Bridges Math Curriculum Introduction

In order to prepare our students for success in high school math and to address the shifts of the Common Core Learning Standards, this curriculum aims to:

- Encourage active thinking wherever possible through estimation, prediction, experimentation and applying newly acquired math skills in multiple contexts
- Prioritize genuine understanding of foundational concepts
- Emphasize using tools and contexts over memorizing rules
- Support independent observation of patterns
- Provide opportunities for students to discuss their thinking process while also acquiring the English language skills to do so
- Structure repetition (spiraling) and multiple approaches to key skills and concepts into our lessons
- Connect to real life wherever possible and get students to comfortably translate word problems into expressions/ equations and vice versa.

The materials presented here are a first draft; subsequent drafts will refine and complete them, and make explicit the interdisciplinary connections with the other Bridges subjects.

I. Common Structures and Procedures across all Units

All Math units consist of lessons with five major elements:

1) Warm-up
2) Main activity/lesson
3) Language objectives
4) Homework
5) Assessments

Each is described briefly below.

1) Warm-up activities - lasting no more than 10 minutes, differ from unit to unit and lesson to lesson. A Unit 1 warm-up activity, for example, is measuring and graphing the outside temperature. Often the warm-up will consist of a review of the vocabulary words that will be used in the lesson. Examples of suggested vocabulary activities are:
   - Matching pictures with words
   - Spell-checks on recently introduced words
   - Questions that can be answered with one word, for example, “What do I use to measure temperature?”
# Bridges Math Curriculum Map

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- Sentence completion exercises/ cloze activities
- Bingo games
- Pronunciation drills

2) **The Lesson** - Math teachers use the same (Bridges) Lesson Plan template as all other teachers with the understanding that the warm-up time takes a little longer and that the modeling may happen twice during the lesson, especially if the teacher models a first step, lets the students experiment with the first step, and then adds a second step to a procedure. There are several lessons within the unit that do not follow the Lesson Plan template at all, for example, when students are preparing their final projects or when an experiential learning activity (such as measuring length or speed) takes up the whole class and requires very little modeling.

3) **Language Objectives**
   This draft of the curriculum does not include the sequence of specific language objectives that accompanies the units’ progression. However, each lesson calls for two major components of language objectives –
   - the word wall, and
   - the language frames.

   It is important that the teacher creates the word wall with the students, not for them. Students see words go up in almost every lesson. As these words are used in class, the teacher points to the word on the wall to reinforce the students’ visualization of the word. During Vocabulary quizzes, the word wall ought to be covered by flip-chart paper/ cloth.

   In the Math units, 4-6 language frames are introduced at the beginning of the week and students practice them throughout the week. Some examples are,
   - How long is the table/ the line/ the ruler?
   - The table/ line/ ruler is 10 cm long.
   - What do we measure with a measuring tape?
   - We use a measuring tape to measure length.
   - How long does it take to fly from New York to Boston?
   - It takes two hours to fly from New York to Boston.

   Apart from these sentence structures that emphasize syntax as much as vocabulary, language objectives in Math Unit 1 also aim to increase awareness about language patterns. For example, students spend at least two weeks on practicing,
   - long, longer, longest
   - fast, faster, fastest
   - heavy, heavier, heaviest
- hot, hotter, hottest
- short, shorter, shortest
- etc.

4) **Homework**

Unlike the other subjects, the Math curriculum urges teachers to provide students with homework every day. Generally, Math homework should not take a student more than twenty minutes to complete. The two main purposes of homework in Bridges Math are:

- increasing fluency and accuracy in the four operations
- spiraling content from previous weeks and units.

Students receive homework at the end of every day and they are expected to turn it in at the beginning of the next day’s class. The homework usually consists of a double-sided worksheet that lists problem sets that require students to use the four operations. At the beginning of the school year, the teacher prepares at least four trays/ boxes of worksheets that are differentiated by difficulty level. Students who are already fluent at addition of multiple-digit numbers should proceed to become faster at solving subtraction problems, for instance. It is important that students receive homework that matches their individual numeracy levels.

The other type of homework that students receive is homework that tests content from previous weeks or units. The purpose is to spiral content knowledge and vocabulary use throughout the school year. In this way, a student should be able to answer questions about measurement units (Math Unit 1) in May, when students are completing Math Unit 4, which deals with statistics. This also ensures that students constantly recycle words that they have learned and apply them to different contexts.

5) **Assessments**

Students are assessed in a comprehensive way. Their acquisition of numeracy skills is as important as their acquisition of vocabulary and their learning behaviors overall. The curriculum calls for regular vocabulary tests, regular submission of homework as well as a monitoring of overall learning behaviors and presentation skills. Each unit includes a mid-term exam and a final exam. Students get at least one practice test before each exam. Starting in Unit 2, students also begin to monitor how many problem sets they are able to solve in five minutes. They set their own individual thresholds and realistic goals for how much they can improve within a month.
II. Common Tools for all Units

Central tools for all units are the Cuisenaire Rods, play money, measurement tools, word walls, recurring timelines, and student binders. Each of these is described briefly below.

Cuisenaire Rods

Students are introduced to Cuisenaire Rods even before Unit 1 launches, during the 1-week mini-unit, where students learn how to count in English. The Rods show up throughout the year and are put to use in a variety of contexts, including adding, subtracting, teaching number sense (bigger than/shorter than and “more of”/“less of”), establishing equivalence, the base ten number system and algebraic thinking.

Play Money

Students use play money especially in Unit 2 and 3 in order to become fluent with U.S. currency, practice the direct application of the base ten number system, understand part-part-whole relationships, unit conversion and also to become familiar with the concept of rate (as in pay rate). Students also maintain “bank accounts” during units 2 and 3. In our experience so far, this banking system served as major motivator for students as they watched their total balance accrue over the unit. It also improved accountability and attendance of Math classes. Students maintain a “bank ledger,” which teaches them basic accounting skills, while also reinforcing addition and subtraction. This culminates in the shopping quiz during the last week of the unit. Students are able to purchase a variety of useful objects (such as stationary, personal hygiene articles, notebooks, educational materials) once they answer unit review questions correctly. The banking system, as well as the recording of temperature, lends itself to illustrating to students concrete examples of negative numbers since both temperature and account balance can drop below zero.

Measurement Tools

Students encounter different tools throughout the year. Unit 1 focuses on measurement tools for length, weight, temperature and speed, but students also become familiar with protractors, compasses and calculators during the year. The word “tool” is a word and concept that resurfaces in all the other subjects; it deliberately features as an interdisciplinary anchor point. In Social Studies, for example, students learn about hunting tools and the invention of tools that we now consider staples of modern life; in Science, students encounter tools that
measure rainfall and humidity, and in English, students learn how to use dictionaries and online applications as tools for language learning.

Word Walls

Each week has its own word bank/ word wall. Each week’s word bank fits on a single page that students receive on Mondays. They file this word bank in their binders and translate as many words as possible into their home language throughout the week. Once the teacher introduces, explains and illustrates a word from the word bank, the word is recorded on a cardboard/ sturdy paper that gets mounted on the “word wall.” The word wall organizes words according to group, for example tools, shapes, operations, etc. Weeks 6 and 7 of the units do not introduce new vocabulary, but rather review and practice the unit’s overall word bank.

Timelines

Students are exposed to the concept behind a number-line/ timeline in Unit 1, but need to practice the use of it throughout the year in order to master skipping, adding and subtracting along the timeline. In Unit 4, students construct a giant timeline on which they mark major events they have learned about in Social Studies and English. They practice calculations around “how many years ago did x happen?” and thus develop a stronger sense for chronology and the sequencing of historical events. As a part of Unit 4’s final project, students also create a timeline of their lives on which they label major events, while also projecting their lives into the immediate future.

Student Binders

Students either have separate binders that stay in the Math classroom or they have a Math section within their large 4-subjects binder, which also stays in one of the classrooms. In addition, students carry a folder that transports homework back and forth from home to school. The main reason why binders stay in school, rather than going home every day, is because teachers need access to the binders whenever possible in order to maintain a tight feedback loop.

II. Unit Overviews

During the first week of school, students will receive a “mini-unit” in each subject. The Math “mini-unit” mainly consists of:

- Learning how to count in English
- Translating the English names of numbers into all languages represented in the class
- pronunciation of numbers 1 – 1000
- pronunciation of years (e.g. the year 1998)
- an introduction to Cuisenaire Rods

Unit 1 provides students with the fundamentals from the elementary grades (Common Core Standards of grades K-3). The unit aims to teach and review math fundamentals such as counting (in English), predicting quantity, measuring and representing data. A daily routine of graphing temperature (Unit 1) and attendance (Unit 2) helps students become comfortable with representing and interpreting data, while predicting tomorrow’s temperature, or estimating a reasonable average temperature, develops their number sense. Unit 1 zooms in on the four operations, with special emphasis on addition and multiplication as repeated addition. Students improve their dexterity at solving, first single, then multiple-digit number problems and regularly connecting “adding” and “taking away” to real life. Students engage in frequent hands-on work through activities that require them to measure temperature, length, height, weight and speed. They learn how to record the data and represent it in abstract ways such as graphs, bar charts, drawings and, eventually, pie charts.

Units 2 and 3 gives students the skills to describe situations mathematically; students become familiar with concepts such as even/odd, fractions, average and categorizing numbers (whole numbers, fractions, decimals). In order to strengthen the understanding of circumstances in which parts make up a whole, students extensively use play money in Unit 2, but also get an introduction to geometry that helps them visualize parts of a circle or rectangle, for example. By shading halves, quarters, eighths, etc. of basic geometric shapes, students also prepare for the lessons on percentage and statistics in Unit 4.

Unit 3 exercises students’ algebraic thinking while also training them thoroughly on the order of operations. Almost all problem sets in Unit 2 and 3 are rooted in real-life examples that students learn to express in mathematical terms. Unit 3 purposely enhances students’ ability to decode and comprehend text, which is a skill that gets emphasized across all subjects in the Bridges curriculum. In all of their subjects, Bridges students practice making claims and supporting their claims with evidence. In Bridges Math, this practice is most applicable to recognizing and describing patterns.

Unit 4 culminates in a final project, “How long have I been alive?” After practicing timelines and chronological thinking, the Math class complements both Science and Social Studies class’ effort to teach students about sun-earth rotation by highlighting the numerical relationships entailed in sun-earth rotation. Students once more practice conversion, equivalence and the operations as they reflect on how long it takes for the earth to travel around the sun, how many hours are in a day, and how many full moons do we see each month.
Their final project asks them to calculate how many hours they have been alive and demonstrate their calculations. Their project also includes the aforementioned personal timeline that students describe in their final presentation by using their newly acquired past tense skills as they describe events that happened in the past.

Unit 4 also draws upon the many numeracy skills that students have acquired during the year in order to give them a comprehensive introduction to statistics. Students learn more about graphing (which they already encountered in Unit 1 and 2), they now use their knowledge of geometric shapes to present data in pie-charts and bar-charts, they review what they learned about social relations and history (Social Studies) and animal migration, water cycle and food chains (Science) through the lens of statistics.

As with all units, Unit 4 aims to address the common core standards but it does this through constant real-life examples, an emphasis on relevance to students' lives, hands-on experiential learning activities and plenty of collaborative learning time. All units culminate in a creative project that prepares students for presentation requirements and public speaking skills in grades 9-12. The student who participates fully in this Math curriculum and takes advantage of all the support structures built into the Bridges curriculum in general, can hope to acquire at least 140 tier 2 & 3 words that specifically relate to academic language used in Math. Although 9th grade Math will still pose a significant challenge to Bridges students, a successful implementation (and further development) of this curriculum will make 9th grade Math less insurmountable as students will have been introduced to the major content areas of Math in a memorable and motivational setting.