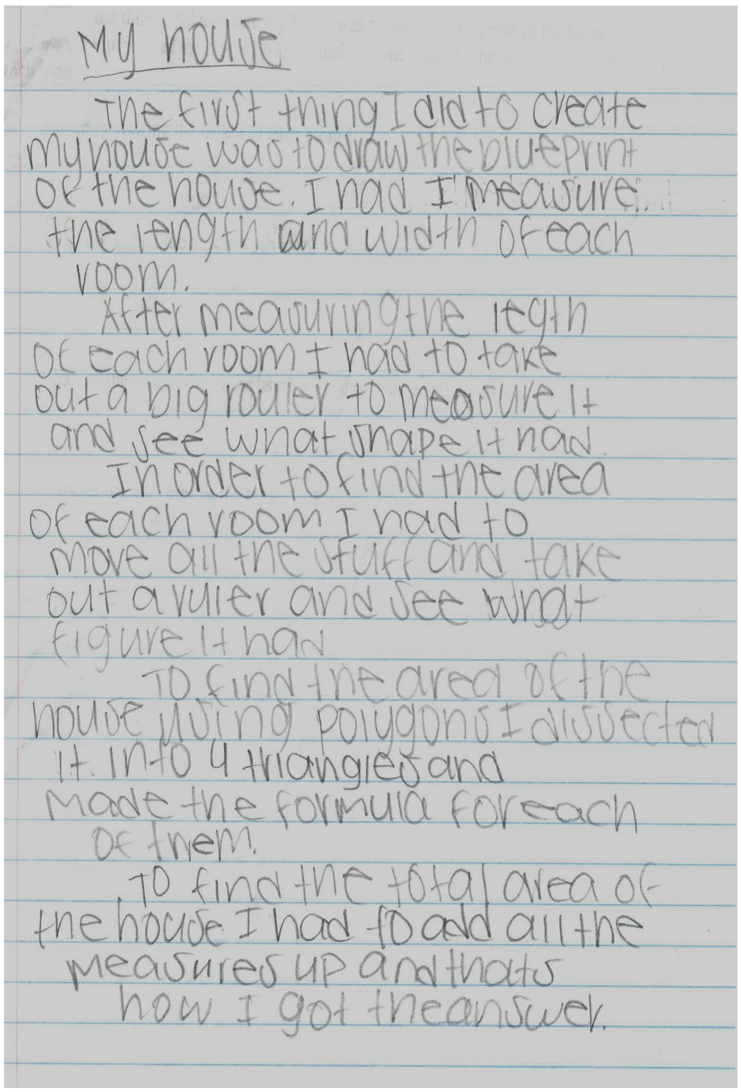
Project Oral/Written Presentations

Students were asked to present their procedures on building their house in both oral and written form (see Figure 18). I discussed with students the goal of the presentation which was to show their knowledge of content on the concept of area. I provided students with sentence starters such as:

- The first thing I did to create my house is….
- After measuring the length of each room, I….
- In order to find the area of each room, I….

- To find the area of the house using polygons, I dissected the house into..

I also let students know that they would be able to choose the language of their presentations. It was interesting to see that many of the pairs decided to do the presentations in both languages. One student presented their work in


My house

The first thing I did to create my house was to draw the blueprint of the house. I had I measure the length and width of each room.

After measuring the legth of each room I had to take out a big rouler to measure it and see what shape it had.

In order to find the area of each room I had to move all the stuff and take out a ruler and see what figure it had.

To find the area of the house using polygons I dissected it into 4 triangles and made the formula for each of them.

To find the total area of the house I had to add all the measures up and thats how I got the answer.

Figure 18: Student’s house written report.

English and the other presented the work in Spanish. Notably, the students who presented in Spanish still used the academic vocabulary in English, for example: "Este es nuestro proyecto, nuestra casa tiene tres rooms, un square y dos rectangles. Encontramos el area del square usando side by side y el area del rectangle usando length times width" (This is our project; our house has three room, one square and two rectangles. We found the area of the square using side times side and the area of the rectangle using length times width). The fact that the students were using Spanish with English academic terms provides evidence that the students understood the content because they were incorporating new content with their previous knowledge. Student audience members were expected to be full participants by asking questions. At first students hesitated to ask questions and participate, so I began asking both presenters and listeners questions. After a few presentations, students were more involved. Reflecting on this task, I realize that I should have provided a few sample questions such as, "How did you find the area of the kitchen?" and "What are the units you used in calculating the area?" as students did not know what type of questions they were able to ask.

Unit Exam

Students were given the unit test based on providing the area and surface of common, uncommon polygons and three dimensional polyhedrons. The test was used as an assessment tool to check for understanding of content of the state's eighth geometry standard: "Students know, derive, and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common and uncommon geometric figures" (Mathematics Content Standards for California Public School, p. 42). Due to time constraints, I was not able to spend enough time on lateral area. In future implementations I would like to spend more time and use hands-on projects to make the lateral area concept more explicit for deeper understanding.

Post Tests and Post Surveys:

Students were given post tests and post surveys (see Appendix, pages 202-208) to collect data to be used in the evaluation of self-efficacy and the effectiveness of the "Making X Relevant" curriculum.

"Making X Relevant" sought to provide students with the opportunity to view math as relevant to their non-academic lives through the use of collaborative learning strategies and authentic context. Students were encouraged to view math as an important component in out-of-school settings and real life experiences with the inclusion of their interests in the curriculum. Through hands-on activities and written and oral explanations, students were offered opportunities to acquire and experience an increase in self-efficacy without communication being a challenge. Finally, students were provided with opportunities to acquire a deeper understanding of math by using oral and written communication such as tasks, problem/solution/explanation and individual oral presentations based on their "house model" final project.

VII. Evaluation of “Making X Relevant”

“Making X Relevant” is a curriculum designed to provide English language learners the opportunity to become active math learners. It focuses on two main goals: The first goal is to increase English Language Learners’ self-efficacy, and the second goal is to deepen the understanding of mathematics through explanations, both written and oral, in an authentic context. I implemented “Making X Relevant” in one sheltered class at the end of third quarter in a 4x4 schedule during the 2007-2008 school year.

To evaluate the effectiveness of “Making X Relevant” I used a variety of qualitative and quantitative methods. I collected data to evaluate the curriculum using pre and post-surveys and tests, warm-ups, teacher open-ended questioning, oral presentations, written student reports and student work (see Table 3).

Table 3: Evaluation strategies used in meeting the goals of “Making X Relevant”

Goals Data	**Increased self-efficacy**	**Deepened the Understanding of Mathematics**
Pre-Post Surveys	✓	
Collaborative learning	✓	✓
Warm-ups		✓
Teacher Questioning	✓	✓
Oral Presentations	✓	✓
Written Explanations	✓	✓
Pre-Post Tests		✓
Student Work	✓	✓

Data Collection Methods

Pre- and Post- Surveys

I created a “Math Attitude Survey” to measure students’ self-efficacy in the beginning and the end of the implementation. The survey asked students to assign a score from one to six; one being “not well at all” and five being “extremely well,” for their beliefs about their math skills and explanation abilities (see Figure 19). I compared pre-survey with post-survey scores to measure the change in students’ beliefs about their abilities to do and explain math procedures.

Collaborative learning

Group tasks were assigned throughout the implementation of “Making X Relevant” with the goal of increasing self-efficacy and deepening the understanding of mathematics. While in pairs or teams, students were given moderately difficult hands-on tasks, challenging them to use prior knowledge and critical thinking skills, and requiring them to present their reasoning and procedures to the class. For example, students were asked to provide two ways of finding the area of a rectangle, or use manipulatives and previous knowledge to explain the procedure for finding the area of a parallelogram. These tasks were deliberately chosen to provide students with the opportunity for discussion and exposure to different procedures to solve math problems.

Warm-ups

Warm-ups were given at the beginning of each lesson. Students were given between 7 to 15 minutes, depending on the difficulty, to complete three problems in which students were asked to explain their reasoning and chosen procedures to find their solutions. I informed the students that warm-ups were being used as an assessment tool to determine their understanding of previously learned content, and if necessary, review concepts once again. I informed the students that they could use their primary language and assured them I would not be assessing grammar and/or punctuation, but only the understanding of the content. During the warm-ups I offered frequent focused feedback while encouraging accurate attributions such as: “Good job,” “Excellent explanation,” “Every step is correct until.., and you might want to take another look” to foster and increase self-efficacy. Warm-ups helped me assess the level of understanding of the content by comparing students’ answers at the beginning of the implementation with their answers midway and toward the end of the implementation. Warm-ups were graded using a modified version of the 2005 NCTM Math Rubric, Problem Solving and Reasoning Rubric (see Table 4).

Table 4: 2005 NCTM Math rubric: Problem solving and reasoning (0-4 Points)

Score	**Description**
4	Student shows complete reasoning to support sophisticated rules for both situations.
3	Student shows adequate reasoning to support at least one sophisticated rule or student gives complete reasoning to support specific rules for both situations.
2	Student shows reasoning about rules through words or organizational instruments but the reasoning is weak - tests an inadequate variety of situations and draws conclusions that would require testing more cases or examining more varied arrangements or student has only one or two specific rules and does not address both situations.
1	Student shows reasoning about rules through words or organizational instruments but the reasoning is faulty - it employs incorrect logic or nonsensical statements in the context of the problem or student only reasons through one specific rule.
0	Student does not engage in the task.

Teacher Questioning

Open-ended questions were used throughout the implementation of "Making X Relevant" to accomplish the goal of deepening the understanding of math and increasing students' self-efficacy. While in collaborative pairs and/or teams I circulated around the room asking open-ended questions such as, "Qué conceptos hemos visto en clase que te puedan ayudar a comenzar o a resolver este problema?" (What information have we covered in class that will help you start or solve this problem?). I informed the students that each individual should be prepared to answer with their ideas and/or ask questions, if needed, to provide focused feedback and encourage students' accurate attributions (Margolis & McCabe, 2006).

Oral Presentations

As part of achieving the goal of increasing self-efficacy and deepening the understanding of mathematics, I explained to the students that one of the requirements was to share with me and/or with the class their chosen procedures and reasoning of given tasks. I explained to them that I would provide assistance throughout the implementation to help clarify or answer questions on tasks to increase self-efficacy. I also communicated to students that this would be part of their class participation grade. The 2001 NCTM rubric on communication was modified and used to grade their presentations (see Table 5).

Table 5: Modified 2001 revised NCTM-based math rubric on communication

SCORE	COMMUNICATING
4	communication of arguments is supported by mathematical properties used. Precise math language and symbolic notation are used to consolidate math thinking and to communicate ideas.
3	Explanation of an approach is evident through a methodical, organized, coherent, sequenced, and labeled response. Formal math language is used throughout the solution to share and clarify ideas.
2	Some explanation of an approach is evident through verbal/written accounts and explanations, use of diagrams or objects, writing, and using mathematical symbols. Some formal math language is used, and examples are provided to communicate ideas.
1	Little or no communication of an approach is evident. Everyday, familiar language is used to communicate ideas.
0	No attempt to communicate is made.

Written Explanations

A crucial daily component of this project was the written explanations of students' procedures and/or reasoning on given tasks to reach the goal of increasing self-efficacy and deepening the understanding of the content. I modeled how to write explanations numerous times and communicated to the class that their written explanations would be used as an assessment tool of their understanding and to clear any misconceptions of the content being covered. I also provided students with the choice to write in their native language to foster self-efficacy. Since I had three students who spoke Vietnamese, two who spoke Farsi, and one who spoke French, I contacted the school translator and was ready to use his services. In the end, most of the student work was done in English. Their written explanations were assessed using the 2005 NCTM math rubric (see Table 4).

Pre and Post-Tests

Tests were used to measure the students' understanding of area and surface area content, the eighth content standard of geometry. Students took a pre-test on area of common and uncommon geometric shapes to determine their weaknesses, strengths, and previous knowledge. As implementation progressed, students were given periodic quizzes, culminating with a final written exam.

Student Work

Student work was collected throughout the implementation of "Making X Relevant" and was used to measure self-efficacy and track student progress in communicating, in written form, the procedures and understanding of the content. Student work was also used as an assessment tool to correct any content misconceptions and was graded using the 2005 NCTM Math Rubric, Problem Solving and Reasoning (see Table 4).

Goal 1: Fostering Self-Efficacy

<u>Findings: The majority of students increased their self-efficacy</u>

Pre and post self-efficacy survey scores demonstrated that students increased their self-efficacy. At the beginning of the implementation, I had to choose students to share and present their explanations, but as the implementation of "Making X Relevant" progressed, students sought out the opportunity to go to the board and present their explanations. For example, Itandehui, Neomi and Joel, among others, started the class as students who chose to sit in the farthest corner of the class. But with my constant focused feedback and encouragement which I offered to the whole class, they moved to the front of the classroom and constantly asked "Mr. Torres, can I do one problem on the board?" Their frequent enthusiasm to present their explanations showed an increase in their self-efficacy (see Figure 19). The comparison of scores of the pre- and post-test showed that "Making X Relevant" made a positive impact on students' self-efficacy as the survey scores shifted positively in each category.

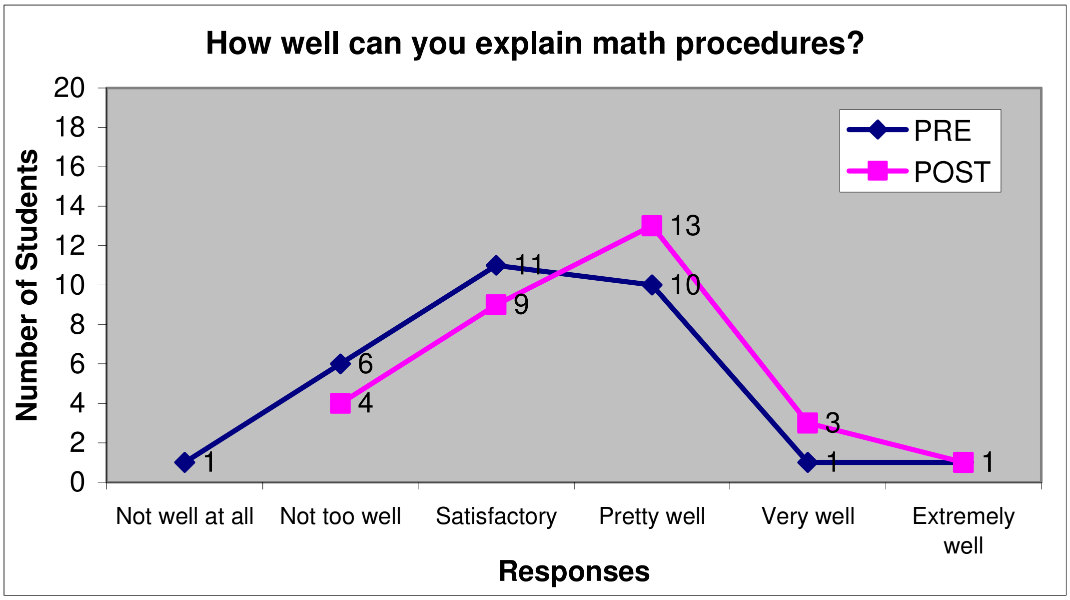


Figure 19: Pre and post-self-efficacy survey results.

Collaborative learning contributed to the increase in students' self-efficacy. As teams became more confident and successful in their abilities in problem solving tasks, they became more willing to share their explanations. Students declared that "Trabajando con otros es mejor porque hay más oportunidad de encontrar la respuesta correcta" (Working with others is better because we have a better chance of getting the problem correct). They also commented that, "Cada uno tiene la oportunidad de ser el presentador, y seis cerebros piensan mejor que uno" (Each one can have the opportunity to have a role such as the presenter or the boss and six heads work better than one). At the beginning of the implementation, teams hesitated three out of five times (60%), to provide explanations on the board as they asked "¿Puede ir el otro equipo primero?" (Can the other team go first?) Towards the end of the implementation teams four out of five times (80%) consistently asked "Maestro, podemos ir al pizarrón a explicar primero?" (Can we be the first ones to go up to the board and explain?).

Open-ended questioning and oral presentations were techniques used throughout the implementation of "Making X Relevant," which culminated with an individual oral test (see Table 6). The majority of the students (93%) were able to provide correct answers to solutions to problems on area. I have omitted student names to protect their privacy, but the individual final oral explanation test transcript represents the majority of typical oral answers by students.

Oral explanations showed students' success in answering questions about area content. The majority of the students (86%) were very comfortable offering their responses to my "How to find the area of…" questions as they replied with "Sin problema Mr. Torres" (Without a problem, Mr. Torres), "Is that all?", and "Cómo no" (Of course).

Table 6: Sample of individual oral explanation test

Teacher: Can you explain how to find the surface area of this figure? **Student X:** Since it is a cube and you want the area around the figure, you do side times side and since all sides are the same size and there are six of them, you multiply the answer of one by six and that is the total surface area. Is that right? Yeah, that is right! **Teacher:** Okay, you can go back and take a seat. **Student X**: Is that all? That was easy, Mr. Torres.
Teacher: Can you explain how you would find the area of the Square Pyramid? **Student Y:** Of course, this figure is a square pyramid; you find the area of the bottom. La figura of the around figures is a triangle, you find the area of one usando base por height sobre dos and you multiply by quatro. (The figure of the figures around is a triangle, you find the area using base times height over two and you multiply by four). **Teacher:** Is this your answer? **Student Y:** No, Los sumas los dos juntos and that is the total. (No, you add the two together and that is the total.)
Teacher: Imagine you are going to make a hexagonal umbrella. How would you find the amount of material used to make one? **Student Z:** If you want the area of an exagono, lo cortas en six triangles, I think its six sides, right? Anyway, find the area of one and multiply by six, then go buy material and sew them together. **Teacher:** Can you tell me how to find the area of a triangle? **Student Z:** Sin problema Mr. Torres, es base por altura dividido por dos (With no problem Mr. Torres, base times height divided by two). **Teacher:** Can you try it in English? **Student Z:** Cómo no, base por height and divide for two (Of course, base times height and divide for two).

Although there were a few students who stopped and took a few minutes to look around, talked to themselves and thought about the steps in the middle of their explanations, the majority of them (86 %) were able to solve the problems with only a few procedure mistakes. I only observed nervousness, resistance and avoidance of the test from two male and two female students (14%) as they asked: "¿Qué pasa si no lo hago?" (What happens if I do not take it?) The two male students were students who declared that they had stopped attending school after third grade in their native country. From the two female students, one did not produce an end project, a house, and the other was a student who missed more than a few weeks worth of classes.

Written explanations showed a positive increase in students' self-efficacy. At the beginning of the implementation the average score for written explanations was 1.5 (37%), as students were not sure what to write. They only provided short explanations such as: "Creo que es lado por lado" (I think it is side times side). Midway through the implementation, the average score increased to 2.3 (58%), and at the end of the implementation, the average score increased to 3.3 (83%) as they were using sentences such as "Cómo sé que el área de un triangle es base por altura dividido por dos…" (Since I know that the area of a triangle is base times height divided by two…). Words at the beginning of the implementation such as "I think" became "I know" at the end of the implementation. The written explanations were scored using the Modified 2001 revised NCTM-based Math Rubric on Communication (see Table 5).

Student work in the form of written problems with solutions is further evidence that the implementation of "Making X Relevant" was effective in increasing student's self-efficacy. The majority of students (86%) declared that "Nos gusto el projecto de construir la casa, cómo trabajamos en grupos y cómo usamos las matemáticas para encontrar el area de nuestra casa. Fue muy divertido" (They enjoyed working on the house construction project, how they worked in groups, and how they used math to find the area of their own house. It was fun). Finally, students were given the task of creating their own problems and providing explanations and solutions (see Appendix, pages 193-195). Twenty-four out the twenty-nine students (83%) were successful in writing their own problems with explanations which increased their self-efficacy as they claimed that, "Nos sentimos muy inteligentes" (It made us feel very smart). The other students (17%) did not turn in the assignment.

Discussion of goal 1: Increase in self-efficacy findings

Through the implementation, a majority of the students increased their self-efficacy in relation to mathematics. Pre and post-surveys, collaborative learning, warm-ups, open-ended teacher questioning, oral presentations, written explanations and students' own written problems have influenced students to positively change the way they feel about their abilities to discuss, explain and share solutions to problems in mathematics, especially in geometry problems dealing with area. Reforms in mathematics have recommended that teachers of English Language Learners use multiple learning strategies, including collaborative learning. The incorporation of collaborative learning and communication, specifically written and spoken explanations in "Making X Relevant", have given students more confidence about solving math problems.

The data I have collected is limited by the relatively small sample size and short implementation period. It would be interesting to discover if the results of this study hold for a larger audience over a longer period of time.

Goal 2: Deepening the understanding of geometry

Findings: Most students deepened their understanding of mathematics

Collaborative learning seemed to help students improve their understanding of math. At the beginning of the implementation, team presentations' average score was 2.2 (55%). In the middle of the implementation, the average score was 3.0 (75%), and toward the end of the implementation, the average was 3.5 (88%). The team explanations were graded using the Modified 2001 Revised NCTM-Based Math Rubric on Communication (See Table 4). The initial scores were low because the students did not provide full explanations to the questions I posed such as "What is your problem about?", "What techniques did you use?", "How did you come up with the answer?" At the end of the implementation the only questions I needed to ask were: "Are you ready to start?" and "Class, do you have any questions?" Teams were successful at presenting correct solutions with the procedures and reasoning for support.

Warm-up explanations displayed students' understanding of geometry. Warm-up scores increased as stated in Goal 1: Beginning average score was 1.7 (42%), midway through implementation the average score was 2.7 (68%) and at the end of the implementation the average score was 3.4 (85%). Warm-ups explanations were graded using the Modified 2001 revised NCTM-based Math Rubric on Communication (see Table 4).

Hilbert (1900) states that math is understood when you can explain it, and Atiyah (2004) claims that math is understood well when you can address it and present it in an understandable way. At the beginning of the implementation of "Making X Relevant," students' explanations lacked reasoning, detailed explanations, and understanding of the content as they only write general comments such as "the area of square is side times side." As the implementation of "Making X Relevant" progressed, students' explanations demonstrated that they were not only able to use the concepts but were able explain them in detail. For example, "To find the area of a rhombus you use the formula $1/2(d_1 \cdot d_2)$ because the rhombus has two diagonals and you make a rectangle out of the rhombus and the height is only half of one of the diagonals."

Open-ended questions showed students' understanding of the content. To facilitate the reading of this thesis, I have translated questions I asked in Spanish. I asked open-ended questions throughout the implementation of "Making X Relevant" Some of these questions were:

"What is the task asking you to do?"

"What information is given that will help you to solve the problem?"

"What information do you already know that can help you?"

"Can you explain how you got that answer?"

"What would happen if I wanted to find…?

Answering these questions provided students with the opportunity to demonstrate their understanding of the content. The first oral examination showed that only 12 out of 29 students (42%) were successful at explaining their procedures and reasoning for solving geometry problems. Students grew in their understanding of the content as 25 out of 29 (86%) were able to successfully provide full explanations in their final oral examinations.

Oral presentations and explanations of their final house construction were true testimonies that many students were able to understand the academic content of area. As some mathematicians claim, if students can explain their reasoning and procedures to complete math problems or projects, they are aware of their understanding of the content (see Table 6). Most students were successful at using the concepts covered in class to describe the process of finding the total area of their house, and they were able to cite the common shapes and how to correctly find their area. The majority of the students (85%) were able to use the proper academic language to describe their processes and reasoning (see Table 7). Most males decided to do presentations in pairs, while females chose to do individual presentations. The most surprising outcome was that students were successful in citing proper area concepts and content in either English or their native language. Written explanations helped to determine students' understanding of geometry concepts.

Written explanations were used to measure the understanding of content. I compared the correct use of math concepts and inclusion of academic vocabulary in their explanations. At the beginning of the implementation, student written explanations were short, lacked concept reference, and the vocabulary was minimal; for example, "A square is equal sides." As the implementation of "Making X Relevant" progressed, students' written explanations demonstrated a better understanding of the content with concepts cited and academic vocabulary included.

Table 7: House presentation with content explanations

STUDENT	LANGUAGE	VOCABULARY (0-4)	CONTENT (0-4)
Pair 1 (Males)	English / Spanish	2.5	3
Student 2 (Male)	English	4	4
Student 3 (Male)	Spanish then English	2.5	3.5
Student 4 (Female)	Spanish - English	3	4
Student 5 (Female)	English	4	4
Pair 6 (Males)	Spanish and Little Eng.	3.5	4
Student 7 (Female)	Spanish then English	4	4
Pair 8 (Females)	Spanish - English	2.5	3
Pair 9 (Males)	English then Spanish	3.5	4
Student 10 (Female)	English	4	4
		AVERAGE	**AVERAGE**
	MALES	**3.2**	**3.7**
	FEMALES	**3.5**	**3.8**

For example, “to find the area of a square we know that each side is the same size and the area formula is side times side so the area of a square is given by multiplying side times side.” Even students who were classified as ELL 1-2 were using more detailed explanations, combining English and Spanish such as “para encontrar el área de un triangle necesitamos saber la height y la base. Si uno sabe la height y la bace uno los multiplica y cómo un triangle es half of a rectangle lo dividimos by two” (to find the area of a triangle, we need to know the height and the base. If we know the height and the base, we multiply them and since a triangle is half of the rectangle, we divide by two). ELLs can often communicate their understanding more effectively if they are permitted to use their native language with English academic vocabulary.

A comparison of *pre- and post-test* scores showed that students increased their understanding of geometry concepts. The SIB math department considers 68% or above to be a passing grade. The sample of individual scores (see Figure 20) shows that 70% of them were successful at obtaining a passing score. The other 30% were able to increase their scores considerably. The test was scored using the 2005 NCTM Math Rubric for Problem Solving and Reasoning (see table 4).

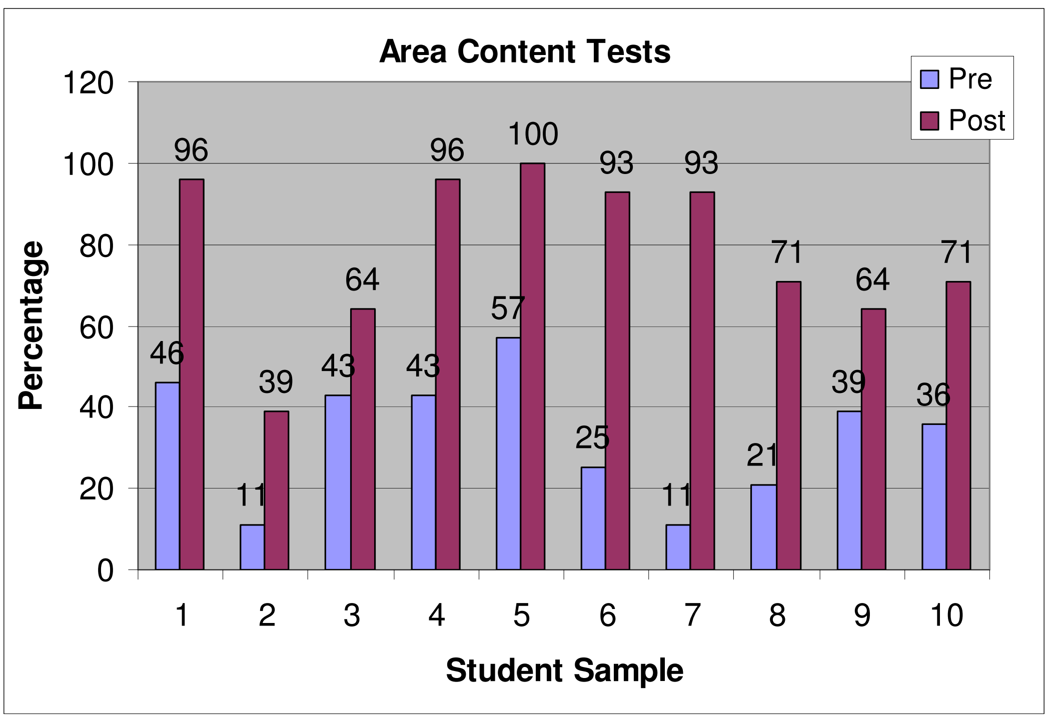


Figure 20: Pre and post-implementation area content scores sample.

The overall quality of *student work* improvement and complete step-by-step explanations and solutions showed that many students were able to understand the concepts of geometry covered in the area unit. Student final projects demonstrated that 26 out of 29 students (89%) successfully used the area concepts to show and find the total area needed to construct their house.

Discussion of Goal 2: Deep understanding of geometry findings

Students have shown that their understanding of mathematics has increased. Scores from the post test have demonstrated that students understood the geometry concepts and deepened their understanding of math. Students benefited from the use of oral and written communication to explain their rationale and procedures for given tasks. Oral exams demonstrated that a majority of the students were successful in understanding the concept of area, as they obtained a passing academic grade of C or higher.

Students' written explanations improved throughout the implementation of "Making X Relevant" to the point that students were able to write full explanations using academic language on area concepts and content. Finally, the house project oral explanations and presentations showed that students recognized the connection of the content learned in the classroom to out-of-school settings with comments such as "Me gustó cómo usamos las matemáticas para encontrar el área de nuestra casa" (I liked how we use math to find the area of our house), "I liked the team work, just like in my work", "Me gustó cómo encontramos el área de cosas de la casa, fue divertido" (I liked how we found the area of things in our house, it was fun).

The majority of the students were able to use the concepts of area correctly, but more time should be dedicated to vocabulary on the next implementation. I would like to further investigate why most of the males decided to do explanations and presentations in pairs, whereas the females chose to do them individually. I was also very delighted to see that even the students who would seldom participate or volunteer in class were taking part in the presentation process by asking questions such as, “How did you get the area of the kitchen?”

Summary

“Making X Relevant” was designed to increase English Language Learners’ self-efficacy and deepen the understanding of math through oral and written explanations and authentic context. Students enjoyed the tasks, especially those that included hands-on activities and manipulatives.

The features of the curriculum are collaborative learning and oral and written communication in the form of explanations where native language is seen as an asset in an authentic context. Research (Gutierrez, 2002; Lee & Luykx, 2005) has shown that when students are allowed to use their native language, they are more likely to learn new content better, and in the case that they already know the content, they should have the opportunity to focus on academic vocabulary and the language of the content.

I had two goals for “Making X Relevant” which included fostering self-efficacy and deepening the understanding of math. “Making X Relevant” met the goals that were originally set as the English Language Learners that took part in “Making X Relevant” were able to increase their self-efficacy. The students were also able to understand the concept of area as evidenced by the unit content scores. Through oral and written communication, students expressed their success in understanding the relevance of math to out-of-school settings while using the content of area and providing full explanations of their house project procedures.

Throughout the implementation of “Making X Relevant,” while in collaborative learning settings, open-ended questioning was used as means of assessment which guided the modification of the assigned activities. Many times my student tasks did not include enough detailed explanations of the activities and students found themselves struggling to complete the tasks. The activities have been revised to overcome their original shortcomings.

VIII. Conclusion

I decided to become a math teacher because I love the challenge of solving math problems. I also love sharing my knowledge and passion for mathematics with my students. However, over the past six years I have seen that many of my students do not feel the same way I do toward mathematics. Talking to other teachers about our students, I realized that it is always easier to say that students do not want to take the time to learn mathematics and that their attitude toward math classes makes it difficult to teach them. However, I decided that we must take a closer look at the reasons why many students' desire to learn math fades away and motivation to learn math diminishes.

Through this research process I have learned that teaching is more than preparing lessons and presenting the content. I have realized that teaching is being aware of your students' prior experiences and current interests. Students who come to class with unpleasant math experiences have closed themselves to the idea that math can be fun, enjoyable, and doable. However, I have also seen that students have great potential and can be open to give math another try if they are provided with adequate support.

Looking back at the implementation of "Making X Relevant", I realized that "Making X Relevant" could have been even more effective with the following revisions:

- Inclusion of a lesson on the concept of perimeter prior to introducing the concept of area, because many students struggle to see the difference between perimeter and area or teach them together.

- In pair and group discussion tasks, prompt students with more open-ended questions to help them clarify the goals of the task.
- Provide more wait time for students to answer open-ended questions.
- Give more detailed directions for each hands-on project.
- Provide sentence starters at the beginning of each lesson, summaries, and presentations to facilitate both oral and written communication.
- Be more selective on practice problems.
- Include step-by-step solution modeling throughout the implementation.
- Provide more discussion time after each lesson and concept.
- Include practice finding the area of more three dimensional objects found in out-of-school settings. Ask students to bring them to class.
- More focus on the difference between lateral area and surface area. Students struggled to differentiate surface and lateral area.

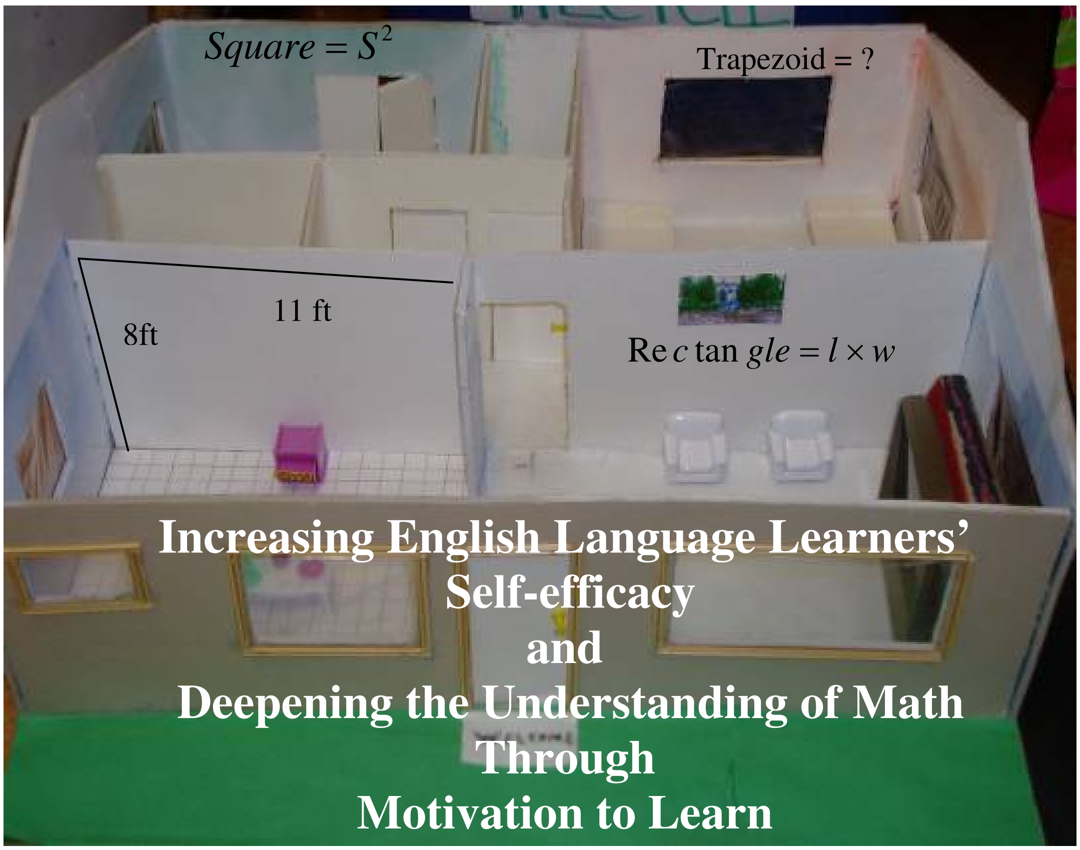
With the implementation of "Making X Relevant" I have learned that English Language Learners can change the way they view math if they see the relevance of the content to out-of-school settings and are provided with the appropriate support. I have witnessed the transformation of students who previously sat quietly in their seats and avoided participation, to intelligent outspoken individuals who demonstrated greater self-efficacy. I have also seen students who would never ask questions raise their hands and pose questions for clarification about the tasks or the content. The most surprising and unexpected result is that I have seen girls take the challenge of "Making X Relevant" with great determination and commitment, even if the project was seen by their classmates as "a male oriented project." The traditional stereotype of girls not being as proficient as boys in mathematics is just that, a stereotype, because provided with the proper support, projects and learning settings, girls can do math just as well, if not better, than their male counterparts as Hyde et al (2008) studies have shown.

The "Making X Relevant" curriculum sought to provide students with the opportunity to view math as relevant to their non-academic lives through the use of authentic context and collaborative learning strategies. Students were encouraged to view math as an important component in out-of-school settings and real life experiences with the inclusion of their interests in the curriculum. Through hands-on activities and written and oral explanations, students were offered opportunities to acquire and experience an increase in self-efficacy without communication being a challenge.

Finally, students were provided with opportunities to acquire a deep understanding of math by using oral and written communication such as tasks, problem/solution/explanations and individual oral presentations based on their house model final project. Finally, with the implementation of "Making X Relevant" I have learned that it is not easy to help students change the way they see an academic subject, especially a subject with which they have struggled. Although it requires a great deal of energy, commitment, effort, collaborative learning, written and oral explanations, and authentic context, it can be done.

Appendix

“Making X Relevant”



by

Jaime Torres Cuevas

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Introduction to teachers:

Have you ever heard your students asked the following questions: “Teacher, why do we have to learn this math?” “Teacher, can you tell me when am I ever going to need this math?” Teachers at my school often feel frustrated when they see that their students have poor attitudes about their math classes. It gets even more frustrating to see that students come with that attitude the very first day of school.

Many students believe that the material covered in the classroom in not going to help them in their daily lives, thus it is not worth putting in the time to learn the material. Using the current math curriculum, I had a hard time convincing students that the content learned in the classroom could be applied to out-of-school settings. The only answer that I could give them at the time was that it was a requirement for graduation and an advantage when they applied for admission to a college or university.

“Making X Relevant” was created to make the content relevant to-out-of school settings, to foster English language learners’ self-efficacy and deepen the understanding of geometry through interaction and authentic context.

In this curriculum, students are encouraged and expected to become effective communicators in written and oral forms. “Making X Relevant” is designed to be implemented in a collaborative learning setting where interaction is essential and students see their first language is a powerful fund of knowledge. Manipulatives and hands-on projects make it enjoyable and facilitate peer-to-peer interactions and teacher-to-student communication.

Students are expected to use math vocabulary and the concepts of area and surface area while designing and building a model house.

Students are further challenged to share their procedures orally through individual and group presentations and produce a written report on finding the total area and total surface area of the model house. The final stage of “Making X Relevant” is to have students write their own problems and provide complete solutions to these problems.

Goals and Features of "Making X Relevant"

GOALS	CONSTRUCTS
1. Foster Self-efficacy 2. Deepen understanding of geometry	• Collaborative learning settings • Written and Oral explanations • Authentic context

Goals

The first goal of "Making X Relevant" is to foster or increase self-efficacy. This goal assumes that all students are provided with multiple techniques and activities to experience a positive change in their attitudes about math and be able to reach success in assigned tasks.

The second goal of this curriculum is to provide students with the opportunity to deepen their understanding of geometry. Research shows that if one can effectively explain the content, then one understands the content. Through this approach, students should be able to explain their procedure and reasoning on given tasks, problems and/or projects in both written and oral form.

Features

The features of "Making X Relevant" are strategies that research has proven to be effective in teaching mathematics:

- Collaborative learning provides students with the opportunity to see different ways of solving problems. While in collaborative settings students are able to develop their cognitive and communications skills since they are forced to analyze, synthesize, speculate and evaluate conflicting points of view (Bayer, 1900, p. 12).

- Communication, such as written and oral explanations, provide a platform where students are asked to explain procedures and problem solving strategies which helps them understand the content more deeply and with greater clarity.

- Authentic context which is based on students' experiences and prior knowledge increase their motivation to learn and provides the opportunity to make "x" relevant to out-of-school setting and real-world problems.

Collaborative Learning Settings and Procedures

SETTINGS DESIGN

Pairs:

Divide the students into two groups according to their English level. Students should not be aware that they are being grouped by English language ability. This can be done by using the CELDT test scores. For example, pairs should be made by placing one ELL 1-2 with one ELL 3-4. Be sure to have pairs with the same spoken language to facilitate peer interaction.

Exploration Groups:

If the class is made up or more than one native language, try to make exploration groups from four to six members of different native languages. This will provide students with the opportunity to practice academic language being covered in the content.

PROCEDURES

Pair Discussions:

Pair Discussions: Tasks are given throughout the unit. While in pairs, students are expected to discuss and create a final product to be shared with the whole class. Each student is responsible for his/her own written work, as well as be prepared for an oral explanation and presentation on the pairs' findings and chosen procedures.

Exploration Groups:

While in exploration groups, each student is expected to be respectful of other's ideas and points of view. It is also expected that each student will be an active participant. Exploration groups will be required to come to an agreement on procedures and techniques used to accomplish a given task and/or project. It is also understood that each member must be accountable for his/her own written and oral explanations.

Final Project Individual or Pairs:

Students are expected to build their final project individually or in pairs. If in pairs, students are provided with the choice of selecting their partner but each student is expected to do their own written report and both must speak equally during the final oral report. Each student should also be able to answer questions about the project posed by any member of the class, including the instructor.

Final Individual Oral Explanation Exam

Each student will meet with the instructor and be expected to verbally explain the procedure and reasoning to a problem chosen by the instructor; this is part of their final exam.

Tentative Schedule of Activities.

Lesson	Topic	Activities
1-2	Getting-to-know you Introduction to collaborative learning teams.	Students interview and introduce partners. Students work in groups to accomplish the mathematical puzzles.
3	Perimeter Vocabulary	Students are introduced to Perimeter and SLIC strategies for vocabulary- guided instruction.
4-5	Oral presentations	Students are expected to present their procedures and reasoning on a given task.
6	Area of common geometric shapes	Students are introduced to classification and procedures to find the area of common geometric shapes: square, rectangle.
7	Area of a triangle	Students are asked to explore the area of a triangle.
8	Area of a parallelogram	Students are asked to explore the procedure to find the area of a parallelogram. Practice time is allocated.
9	Area of a trapezoid.	Students are asked to explore the formula to find the area of a trapezoid.
10	Area of a Rhombus	Students are asked to explore the procedure to find the area of a rhombus.
11	Review of area	Students are provided time to review area of common shapes.
12-13	Area of uncommon shapes	Students are introduced to finding the area of any shape by using dissection.
14	Area of equilateral and equiangular shapes.	Students are challenged to find the area of such shapes such as pentagons, hexagons, etc.
15	Surface area and Lateral area	Students are introduced to the concepts of Surface area and Lateral area.
16-17	Nets	Students are introduced to 2-D drawings of 3-D objects.
18	House Surface area	Students are challenged to find the surface area of their room and eventually their entire house
19 -20	Oral presentations of their house	Students are expected to present their final project, the house.
21	Area unit content exam	Students are given the unit content exam to cover math standard 8.
22	Individual oral exam	Students are individually asked to explain the process to solve an area problem.
23	Post Implementation surveys	Students are given surveys used to measure self-efficacy.

Sample Unit

Introducing the Concept

What follows are some guidelines for the flow and sequence of a course that uses “Making X Relevant” activities. The rationale for the sequence of the chosen activities is scaffold to build vocabulary, oral and written explanation skills, content knowledge, in order to attain the level of understanding that is desired.

The content was based on the Geometry: Concepts and Skills textbook with additional resources such as Discovering Geometry textbook exercises, student workbook handouts, student interests and student out-of-school experiences. Each lesson starts with a warm-up which is based on students’ previous knowledge and previously covered content. Student volunteers are asked to share their explanations on the board and, when needed, the teacher models step-by-step explanations and clears any misunderstandings.

Follow the lesson plan model provided by the San Diego math administrators in 2001 (see lesson template below) which includes a warm-up, an introduction, exploration time and summary section. The last problem of the warm-up is used as a bridge to introduce the topic of each day, which is followed by a hands-on project culminating with practice time or class sharing of group and pair reasoning and explanations. Homework assignments are mainly based on out-of-school setting objects and concepts to provide students the “x” factor and relevance to out-of-school settings.

The sequence of the lessons scaffolds the content to produce a final project which is to build a 3-D model of their house. Along with the model, students are expected to produce a written and oral explanation report of their procedure which demands the inclusion of academic vocabulary and area concepts covered in the lesson.

It is also crucial that the instructor starts by making the classroom safe for learning so that students feel comfortable and willing to share their interests and past experiences which are crucial for the success and effectiveness of “Making X Relevant.”

Math and me
Student Interest Survey

Name/Nombre____________________________

Please answer the questions completely and honestly. This information will be used to help me with my teaching this semester.

Favor de contestar las preguntas completa y francamente. Esta información será usada para ayudarme con mi enseñanza este semestre.

1. What is your favorite way to spend your time?
   ¿Cómo te gusta pasar tu tiempo libre?

2. What is something you are really good at?
   ¿Qué es algo que sabes hacer muy bien?

   Why are you really good at this?
   ¿Qué características te hacen sobresalir en esto?

3. What are your feelings about school?
   ¿Cuáles son tus pensamientos y sentimientos sobre la escuela?

   Why do you feel this way?
   ¿Qué es lo que te hace tener estos sentimientos?

4. What is your favorite subject in school?
   ¿Cuál es tu materia favorita en la escuela?

   What do you like about it?
   ¿Por que te gusta esta materia?

5. What type of math do you like to do?
   ¿Qué tipo de matemáticas te gusta hacer?

6. How might I help you this term with your math in class?
   ¿Cómo podría yo ayudarte este semestre con tus matemáticas en la clase?

7. What can a teacher do to help your learning?
   ¿Qué puede hacer un profesor para ayudarte en tu aprendizaje?

8. What is one characteristic that makes you unique?
   ¿Cuál es una característica que te hace única?

9. What do your parent/guardians do?
   ¿ Que profesion tienen tus padres o guardíanes?

10. How do you feel about math?
    ¿Cuáles son tus sentimientos acerca de las matemáticas?

    Why do you feel this way?
    ¿Qué te hace sentir de esta manera?

IS MATH IMPORTANT IN OUR LIVES?
¿Son Las Matemáticas Imporantes en Nuestras Vidas?

Please circle the number that best describes the way you feel being as honest as you can.
Favor de circular el número que mejor describe tu sentimientos. favor de ser honesto/a.

1 = strongly disagree / ***Absolutamente No estoy nada de acuerdo***
2 = somewhat disagree / ***No estoy muy de acuerdo***
3 = disagree / ***No estoy de acuerdo***
4 = somewhat agree / ***Estoy un poco de acuerdo***
5 = strongly agree / ***Estoy absolutamente de acuerdo.***

1. I am motivated to do math problems on my own. *Tengo motivación para hacer problemas de matemáticas.*	**1**	**2**	**3**	**4**	**5**
2. When a math problem is difficult, I do not. get discouraged *Cuando un problema de matemáticas es difícil, no me doy por vencido/a.*	**1**	**2**	**3**	**4**	**5**
3. I look forward to coming to math class. *Me gusta venir a la clase de matemáticas.*	**1**	**2**	**3**	**4**	**5**
4. I always attempt to solve a problem myself before I ask anyone else. *Siempre intento solucionar un problema yo mismo/a antes de preguntarle a alguien más.*	**1**	**2**	**3**	**4**	**5**
5. I complete my math homework assignments. *Completo mis tareas de matemáticas.*	**1**	**2**	**3**	**4**	**5**
6. If a problem is difficult, I ask for help instead of avoiding the problem. *Si un problema es difícil, pido ayuda en vez de olvidarme del problema.*	**1**	**2**	**3**	**4**	**5**
7. I feel confident in my math problem solving skills *Me siento confidente en mis habilidades de resolver problemas de matemáticas*	**1**	**2**	**3**	**4**	**5**

8. I feel competent enough to help others solve math problems. *Me siento bastante competente para ayudar a otros a solucionar problemas de matemáticas.*	**1**	**2**	**3**	**4**	**5**
9. My performance on tests does not always represent my actual knowledge. *Las calificaciones en mis examenes no siempre representa mi conocimiento.*	**1**	**2**	**3**	**4**	**5**
10. I believe that some students are mathematically Gifted and some are not. *Creo que algunos estudíantes son buenos en las matemáticas y otros no.* .	**1**	**2**	**3**	**4**	**5**
11. I believe I am capable of learning math. *Creo que soy capaz de aprender matemáticas.*	**1**	**2**	**3**	**4**	**5**
12. I understand the importance of math outside. the classroom *Comprendo la importancia de matemáticas fuera del aula*	**1**	**2**	**3**	**4**	**5**
13. I believe math will be important in my future. *Creo que las matemáticas serán importantes en mi futuro.*	**1**	**2**	**3**	**4**	**5**
14. I enjoy solving math problems. *Disfruto encontrar soluciones a los problemas de matemáticas.*	**1**	**2**	**3**	**4**	**5**
15. If I had the choice, I would stop taking math classes. *Si yo tuviera la opción, yo dejaría de tomar clases de matemáticas.*	**1**	**2**	**3**	**4**	**5**

GETTING TO KNOW YOU

"Getting to know you" is an activity that offers students the opportunity to get used to pair interaction. The main goal of this activity is for everyone in the class to get to know their peers as well as to have the opportunity to be an active participant and learner.

Additionally, this activity provides the platform for a care free learning environment that emphasizes each individual's uniqueness developing a classroom climate of respect.

The fields of information chosen for this activity were based upon the information obtained from students to make "Making X Relevant" more effective. These fields can be changed to meet your goals or acquire desired information.

Activity:
Each student is assign the letter A or B.
Student A gets two minutes to talk about him/herself to the student B
Student B listens
Student B has 30 seconds to say "I heard you say that….."
Student A has 30 seconds to correct or agree with student B.
Students switch roles.

This activity is implemented at the beginning of the unit and culminates with students presenting their partner and at least three fields of information without reading the paper.

After each member of the class has gotten the chance to be presented and present, a class discussion/debriefing on the goals of the activity: Listen, respect each other, and be an active participant at all times.

GETTING TO KNOW YOU

1. Take 5-7 minutes to complete the sentences.
2. Share with partner and whole class.

SOMETHING I REMEMBER FROM MY PAST IS……	**MY NAME IS..**	**SOMETHING I AM PROUD OF IS…**
AFTER SCHOOL I LIKE TO…	**ONE THING I ALWAYS WANTED TO DO IN MATH CLASS IS……**	**IN 5 OR 10 YEARS I SEE MYSELF AS…..**

COLLABORATIVE LEARNING

Who's got the right picture?

GOAL: Have students work together to come up with the final picture of the project.
Triangle project is easier to complete.
Teacher must choose accordingly.

DIRECTIONS:

Cut each clue separately (see clues on pp. 144, 145)
Put clues in an envelope
Hand clues to groups of 4 to six members
Have popsicle sticks available for students, at least 40 per team.
Have students complete the task.

Try to circulate while they are working to complete the task

Instructor role: Facilitator
Ask open-ended questions to facilitate team effort.
Assign adequate time.

At the end: Instructor debrief on student work guidelines

COLLABORATIVE LEARNING
TRIANGLES FIGURE CLUES

This figure is made up of **two** figures sharing a side.

The bottom of the big figure is made up of a total of
(-3 + 1) + 4 (3 + 5) - 4 (5) sticks

The number of sticks needed to make the smaller figure is **12**

To create this figure you must obtain a total of
$10 + 5 – 3(3 - 1) + 2(3 + 2) + 3^2 +2$ sticks.

The number of sticks around the big picture is 30 sticks.

The shared side of the two figures and the bottom side make a right angle.

Explain the process you followed to complete this activity.

COLLABORATIVE LEARNING
OCTAGON FIGURE CLUES

This figure is made up of an **octagon** in the center.

There are 4 figures attached do the **North, South, East** and **West**.

The **number of sticks** of one of the 4 attached figures **is 4**.

To create this figure you must obtain a total of
(10 + 6) – 3(3+1) + 2(4 + 2) sticks.

The number of sticks around the completed figure is 32 **divided** by 2.

To get the points for the team exercise, you must answer the following question.

Explain the process you followed
to complete this activity.

Lesson Plan Template

(For a filled example see page 148)

Date: _________ Topic:

____

WARM-UP:	**FOCUS:**	**OUTCOME:**
(Based on previously covered content) (5-7 minutes)	*(Topic of the day)* **STANDARDS**: *No.*	***(GOAL)***

LAUNCH:

(Connect to previous knowledge, Introduce vocabulary)
(7-10 Minutes)

EXPLORE:

(Pose open-ended questions,
Collaborative learning tasks,
and use hands-on activities)
(15-25 minutes)

SUMMARY:

(Use students input and compare to formal definition)
(5-10 Minutes)

OUT OF SCHOOL ASSIGNMENT:

(Based on student interests)

Lesson Plan Template

Date:_________ Topic:___________________________

WARM-UP:	FOCUS: STANDARDS: .	OUTCOME:

LAUNCH:

EXPLORE:

SUMMARY:

OUT OF SCHOOL ASSIGNMENT:

Lesson Plan Template
FILLED EXAMPLE

Date:_________ Topic: ______*Perimeter*__________

WARM-UP:	FOCUS:	OUTCOME:
1. Explain how you got to school. 2. Simplify: (2-3)(5+2)-2 3. What do you remember about perimeter	Perimeter **STANDARDS**: 8Th:	Students will be able to explain the concept of perimeter.

LAUNCH: ***(Connect to previous knowledge, Introduce vocabulary)***
***** Use student answers to problem 3 in the warm-up.
* What would happen if you have two figures together?
* Coming to school, how would you use the concept of perimeter?

EXPLORE: ***(Pose open-ended questions, collaborative learning tasks, and use hands-on activities)***
* How would you describe the concept of perimeter to a first grader?
* Hands-on activity on Perimeter.

SUMMARY: ***(Use students input and compare to formal definition)***
* Use class discussion to come up with their own concept of perimeter
* Refer to the textbook and compare class's definition.
Textbook definition: *Perimeter is the distance around a figure.*

OUT OF SCHOOL ASSIGNMENT: (*Use student interests)*
- Find the perimeter of you room.
- Find the perimeter of …

PERIMETER
PERIMETRO

ACTIVITY/ACTIVIDAD

Key Vocabulary/Vocabulario: Square, Rectangle, Triangle, Perimeter.

Directions: 1. Complete in your teams/Completar el ejercicio en equipos.
2. Share findings in whole class discussion/Compartir con toda la clase.

Materials/Materiales:

- 6"x 6" Square, 6"x 12" Rectangle, 6"x 6" Triangle
  6"x 6" Cuadrado, 6" x 12" Rectángulo, 6"x 6" Triángulo
- A roll of color lace or string / Un rollo de liston o cordón
- Ruler / Regla

GOAL/**META:**

Find the length of lace to go around each figure
Encontrar cuánto listón se necesita para cubrir las orillas de cada figura

1) Use the lace to go around each figure and measure it.
   ¿Cuánto listón se necesita para cubrir las orillas de cada figura?

   Square / Cuadrado =
   Rectangle/Rectángulo =
   Triangle/Triangula =

2) How would you calculate the length of Lace needed to go around a square if you knew one side? Explain your reasoning.
   ¿Cómo encotrarías la canticad de listón necesaria para cubrir las orillas de un cuadro si supieras la medida de un lado? Explica tu razonamiento.

3) How would you find the amount of lace needed to go around a right triangle if you knew two sides? Explain your reasoning. *¿Cómo encotrarías la cantidad de listón que es necesaria para cubrir las orillas de un triángulo recto si sabes la medida de dos lados? Explica tu razonamiento.*

Visual Vocabulary Template

Vocabulary is introduced at the beginning of each concept. This template is used and placed on the word wall every time a key word is introduced in the lesson. Students include the words in their daily journal.

PERIMETER

IMPORTANT IMPORTANTE	TEXTBOOK DEFINITION DEFINICION DEL LIBRO	IN YOUR OWN WORDS EN TUS PALABRAS	EXAMPLE EJEMPLO

DESIGN A TILE
DISEÑA UN MOSAICO

ACTIVITY/ACTIVIDAD

Key Vocabulary/*Vocabulario*: Concave, convex, equilateral, equiangular, regular.

Directions: 1. Complete in your teams/Completar el ejercicio en equipos.
2. Share findings in whole class discussion/Compartir con toda la clase.

Materials/*Materiale*s:

- 12” x 12” Square /12” x !2”*Cuadrado*
- Color construction paper /*Cartulina*
- Scissors / *Tijeras*
- Glue / *Pegamento*

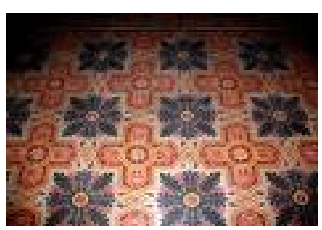
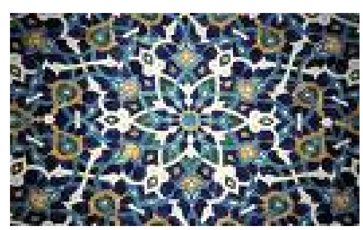
GOAL/**META:**

Design a tile you would use to cover the floor of you room.
Diseña un mosaico que podrías utilizar para cubrir el piso de tu recámara.

One day you decide that you are tired of looking at the same room every day. You decide to remodel your room and must also redo your floor. Use the provided items to design a tile that you are going to use on your floor. Explain why you chose your design.

Un día decides que estás cansado/a de despertarte y mirar el mismo cuarto cada día. Despúes de pensarlo decides remodelar tu cuarto y cubrir el piso con un diseño usando mosaico. Usa los materiales provistos por el maestro y diseña un mosaico que usarías en tu cuarto. Explica la razon por la cual decidiste usar ese diseño.

Examples:

WARM-UP (7 minutes)

NAME:________________________________DATE:____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. Draw a polygon that is **CONVEX** and a polygon that is **CONCAVE**. Explain what makes them convex or concave.
   Dibuja un polígono que sea considerado CONVEX y un polígono que sea considerado CONCAVE. Explica por queue as "convex" y "concave."

2. Define the following words:
   Favor de definir las siguientes palabras.

   EQUIANGULAR:

   EQUILATERAL:

3. What are the requirements to make a REGULAR polygon? Explain.
   ¿Qué requisitos necesitamos para formar un polígono REGULAR?
   Explica tu razonamiento.

REGULAR POLYGONS
POLYGONOS REGULARES

ACTIVITY/ACTIVIDAD

Key Vocabulary/*Vocabulario*: Concave, convex, equilateral, equiangular, regular, exterior angle.

Directions:
1. Find the similarities and differences of the polygons/Encuentra las similaridades y diferiencias de los polígonos
2. Complete in your teams/Completar el ejercicio en equipos.
3. Share findings in whole class discussion/Compartir con toda la clase.

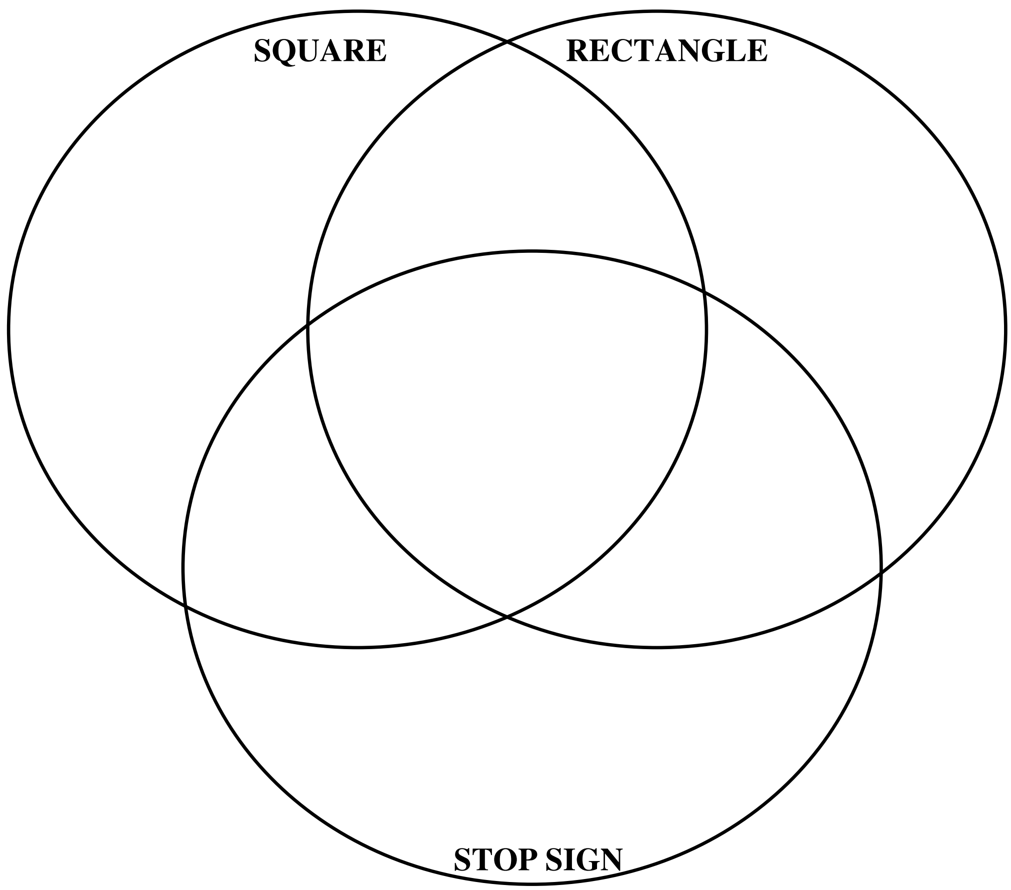
Materials/*Materiales*:

- Square, Rectangle, stop sign /*Cuadrado, Rectángulo, cartel de signo de pare*
- Protactor/*Protractor*

GOAL**/META: (5-7 minutes)**

Know and understand the similarities and differences between a regular square, rectangle and hexagon.

Saber y compender las similaridades y diferencias entre un cuadrado, rectángulo y hexágono regular



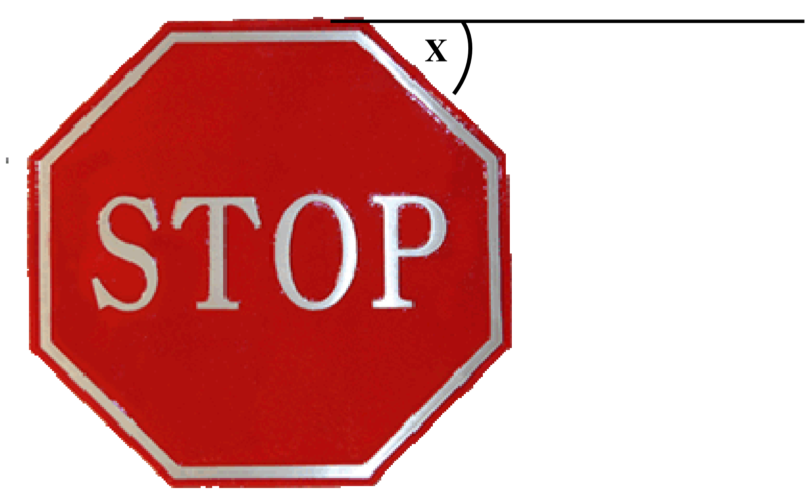
WARM-UP (7 minutes)

NAME:__________________________________DATE:_____________________

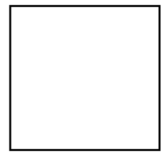
SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. Imagine you are in charge of building the stop sign in the shape of a regular Octagon. What would the measure of one interior angle be? Explain your reasoning!
   Imagina que estás encargado/a de fabricar el signo de pare en la figura de un octógono regular. ¿Cuál sería la medida de un ángulo interior? Favor de explicar.

2. Find the value of the angle x/*Encuentra el valor del ángulo x*:
   Explain your reasoning/ *Favor de explicar tu razonamiento*.



SQUARES
CUADRADOS



ACTIVITY/ACTIVIDAD

Key Vocabulary/Vocabulario: Square, Side, Area

Directions: 1. Complete in your teams/Completar el ejercicio en equipos.
2. Share findings in whole class discussion/Compartir con toda la clase.

Materials/Materiales:

- 6"x 6" Square /Cuadrado
- 1"x 1" Color paper squares/cuadros de cartulina
- Glue stick/Pegamento

GOAL**/META: (15-20 minutes)**

Find the number of paper squares needed to cover the provided bigger square.

1. How many squares did you use to cover the square?
   ¿Cuántos cuadros de papel fueron necesarios para cubrir el cuadrado?

2. Explain the process you used to find the number of tiles needed.
   Explica los pasos que empleaste para encontrar el número de mosaicos que usaste.

3. How would you calculate the number of tiles you need to cover the floor of your room?.
   ¿Cómo encotrarias el número de mosaicos que necesitas para cubrir el piso de tu cuarto.
   PLEASE EXPLAIN/*FAVOR DE EXPLICAR*.

RECTANGLES
RECTÁNGULOS

ACTIVITY/*ACTIVIDAD*

Key Vocabulary/Vocabulario: Rectangle, length, width.

Directions: 1. Complete in your teams/Completar el ejercicio en equipos.
2. Share findings in whole class discussion/Compartir con toda la clase.

Materials/*Materiales*:

- 6"x 12" Rectangle /*Rectangle*
- 1"x 1" Color paper squares/*cuadros de cartulina*
- Glue stick/*Pegamento*

GOAL/***META*: (15-20 minutes)**

Find the number of paper squares needed to cover the provided shape.
Encuentra el número de cuadros de papel necesarios para cubrir el rectángulo.

1. How many squares of paper did you use to cover the rectangle?
   ¿Cuántos cuadros de papel fueron necesarios para cubrir el rectángulo?

2. Explain the process you used to find the number of tiles needed.
   Explica los pasos que empleaste para encontrar el número de mosaicos que usaste.

3. How would you calculate the number of tiles you need to cover the floor.
   ¿Cómo encotrarías el número de mosaicos que necesitas para cubrir el piso de tu cuarto?
   PLEASE EXPLAIN/*FAVOR DE EXPLICAR*.

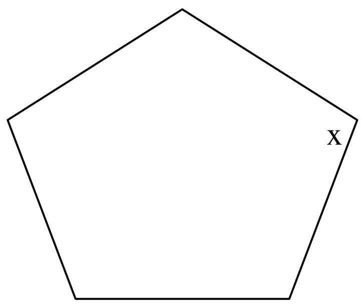
WARM-UP (7 minutes)

NAME:________________________________DATE:____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de Resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

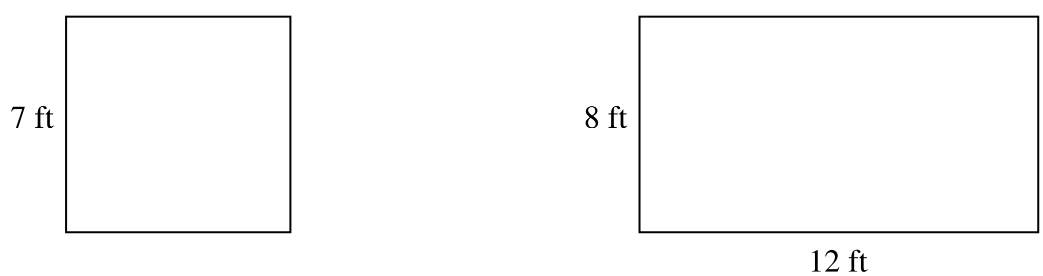
1. a). Name the polygon and explain your reasoning.
Nombra el polígono y explica tu decisión.

b). Find x if the polygon is regular. Explain what x represents.
Encuentra el valor de x si el polígono es regular. Explica lo que x representa.

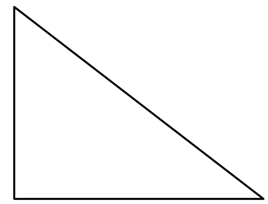


2. Explain in your own words the meaning of AREA.
Explica en tus propias palabras el significado de AREA.

3. Find the area of the following polygons. Explain your answer.
Encuentra el área. Explica tu respuesta.



TRIANGLES
TRIÁNGULO S



ACTIVITY/*ACTIVIDAD*

Key Vocabulary/Vocabulario: Triangle, Base, Height, Half.

Directions: 1. Complete in your teams/Completar el ejercicio en equipos.
2. Share findings in whole class discussion/Compartir con toda la clase.

Materials/Materiales:

- 6"x 6" Triangle /*Triángulo*
- 1" x 1" Color paper squares/*cuadros de cartulina*
- Glue stick/*Pegamento*

GOAL/***META*: (15-20 minutes)**

Find the number of paper squares needed to cover the provided shape.
Encuentrar el número de cuadros de papel necesarios para cubrir el triángulo.

1. Using what you know about the area of squares and rectangles. How would you find the area of a triangle?
   Usando lo que aprendiste sobre cuadrados y rectángulos, ¿cómo encontrarias el área de un triángulo?

2. Use the paper squares and find the area to prove your statement.
   Utiliza los cuadros de papel de cartulina para comprobar tu proceso.

WARM-UP (7 minutes)

NAME:________________________________DATE:____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de Resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. Draw a polygon that is convex and regular. Explain your reasoning.
   Dibuja un polígono que sea clasificado cóncavo(concave) y regular. Explica tu razonamiento

.

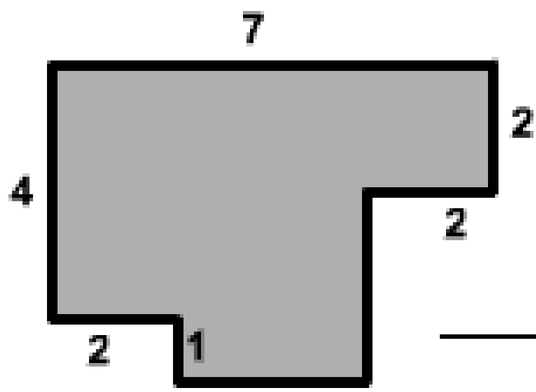
2. Find the area of a square whose side is 8ft. and a rectangle whose length is 6 ft. and width is 13 ft. Explain your reasoning.
   Encuentra el área de un cuadrado con lado de 8ft y un rectángulo con longitud de 6 ft. y anchura de 13 ft. Explica tu razonamiento.

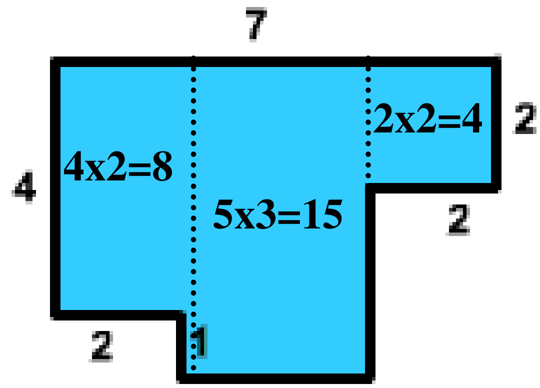
.

3. How would you find the area of a triangle? Explain.
   ¿Cómo encontramos el área de un triángulo? Explica.

Find the AREA cutting the figures into common shapes -dissections (20-25 minutes).
Encuentra el AREA de las figuras usando disecciones.

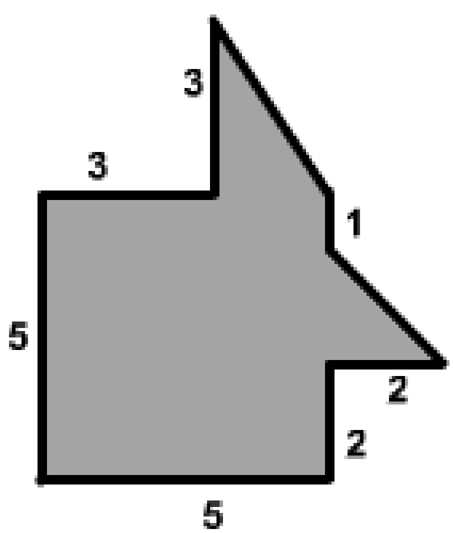
1. Example





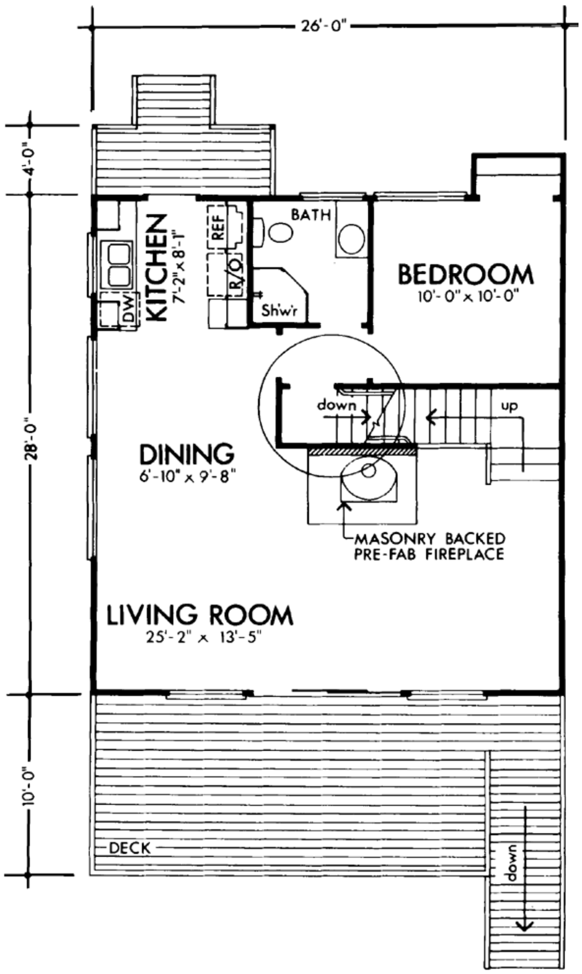
Total area is: 8 + 15 + 4 = 27 square units

2.

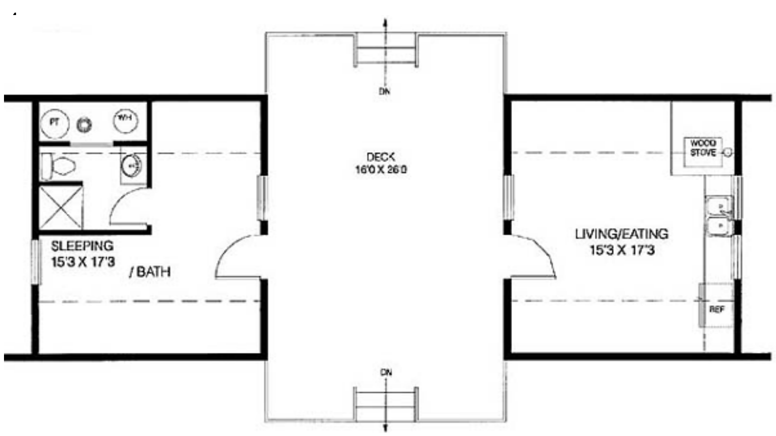


Dissections can also be done on real-world projects such as house blue prints.

3.



4.



SUMMARY
On Area of Squares and Rectangles.

Directions: 1. Complete on your own
2. Share with your group
3. Share in whole class discussion

In finding the ___________ of a :

Square we multiply the __________ by __________

thus ______________ = ___________

Rectangle, we multiply the ____________ by the ______________

Thus ____________ = _______ x__________

And in a Triangle we multiply the __________ by ___________ and _________

by ____Thus ____________ = ____________.

Area represents ____________________________________

Also a polygon classified as _____________ is_____________ and _________________

The sum of the ________________ of a polygon is found by________________

And a single angle is found by ____________________ since all the _______________

are _______________. An exterior angle in a regular polygon is found by____________

since all the exterior angles add up to ___________ all the angles are________________.

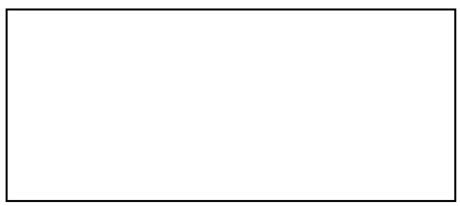
Area	Side	Length	Width
Equiangular	Equilateral	Regular	Interior
Exterior	Formula	Congruent	
Squares needed to cover the figure.			

WARM-UP (7 minutes)

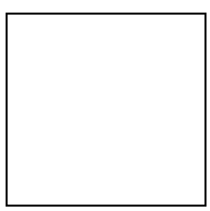
NAME:________________________________DATE:____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

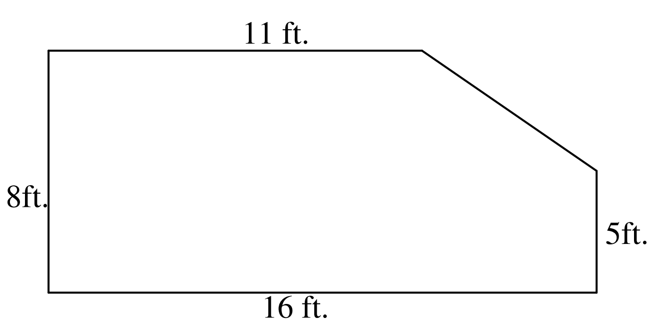
1. If the area of my rectangular room is 55 square feet and the width is 5ft. What is the length? **Explain your procedure.**
   Si el área de mi recámara rectangular es 55 pies cuadrados y la medida de la anchura es 5 pies, ¿Cúal es la medida de la longitud? ***Explica tu procedimiento***.



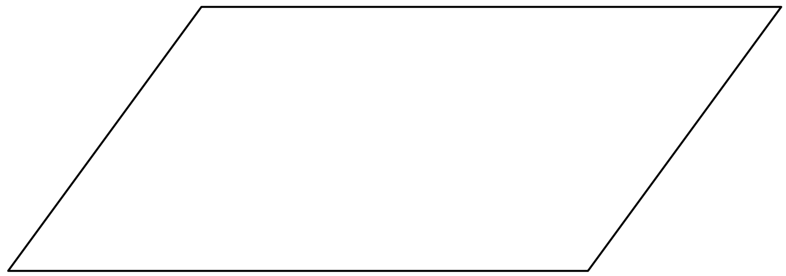
2. Find the area of a square if it took 16 squares of paper to cover the perimeter. **Explain your procedure.**
   Encuentra el área del cuadrado si tomo 16 cuadros de papel para cubrir el perimetro. ***Explica tu procedimiento.***



3. Find the area of the figure. **Explain your procedure.**
   Encuentra el área de la figura. ***Explica tu procedimiento***.



PARALLELOGRAM
PARALELOGRAMO



ACTIVITY/*ACTIVIDAD*

Key Vocabulary/Vocabulario: Parallelogram, Triangle, Base, Height, Perpendicular.

Directions: 1. Complete in your teams/Completar el ejercicio en equipos.
2. Share findings in whole class discussion/Compartir con toda la clase.

GOAL/***META*****: (15-20 minutes)**

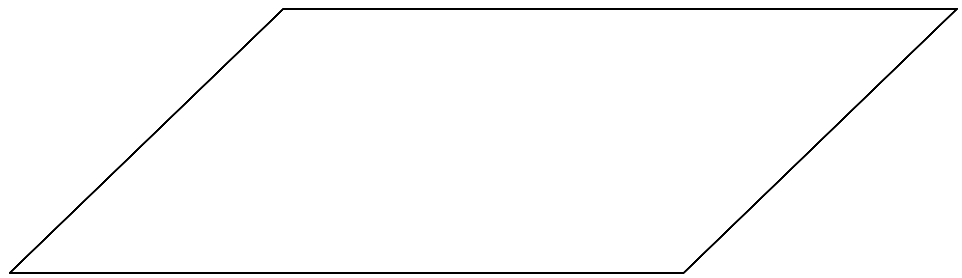
Find a procedure to find the AREA of the provided shape.
Encuentra un proceso para encontrar área de un paralelogramo.

1. Using the knowledge you have learned, how would you find the number of tiles needed to cover (area) the parallelogram?
Usando conocimientos que has aprendido, ¿Cómo encontrarias el número de cuadros necesarios para cubrir (área) el paralelogramo?

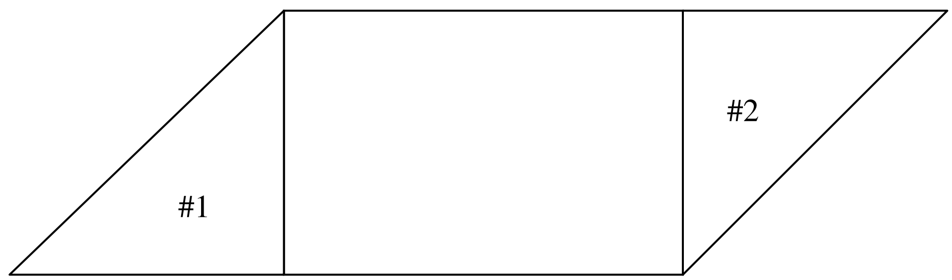
2. DEMONSTRATE your procedure to find the area of a parallelogram.
DEMUESTRA tu procedimiento para encontrar el área de un paralelogramo.

GUIDED PRACTICE: (Teacher Directions for guided discussion)

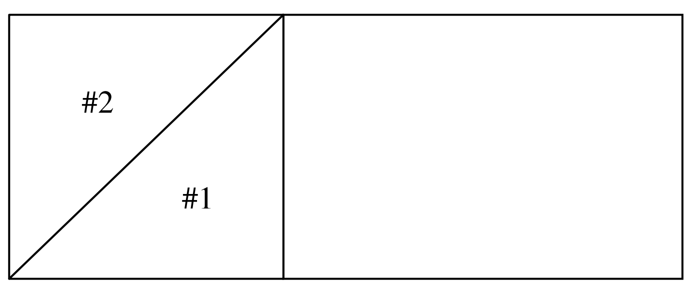
1. Provide students with time to try it on their own. Then provide guided instructions using the following unless they are successful in finding a way.



Dissect (cut) the parallelogram into a rectangle and two triangles.



Move the right triangle and put it on top of the left triangle.



Answer the following questions.

1. What shape have you made?

2. Going back to the previous lesson, how do you find the area of the new shape?

3. Summarize how to find the area of a parallelogram.

AREA OF A TRAPEZOID
AREA DE UN TRAPEZOIDE

ACTIVITY/*ACTIVIDAD*

Key Vocabulary/Vocabulario: Trapezoids, Base, Height, Perpendicular, Half.

Directions: 1. Complete in your teams/Completar el ejercicio en equipos.
2. Share findings in whole class discussion/Compartir con toda la clase.

Materials/Materiales:

- Two trapezoids handout (see page 168)/ *Hoja con dibujo de dos trapezoids(ver pagina 168)*
- Scissors/*Tijeras*
- Glue stick/*Pegamento*

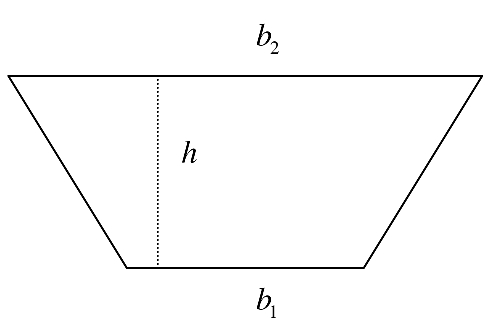
GOAL/***META*: (15-20 minutes)**

Understand why the area of a trapezoid is given by $Area = \frac{1}{2}(b_1 + b_2)h$ **.**

Entender la razón por la cual el área de un trapezoide se encuentra usando la fórmula $Area = \frac{1}{2}(b_1 + b_2)h$.

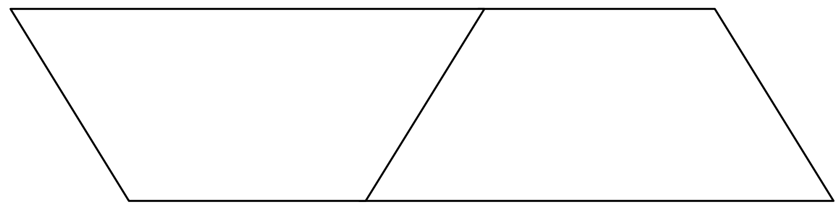
1. Cut the two trapezoids.
   Recorta los dos trapezoides

2. Label the two trapezoids with the following following information..
   Marcar los dos trapezoides con la siguiente información.



3. Put the two trapezoids together so that they share one of the slanted sides. Label the segments appropriately.

Junten los dos trapezoides para que tengan un lado en común y marca los segmentos segun la informacion de el paso número dos.



4. What type of figures do the two of them make?

¿Qué tipo de polígono hacen los dos trapezoides juntos?

5. How do we find the area of the polygon they make?

¿Cómo encontramos el área del polígono que los dos forman?

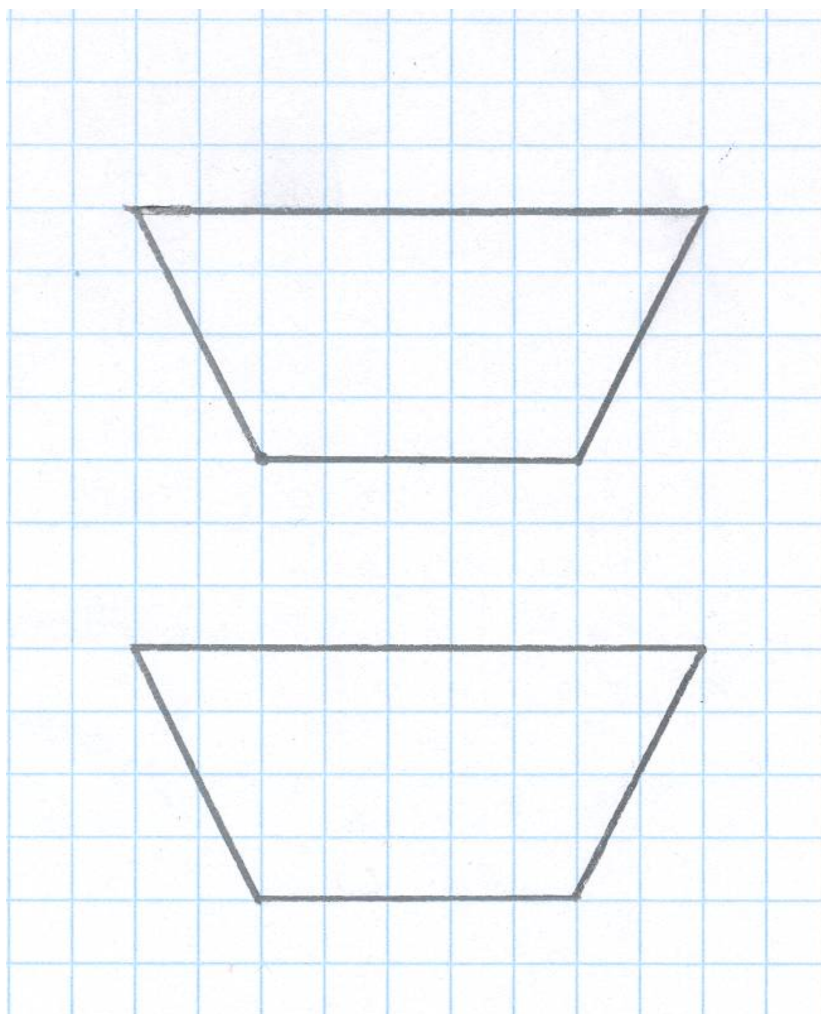
6. How would we find the area of one of the trapezoids instead of the two?

¿Cómo encontrariamos el área de uno y de dos trapezoides?

7. Summarize in your own words why the area of a trapezoid is found using $A = \frac{1}{2}(b_1 + b_2)h$?

Explica en tus propias palabras por qué el área de un trapesoide se encuentra usando la fórmula $A = \frac{1}{2}(b_1 + b_2)h$

TRAPEZOIDS
MANIPULATIVE
.



SUMMARY
On
Trapezoids.

Directions: 1. Complete on your own
2. Share with your group
3. Share in whole class discussion

In finding the ___________ of a Trapezoid we need ________ trapezoids to make a ________________. The formula to find the area of a parallelogram is _______.

The new __________ of the parallelogram made by the two trapezoids is ________ +________ because we have to add the ________ and _________ bases of the trapezoid.

Since the ____________ of the parallelogram has to be ___________ to the base, the height of the trapezoid ________ the same.

The area of the new parallelogram is __________________, but since we only need the area of ONE trapezoid, we must _________ by __________, Thus the formula for

The area of a Trapezoid is: $\frac{(b_1 + b_2)h}{2}$ or $\frac{1}{2}(b_1 + b_2)h$

Example:

Base	height	stays	b_1
$(b_1 + b_2)h$	Top	perpendicular	b_2
Area	two	$b \cdot h$	divide
parallelogram			

WARM-UP (7 minutes)

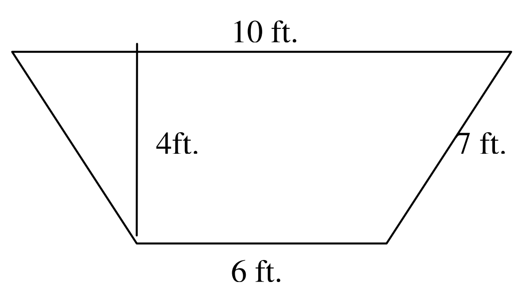
NAME:________________________________DATE:____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. Explain how to solve the area of a Triangle.
   Explica cómo encontrar el área de un Triángulo .

2. Create a problem where you are required to find the height of a parallelogram if you are given the total area.
   Crea un problema donde se solicite encontrar la altura de un paralelogramo si se da el área.

3. Find the area of the Trapezoid:
   Encuentra el área del Trapezoide.



WARM-UP (7 minutes)

NAME:________________________________DATE:____________________

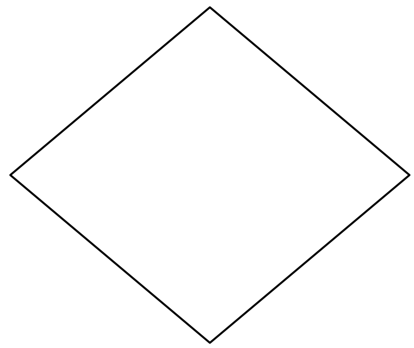
SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de Resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. You are in charge of making this stop sign to be placed in front of your house, How would you find the amount of area needed to make it? **Explain.**
Tu estás a cargo de hacer el signo de "pare" para colocarlo en frente de tu casa, ¿Cómo encontrarías la cantidad de metal necesario para fabricarlo? ***Explica tu procedimiento..***

2. Explain why the area of a Trapezoid is $\frac{1}{2}(b_1 + b_2)h$.

Explica por qué el area de un trapezoide se encuentra usando la fórmula: $\frac{1}{2}(b_1 + b_2)h$.

AREA OF A RHOMBUS
AREA DE UN ROMBO



ACTIVITY/*ACTIVIDAD*

Key Vocabulary/Vocabulario: Triangle, Base, Height, Half.

Directions: 1. Complete in your teams/Completar el ejercicio en equipos.
2. Share findings in whole class discussion/Compartir con toda la clase.

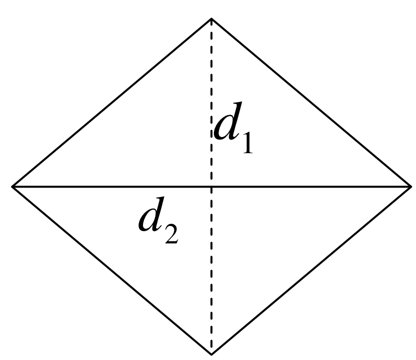
Materials/Materiales:

- Rhombus manipulative handout (see page 174)/ hoja con el rombo en *papel cuadrado(ver la pagina 174)*
- Scissors/*Tijeras*
- Glue stick/*Pegamento*

GOAL/***META*****: (10-15 minutes)**

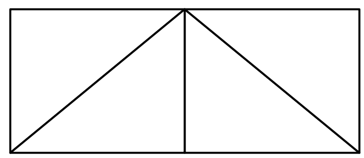
Find the formula for the area of a rhombus.
Encontrar la fórmula para el área de un rombo.

1. Label the díagonals as d_1 *and* d_2.
   Marca las díagonaels con d_1 *y* d_2



2. Cut the two bottom triangles..
   Corta los dos triángulo s de abajo.

3. Put the two trapezoids together so that they shares one of the slanted sides. Label the segments appropriately.
   Junten los dos trapezoides para que tengan un lado en común y marca los segmentos según la informacion del paso número dos.



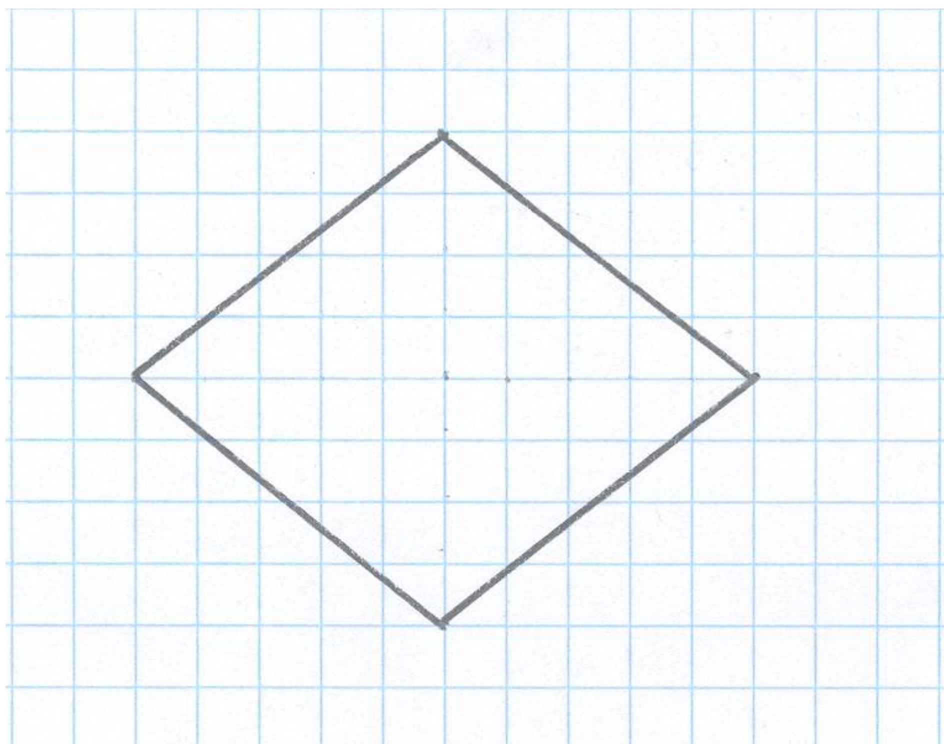
4. What type of figures do the four triangles make?
   ¿Qué tipo de polígono hacen los cuatros triángulo s?

5. How do we find the area of the polygon they make?
   ¿Cómo encontramos el área del polígono que los dos hacen?

6. Summarize in your own words how to find the area of a Rhombus.
   Explica en tus propias palabras cómo encontrar el área de un rombo.

.

RHOMBUS MANIPULATIVE.



SUMMARY
On
Rhombus.

Directions: 1. Complete on your own
2. Share with your group
3. Share in whole class discussion

In finding the ___________ of a Rhombus we need to ________ the

bottom ______________ and place them in the _______________

to make a ________________.

The formula to find the area of a rectangle is _______

The new __________ of the rectangle is made by ____________

And the height is _____________ of _________________

Thus the ___________ of a ___________ is: $\frac{d_1 \cdot d_2}{2}$ or ____________

Example:

---

base	height	divided	Top
$\frac{1}{2}(d_1 \cdot d_2)$	Area	Rectangle	Rhombus
Cut	triangles	d_1	$b \cdot h$
Half	d_2		

WARM-UP (7 minutes)

NAME:________________________________DATE:____________________

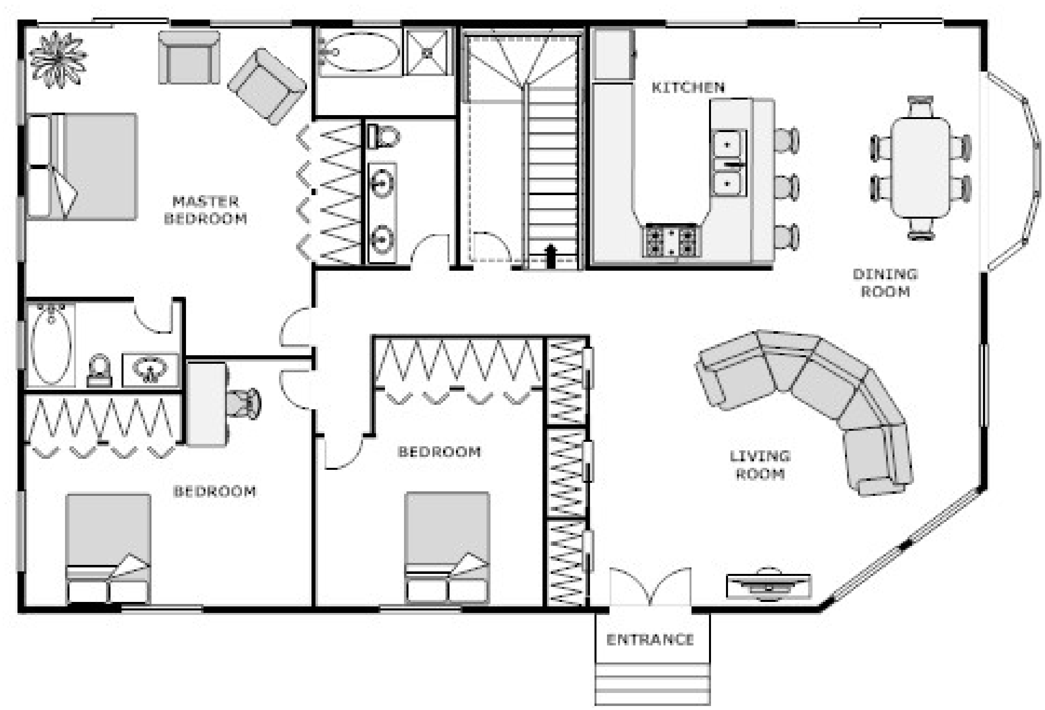
SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. Explain why the area of a parallelogram is $A = b \cdot h$
   Explica la razón por la cual el área de un paralelogramo es $A = b \cdot h$.

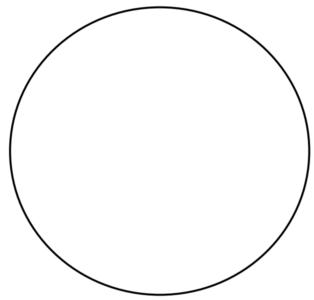
2. How would you find the area of the plan of your house? Explain.
   ¿Cómo encontrarías el área del plano de tu casa? ***Explica tu razonamiento.***

How do we find the AREA of a house?

Using the plan of the house below. Explain how you would find the AREA of the floor.
Usando el plano de la casa, explica lo que harías para encontrar el AREA del piso.



AREA OF A CIRCLE
AREA DE UN CIRCULO



ACTIVITY/*ACTIVIDAD*

Key Vocabulary/Vocabulario: Circle, circumference, radius, height, half.

Directions: 1. Complete in your teams/Completar el ejercicio en equipos.
2. Share findings in whole class discussion/Compartir con toda la clase.

Materials/Materiales:

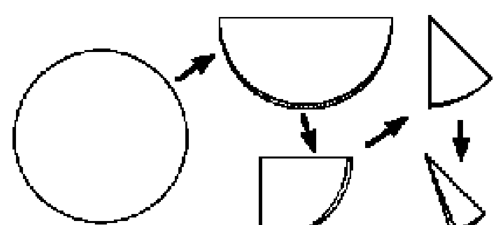
- Circle / *Circulo*
- Scissors/*Tijeras*
- Glue stick/*Pegamento*

GOAL/***META*: (15-20 minutes)**

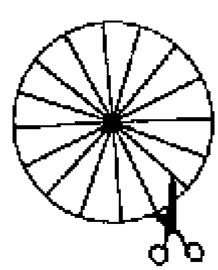
Find the area of a circle.
Encontrar la fórmula para el área de un círculo.

Remember : Circumference = $2\pi r$ *or* dr

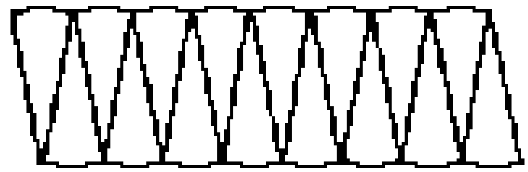
1.) Fold the circle 4 times.
Marca las díagonales



2.) Cut the slices.
Corta las 16 partes.



3). Put the slices together so that one is up and the other is down.
Junten las partes, una para arriba y otra para abajo.



4). What type of figures do the slices make?
¿Qué tipo de polígono forman las partes juntas?

5.) How do we find the area of the polygon they make?
¿Cómo encontramos el área del polígono que los dos forman?

6). Summarize in your own words how to find the area of a circle.
Explica en tus propias palabras cómo encontrar el área de un círculo.

SUMMARY
On
Area of Circles

Directions: 1. Complete on your own
2. Share with your group
3. Share in whole class discussion

In finding the ___________ of a

Circle we multiply the __________ by _________ and _________

thus ______________ = ___________

If we are given díameter, we find the radius by ____________

Thus ____________ = _______ divided by __________

If we are given the radius we find the díameter by __________ by ___________ a

Thus radius =_________ / _______

If we are given the Area of a Circle, we can find the radius by dividing by __________ and taking

And taking _________ of r.

Area represents: ____

Example:

Area	πr^2	dividing
Diameter	Radius	square root
π	two	multiplying
The number of squares to cover the figure		

WARM-UP (7 minutes)

NAME:________________________________DATE:____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. Michael Jackson's CD is 16 cm across. What is the amount of plastic needed to make 500 CDs? Explain your reasoning.
   El disco compacto de Michael Jackson mide 16 cm de díámetro. ¿Cuanto plástico es necesario para fabricar 500 discos? Explica tu razonamiento.

2. If I have 250 cm^2 of Plastic. How many CDs can I make if the radius has to be 10 cm? **Explain your prodecure.**
   *Si tenemos 250 cm de plastico. ¿cuántos CDs podemos fabricar si el radio tiene que medir 10 cm?**Explica tu procedimiento.***

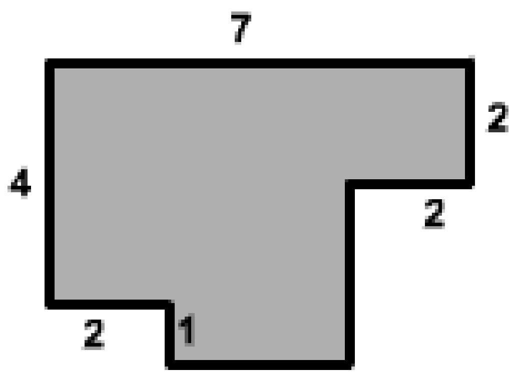
WARM-UP (7 minutes)

NAME:________________________________DATE:____________________

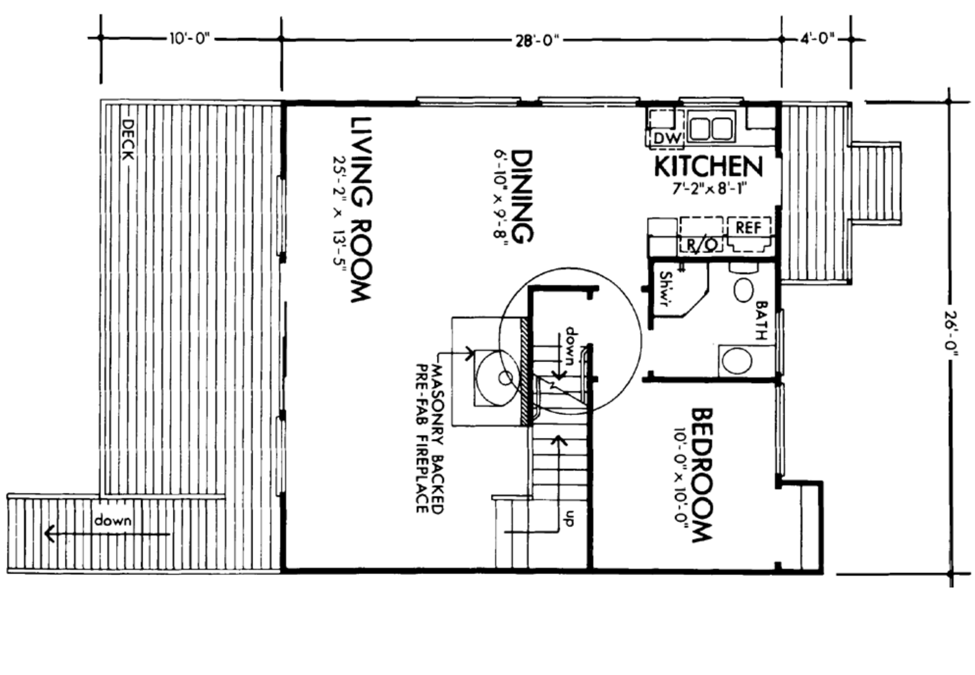
SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

Find the area of the following figures.
Encuentra el AREA de las figures.

1



2.

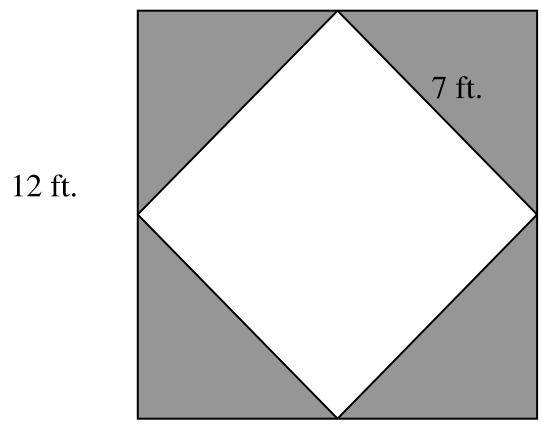


WARM-UP (7 minutes)

NAME:______________________________ DATE:_____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. Find the area of shaded region on the following figure. **Explain your process.**
   *Determina el área de la región gris**. Explica tu procedimiento**.*



2. How would you find the area of a regular octagon. (8 sides) with a side of 12 inches and height of 20 inches. Show your work.
   Explica cómo encontrarías el área de un octágono regular (8 lados) si cada lado mide12 pulgadas la altura es de 20 pulgadas. Muestra tu procedimiento.

WARM-UP (7 minutes)

NAME:______________________________ DATE:____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. You are in charge of building an office in California like the Pentagon in Washington D.C. with side measurement of 90 feet and apothem of 70 feet. Find the space needed to make this office. **Explain your procedure.**
   Tu estás a cargo de consrtuir una oficina o edificio en California, cómo el Pentágono de Washington en DC con medida de lado de 90 ft. y la medida del apotema de 70 ft.Encuentra el espacio necesario para construir la oficina. ***Explica tu procedimiento****.*

WARM-UP (7 minutes)

NAME:______________________________ DATE:____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

You are to open a store and one of the items you sell is the portable hexagonal shade canopy. You found out that it is cheaper to make them instead of buying them from a factory. Find out how much material you will need to make 100 canopies if the measure of one side is 5 ft and the apothem is 3.5 ft. Explain your reasoning.
Tu vas a abrir una tienda y uno de los artículos que quieres vender es la sombrilla hexagonal portátill. Te das cuenta que es más barato hacer las sombrillas que comprarlas de una fábrica. Averigua cuánto material se necesita para la fabricación de 100 sombrillas si la medida de un lado es 5 pies y el apotema es 3.5 pies. Explica tu razonamiento.

Portable Hexagonal Shade Canopy

WARM-UP (7 minutes)

REMODELING YOUR ROOM.

Name:__________________________________ Date:____________

Your job is to paint your room.
Tu meta is pintar tu habitación,

What colors are you going use to paint your room?
¿Qué colores usarás para pintar tu cuarto?

How would you find the amount of paint needed to paint the room? Explain your procedure.(You can use drawings)
¿Cómo encontrarias la cantidad de pintura necesaria para pintar tu habitación? Explica tu procedimiento.(Puedes usar dibujos)

WARM-UP (7 minutes)

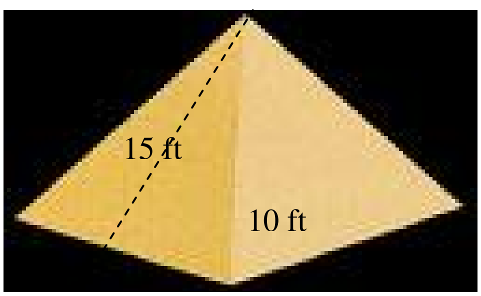
NAME:__________________________________ DATE:_____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. What monuments can we find in Egypt and in Mexico?
   ¿Qué monumentos podemos encontrar en Egipto y México?

2. What is the difference between Lateral Area and surface area? Explain.
   ¿Cuál es la diferencia entre área lateral y área superficial. Explica.

3. Draw the net. Explain.
   Dibuja la piramide en segunda dimension. Explica.



4. Find the Lateral Area. Explain your procedure.
   Encuentra el Área Lateral. Explica tu procedimiento.

5. Find the Surface Area. Explain your procedure.
   Encuentra el Área de la Superficie. Explica tu procedimiento.

WARM-UP (7 minutes)

NAME:_______________________________ DATE:____________________

SOLVE THE FOLLOWING PROBLEMS. **Always explain your procedure**.
Favor de resolver los siguientes problemas. ***Explica siempre tu procedimiento.***

1. Draw a net for the box of cookies. Explain your reasoning.
   Dibuja la superficie de la caja de galletas Explica tu razonamiento.

2. What is the total amount of paper needed to make the box? Explain.
   ¿Cuánto papel es necesario para hacer la caja? Explica tu razonamiento.

WARM-UP (7 minutes)

NAME:__________________________________ DATE:__________________

Please answer the following questions as honestly as possible.
Favor de contester las preguntas con honestidad.

1. What did you like about finding the area unit?
   ¿Qué fue lo que te gusto sobre la unidad de encontrar el área?

2. What was the least thing you liked about finding area?
   ¿Qué fue lo que menos te gusto de la unidad de encontrar el área?

3. If you were the teacher, what would you have changed in the finding area unit?
   Si tu fueras el maestro, ¿qué cambiárias en la unidad de encontrar el área?

4. What recommendations would you do to make the project better?
   ¿Qué recomendaciones darías para mejorar el proyecto de la unidad de área?

HOW TO FIND MISSING MEASURES
Always explain your reasoning or procedure!

Class Discussion (10-15 minutes)

Name:________________________________ Date____________________

The area of a square is 144 square feet. What is the measure of the sides of the square?
El área de un cuadrado es 144 pies cuadrados. ¿Cuánto miden los lados del cuadro?

A rectangular table needs a cloth of 132 square feet. If the width of the table cloth is 10 feet. Provide the length of the table cloth.
Una mesa rectangular necesita un mantel de 132 pies cuadrados. Si la anchura del mantel es de 10 pies. ¿Cuánto mide de largo el mantel?.

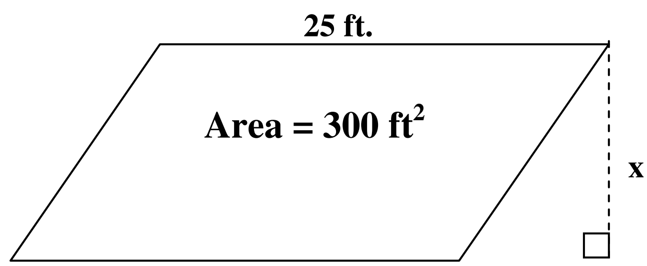
If the total amount of paper needed to cover your geometry book is 198 squares inches and the length is 18 inches, what is the measure of the width?
Si se requiere 198 pulgadas cuadradas para cubrir tu libro de geometria, y el libro mide 18 pulgadas de largo, ¿Cual is la medida de la anchura de tu libro?

HOW TO FIND MISSING MEASURES.
Always explain your reasoning or procedure!

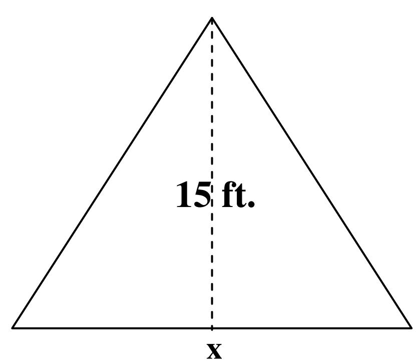
Class Discussion (10-15 minutes)

Name:________________________________ Date____________________

Find the missing measure.
Encuentra la medida que falta.



If the area of the triangle is 200 ft^2 . What is the measure of the base?
Si el área de un triángulo es 200 pies cuadrados, ¿Cuál es la medida de la base?

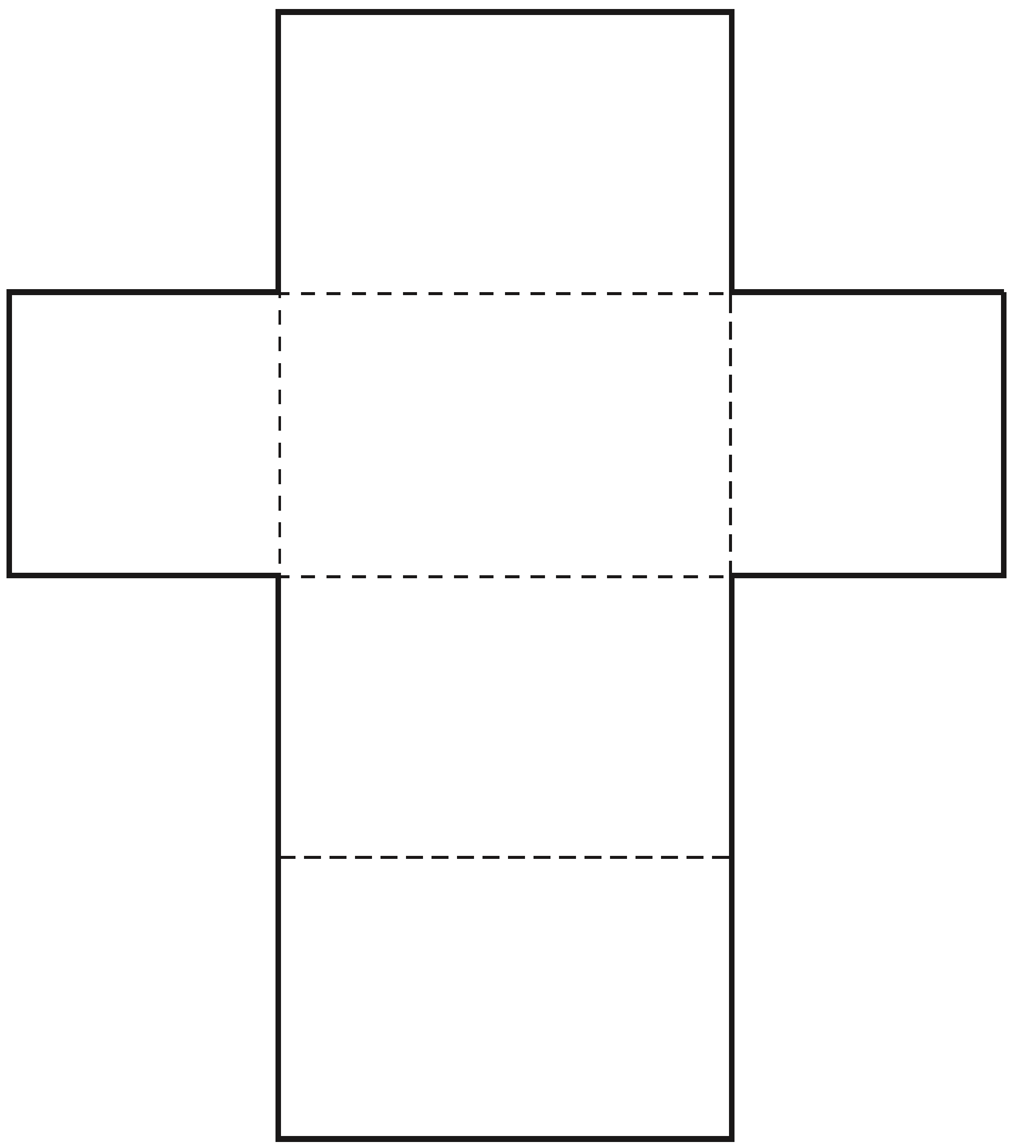


If the area of a trapezoid is **500 square feet** and the measure of **base 1 = 5 ft, base 2 = 15 ft**, How **tall (x)** is the trapezoid?.
*Si el area de un trapezoide es **500 pies cuadrados** y la **base 1 mide 5 pies**, y la **base 2 mide 15 pies**. ¿Cuál es la altura del trapezoide?*

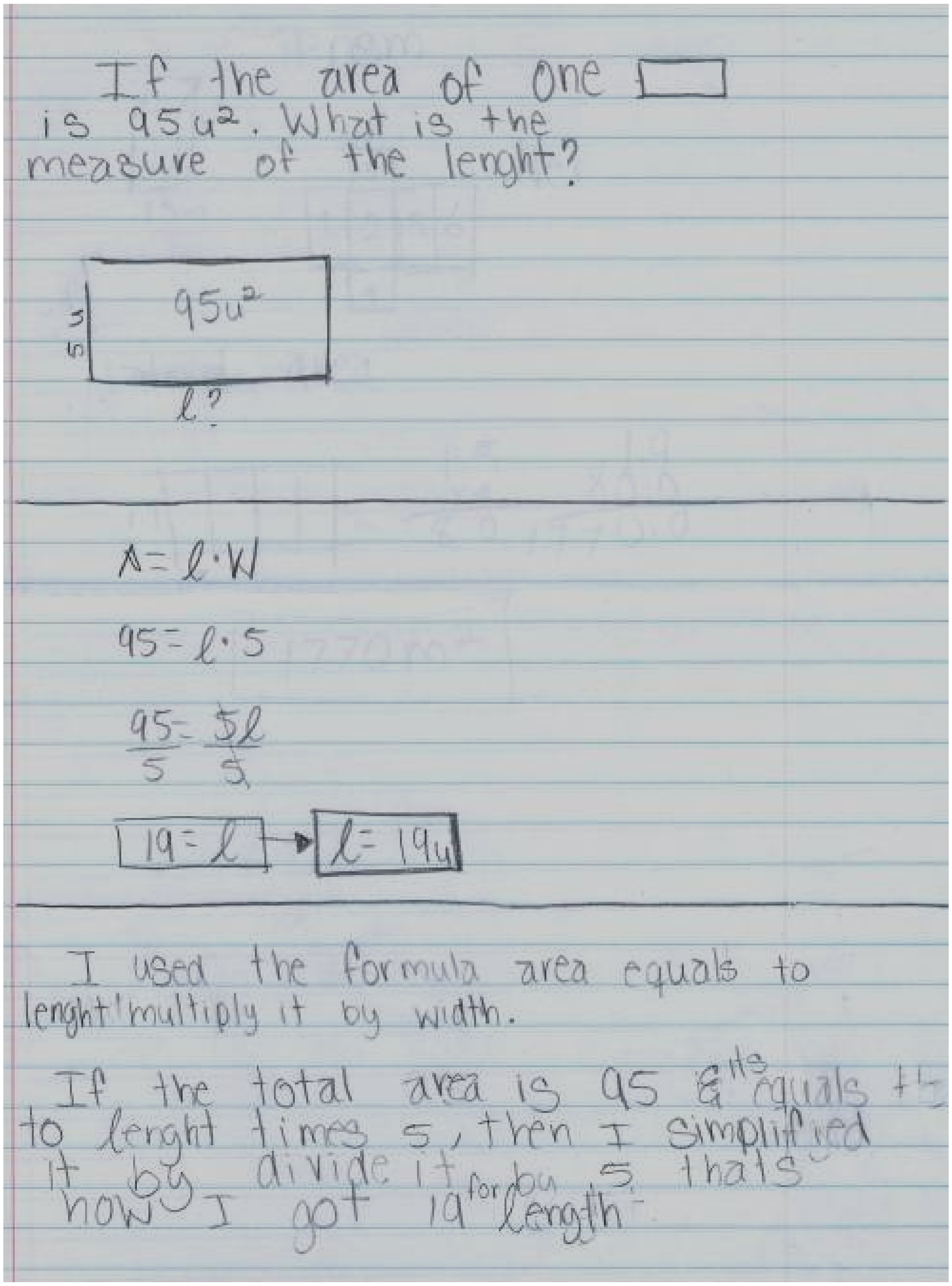
Names:____

Using your teacher's handout (net) find the amount of paint needed to paint your room.
Usando la pagina que tu maestro te entregara(net) encontra la cantidad de pintura necesaria para pintar tu habitación.

RECTANGULAR NET



Sample of problems created by students.



If the area of one ▭ is 95u². What is the measure of the lenght?

A = l · W

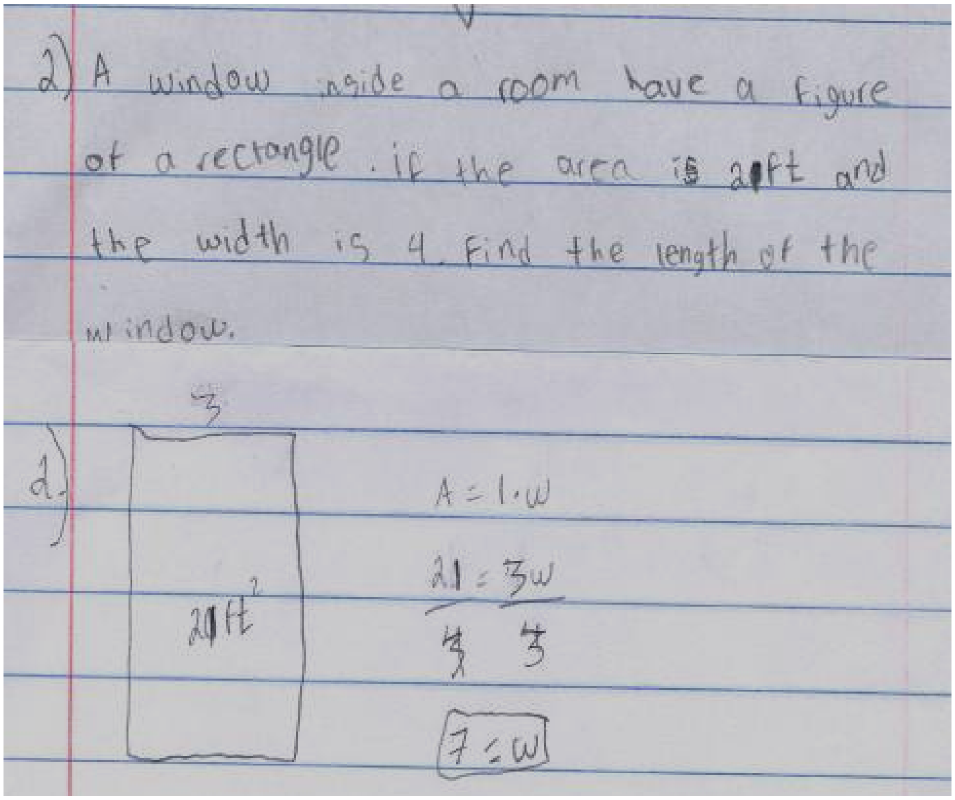
95 = l · 5

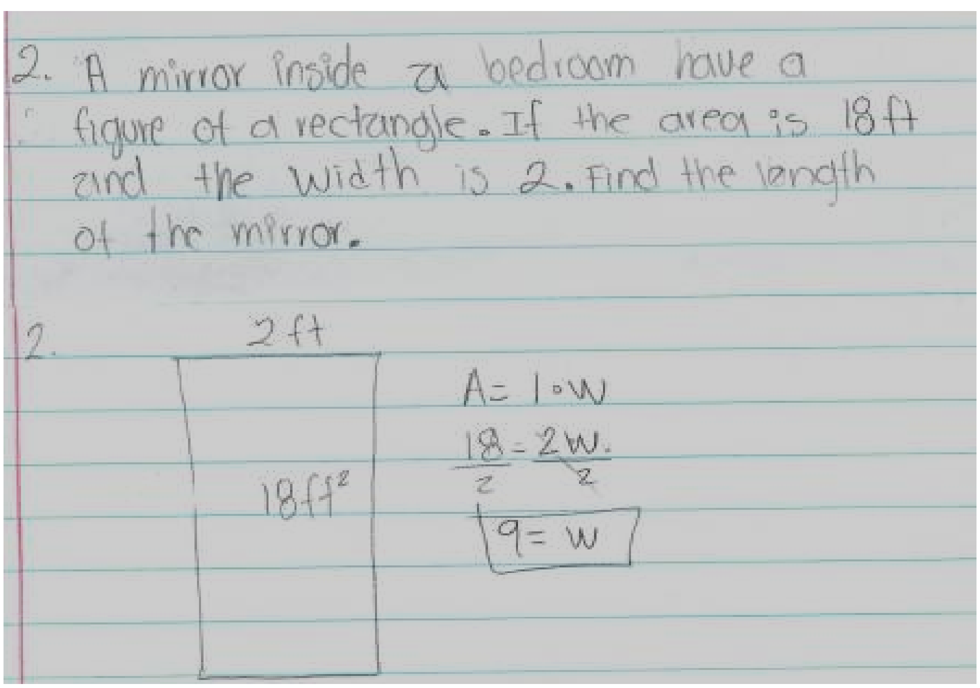
$\frac{95}{5} = \frac{5l}{5}$

19 = l → l = 19u

I used the formula area equals to lenght multiply it by width.

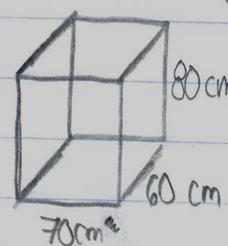
If the total area is 95 & its equals to lenght times 5, then I simplified it by divide it by 5 thats how I got 19 for length.


2) A window inside a room have a figure of a rectangle. if the area is 21ft and the width is 4. Find the length of the window.
2)
3
21ft²
A = l·w
21 = 3w
3 3
7 = w

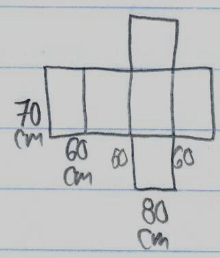

2. A mirror inside a bedroom have a figure of a rectangle. If the area is 18 ft and the width is 2. Find the length of the mirror.
2.
2 ft
18ft²
A= l·w
18 = 2w.
2 2
9= w

3. Ayer compre una television nueva y quiero saber cual es su lateral area y la surface area.

- ¿Cuál es su lateral area?
- ¿Cuál es la surface area?



3.



70 × 60 = 4200

4200 × 4 = 16800

lateral A = 16800 cm²

surface A = 26500 cm²

60 × 80 = 4800

4800 × 2 = 9600

16800 + 9600 = 26500

FINAL PROJECT

This project requires that you to practice your knowledge about area.
Este proyecto requiere que pongas a práctica tus conocimientos sobre área.

<u>Part 1:</u> Sketch/*Dibujo* – Due date/*Fecha*________________ (X Points)

- Sketch out the basic floor plan of your home.
  Dibujo un plano básico de tu casa

<u>Part 2:</u> Blueprint – Due_______________ (Y Points)

- Measure the dimensions of each room of your home.
  Mide las dimensiones de cada una de las habitaciones de tu hogar.

- On graph paper, carefully create a blueprint of your home that is similar to the actual size of your home. Be sure to include the scale factor, and label each wall length.
  En papel cuadriculado, cuidadosamente crea un plano de tu hogar que es similar al tamaño real de tu hogar. Asegúrate que incluyas la escala, y las dimensiones de cada pared.

- Carefully draw in the furnishings of at least one bedroom, one bathroom, your living room and the kitchen. Be as accurate as possible with the sizes of objects.
  Cuidadosamente, dibuja el mobiliario de un dormitorio, un baño, la sala y la cocina. Se lo más preciso posible con los tamaños de los objetos.

- Calculate the area of each room for your home.
  Calcula el área de cada recámara de tu hogar.

- Calculate the total area of you home.
  Calcula el área total de tu hogar.

* See example/*Ver el ejemplo*

** If your home has more than one floor, you may choose ONE to work with. In this case, please draw the furnishings of ALL rooms on that floor.
***Si tu hogar tiene más de un piso, tu puedes escoger sólamente un piso. En este caso, favor de dibujar la mueblería de todos los cuartos.*

<u>Part 3:</u> **Building your Home – Due______________ (Z Points)**
Construccion del hogar-Fecha

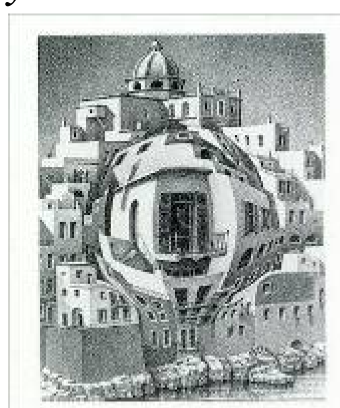
- Build a 3-dimensional scale model of your home. Make it quality! An example will be shown in class.
  Construye un modelo de tres dimensiones a escala de tu hogar. Asegurate que sea de calidad! Recueda el ejemplo mostrado en la clase.

Be Creative!! Extra points will be awarded for creativity and otherwise going above and beyond the directions provided here. You will be presenting your final product to the class on ______________.
¡Sé creativo! Extra puntos serán otorgados por creatividad. Tu vas a presentar tu proyecto final a la clase el día ______________.

Good Luck on your Project.

Buena suerte con tu proyecto.

Make your parents and teachers PROUD!!!
¡¡¡Enorgullese a tus padres y maestros!!!!



WRITTEN AND ORAL REPORTS
REPORTE ESCRITO Y ORAL

Your written report and oral presentation should include the following:
Tu reporte escrito y presentación oral debe incluir lo siguiente:

1. A description of the process to create your sketch and blue print.
   Una descripción del proceso para crear el dibujo y el plano de tu casa.

2. A description of the process you followed to find the area of the house using as many area concepts and academic vocabulary as possible. (Here you want to classify the shapes, describe the area procedures and formulas used, etc.)
   Una descripción del proceso para encontrar el área de la casa utilizando los conceptos y el vocabulario. (Aquí tu deberias clasificar las figuras, describir, los procedimientos y las fórmulas utilizadas, etc)

3. **Presentation of the House**. You will have between 5-7 minutes to present your model house to the class. You must include the scale factors from your blueprint to your model house, and from your model house to your real house.
   Presentación oral de la casa. Tu tendrás de 5-7 minutos para presentar tu modelo de casa a la clase. Aqui debes incluir la escala de tu plan a tu modelo de casa, y de tu modelo de casa a tu casa original.

Create an oral report:

1. Describe the process to create your blueprint.
   Presenta el proceso de crear el plano de la casa.

2. Describe the shapes and area of each polygon in the house.
   Describe las figuras y área de cada polígono encontrado en tu casa.

3. Present the procedure used to find the area of the blue print.
   Presenta el procedimiento de encontrar el área del plano de la casa.

My House:

The first thing I did to create my house was to draw the blueprint of the house. To draw the blueprint of the house, I had my mom/dad/family member help me measure the length and width of each room.

After measuring the length of each room I…….

In order to find the area of each room I………….

To find the area of the house using polygons I dissected it into……

To find the total area of the house I……..

HOUSE PROJECT:

Name:______________________________________

Reports	Possible Points	Received Points	COMMENTS:
House	500		
Written Report	300		
Oral Report	500		
BluePrint	200		
	Total Points		
	Percentage		
	grade		

HOUSE PROJECT:

Name:______________________________________

Reports	Possible Points	Received Points	COMMENTS:
House	500		
Written Report	300		
Oral Report	500		
BluePrint	200		
	Total Points		
	Percentage		
	grade		

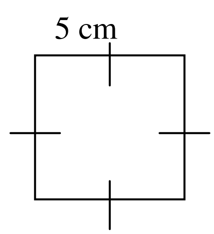
Area of polygons Final Exam.
Examen Final del Area de polígonos

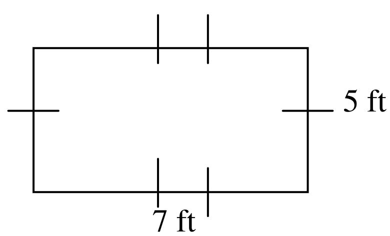
Name:______________________________Date:____________

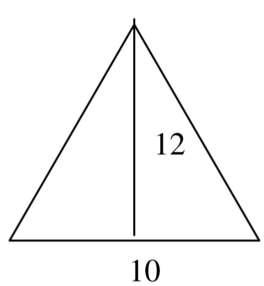
Always explain your procedures or reasoning.
Siempre explica tu procedimiento or razonamiento.

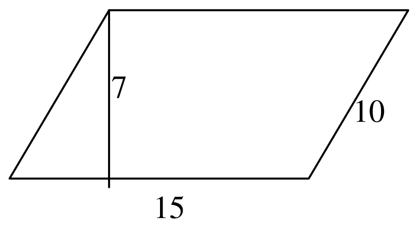
1. Explain the concept of Area.
***Explica** el concepto de Area.*

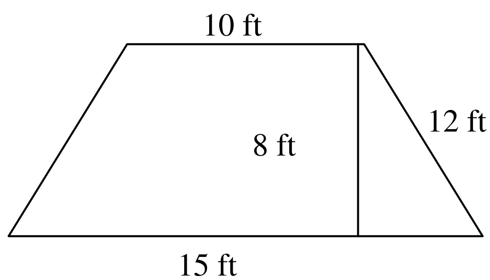
2. Name and find the area of the polygons. **Explain your reasoning.**
Nombra y encuentra el área de los polígonos. ***Explica tu razonamiento.***



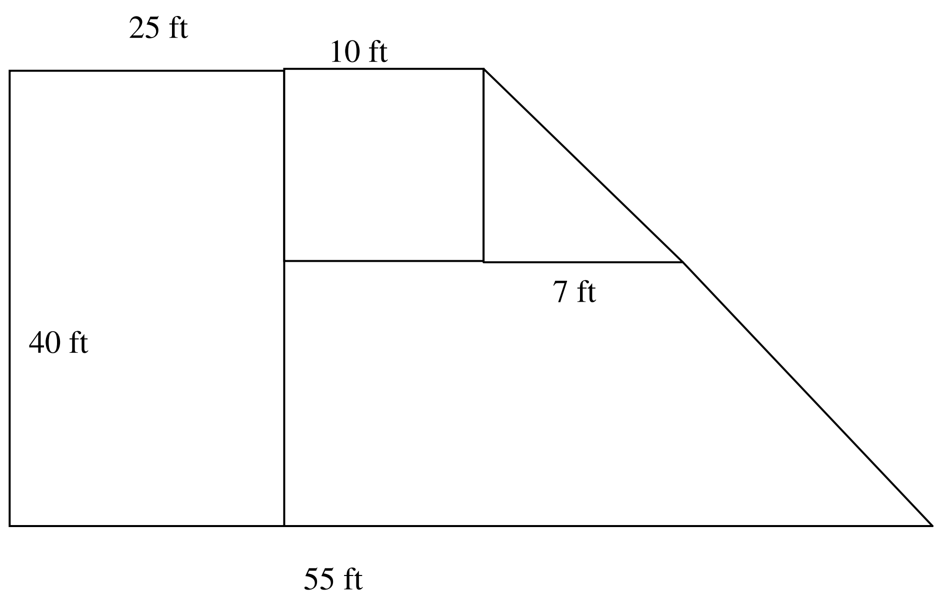




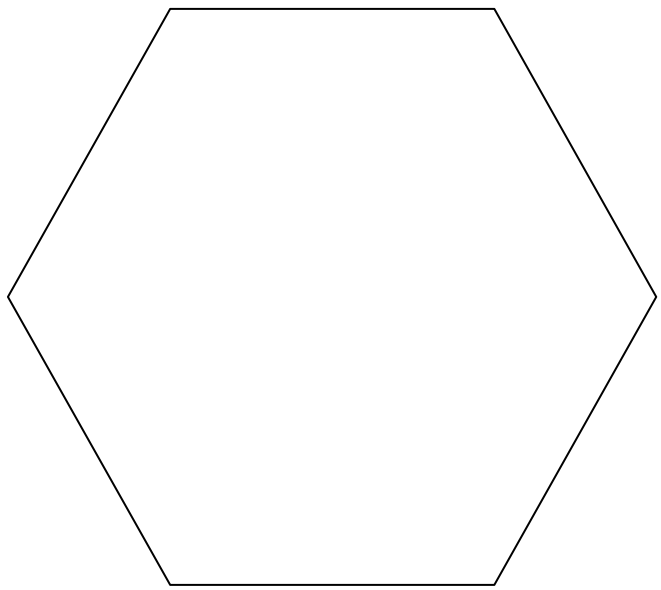




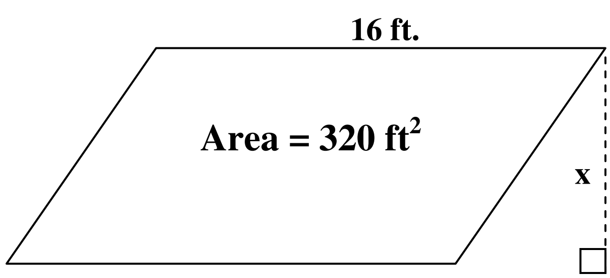
3. Find the total area of the figure. **Explain your reasoning.**
   Encuentra el área total de la figura. ***Explica tu razonamiento.***



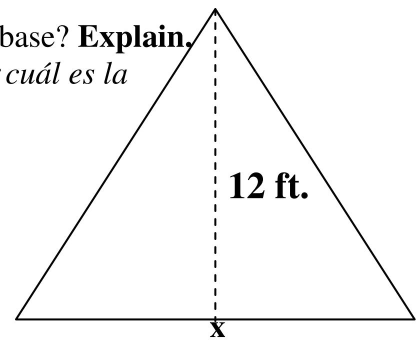
4. Use your knowledge to find the following hexagon whose side is 10 cm and height is 60cm. **Explain your reasoning.**
   Usa tus conocimientos para encontrar el área del hexágono con la medida de un lado de 10 cm. y una altura de 60 cm. ***Explica tu razonamiento.***



5. Find the missing measure. **Explain your procedure.**
   Encuentra la medida que falta. ***Explica tu procedimiento.***



6. If the area of the triangle is 120 ft^2 . What is the base? **Explain.**
   Si el área del triángulo es 120 pies cuadrados, ¿cuál es la medida de la base? ***Explica tu razonamiento.***



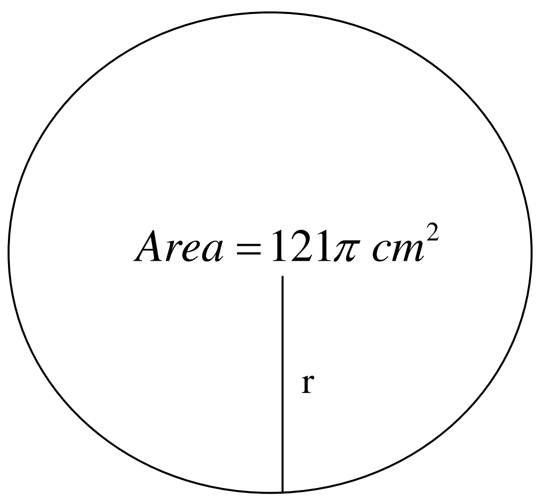
7. The area of a square is 121 square feet. What is the measure of the sides of the square?**Explain your reasoning.**
   El área de un cuadrado es 121 pies cuadrados. ¿cuánto miden los lados del cuadro? ***Explica tu razonamiento.***

8. A Rectangular table needs a cloth of 180 square feet. If the width of the table cloth is 12 feet. Provide the length of the table cloth. **Explain your procedure.**
   Una mesa rectangular necesita un mantel de 180 pies cuadrados. Si la anchura del mantel es de 12 pies. ¿Cuánto mide de largo el mantel? ***Explica tu razonamiento***.

9. If the total amount of paper needed to cover your geometry book is 240 squres inches and the length is 12 inches, What is the measure of the width.?. **Explain your procedure.**
   Si se requiere 240 pulgadas cuadradas para cubrir tu libro de geometría y mide 12 pulgadas de largo, ¿cuál es la medida de la anchura de tu libro? ***Explica tu procedimiento.***

10. How do we find the area of a Circle? **Explain.**
    Explica *cómo encontramos el área de un círculo.*

Find the missing length. **Explain your reasoning**.
Encuentra la medida que falta. ***Explica tu procedimiento.***



How much material will you need to make a table cloth for a round table that measures 6 feet across? **Explain you reasoning.**
¿Cuánta tela se necesita para hacer un matel para una mesa que mide 6 pies de díametro? ***Explica tu razonamiento.***

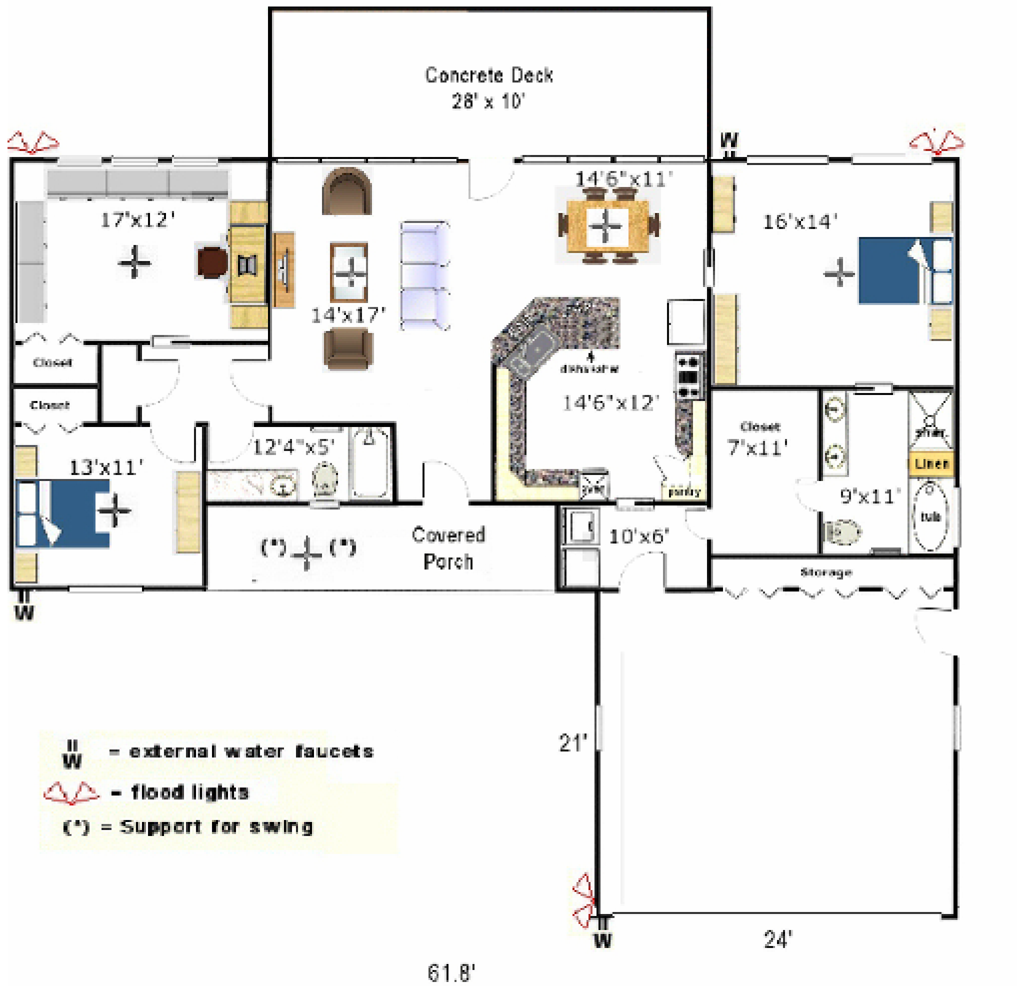
11. If the classroom is 19 feet long, 15 feet wide and 20 fee high,
Si el aula mide 19 pies de largo, 15 pies de ancho y 20 pies de alto:

a) What is the shape of the room? **Make a sketch.** (Drawing)
¿Cuál es la figura que el aula forma? ***Provee un plano***.

b) What is the total Lateral area. **Explain.**
¿Cual es el Area Lateral total? ***Explica.***

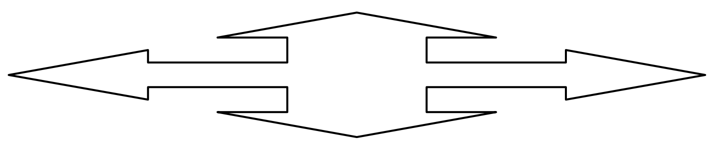
c) What is the total Surface Area? **Explain.**
¿Cual es el Area de la superficie total? ***Explica.***

12. Find the area, surface area and lateral area of the house below if the height is 20 feet. **Explain your procedure.**
Encuentra el área, área lateral y área de la superficie de la casa si la altura es de 20 pies. ***Explica tu procedimiento.***

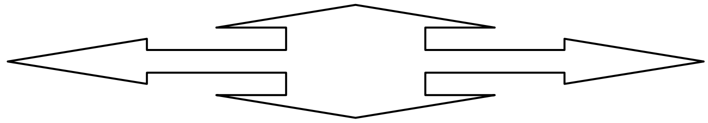


SLIC Curriculum

Using Surface Features of the Text		
Determine text form and anticipate content and location of content using text features; *Use text and language features to build an understanding of content prior to reading* *Determine main idea using knowledge of paragraph structure.*	*Make inferences, cross-check and confirm using text features;* Use text features for gathering and organizing information; Makes decisions about text forms and structure appropriate to purpose, audience and content.	Use a range of text forms depending on purpose, audience and content; Use text features in writing as tools for conceptualizing and thinking critically.



Reading and Writing for Deeper Understanding		
Use knowledge of text form to identify authorial intent; *Locate main points in a paragraph;* *Gather literal and inferred information from single sources;* Develop coherent paragraphs with controlling ideas.	*Integrate information from text features with running text;* *Develop understanding of main ideas in whole text;* *Gather literal and inferred informaiton from multiple sources;* *Categorize, synthesize, summarize information from multiple sources;* Develop relevant research questions; Develops controlling thesis that is narrow, clearly defined and makes a claim that requires analysis.; Organize, analyze, evaluate and synthesize information from multiple sources.	*Analyze, critique and evaluate author's intent;.* Use a range of text forms and features to analze, critique and evaluate; Support claims or arguments with relevant, reasonable, logical evidence; Anticipate and address readers' concerns, counterclaims, misunderstandings or biases.



Building Knowledge of Language Conventions and Vocabulary
Make meaning in unfamiliar vocabulary using context, morphology, [1]grammar, prior knowledge
Uses vocabulary appropriate to purpose, audience and content
Edits drafts for clarity and accuracy in spelling, punctuation, grammar, citations etc.

[1] Text in italics denotes reading skills and strategies

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