K-8 Franklin Lakes Public Schools Mathematics Program Evaluation
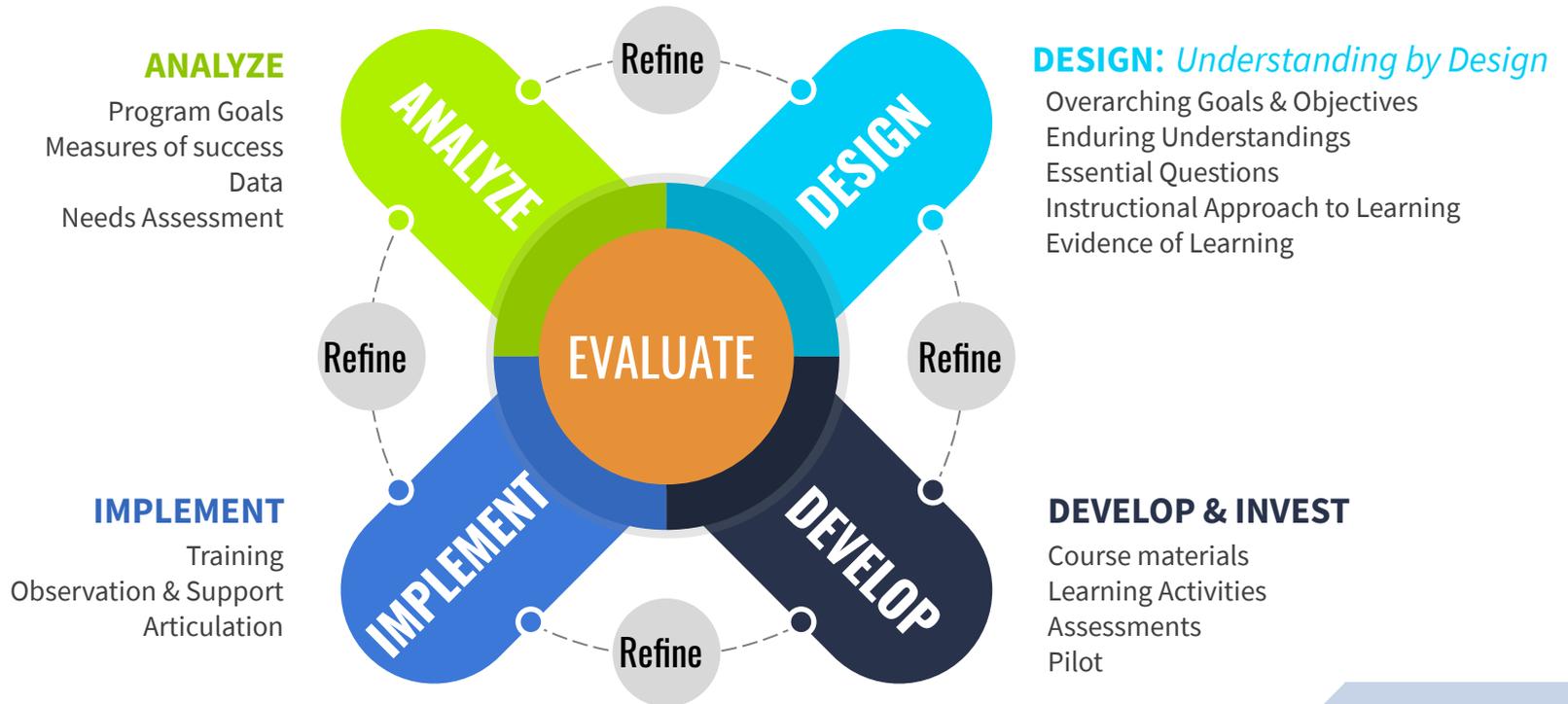
CURRICULUM PROCESS: A CYCLE FOR CONTINUOUS IMPROVEMENT

ANALYZE

Program Goals
Measures of success
Data
Needs Assessment

DESIGN: *Understanding by Design*

Overarching Goals & Objectives
Enduring Understandings
Essential Questions
Instructional Approach to Learning
Evidence of Learning

ANALYZE

DESIGN

Refine

Refine

EVALUATE

Refine

Refine

IMPLEMENT

DEVELOP

IMPLEMENT

Training
Observation & Support
Articulation

DEVELOP & INVEST

Course materials
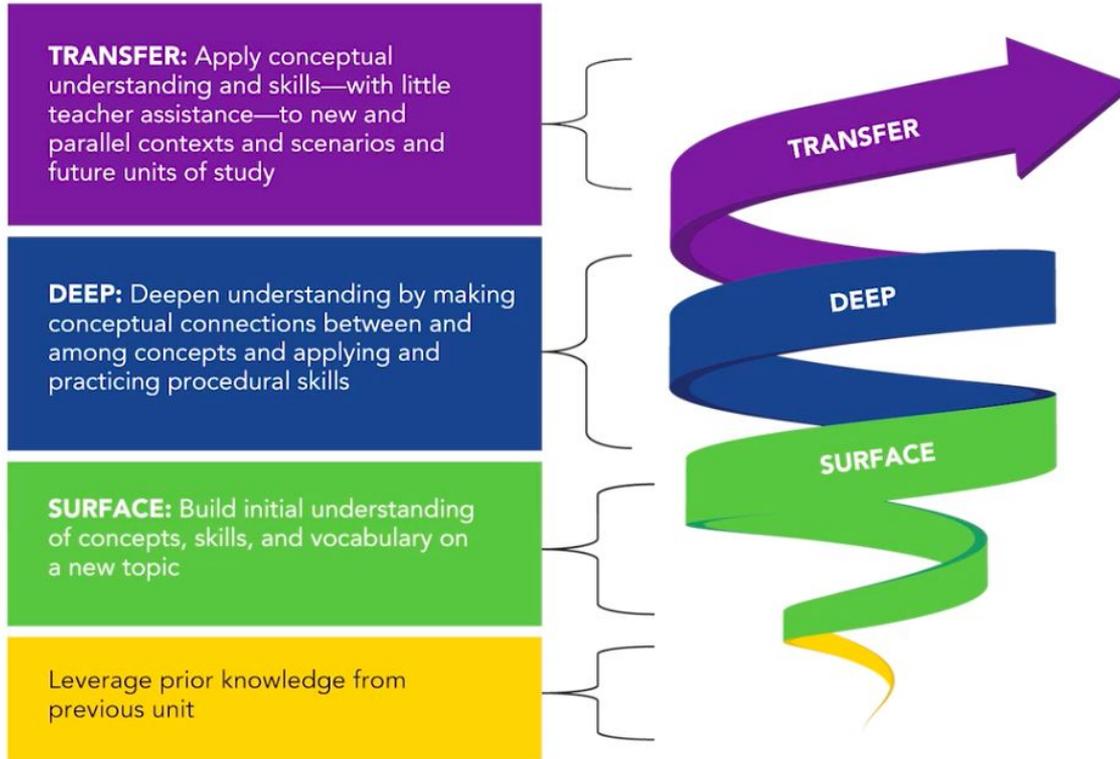Learning Activities
Assessments
Pilot

Refine

Essential Question

To what extent are our students engaged in deeper learning and understanding of mathematics? Is this understood, agreed upon, and evident in our data regarding:

- *Student learning results*
- *Assessments*
- *Curriculum*
- *Instructional practices in place*
- *Professional Development*

THREE PHASES OF LEARNING

TRANSFER: Apply conceptual understanding and skills—with little teacher assistance—to new and parallel contexts and scenarios and future units of study

DEEP: Deepen understanding by making conceptual connections between and among concepts and applying and practicing procedural skills

SURFACE: Build initial understanding of concepts, skills, and vocabulary on a new topic

Leverage prior knowledge from previous unit

TRANSFER

DEEP

SURFACE

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Findings and Conclusions

Mathematics Program Evaluation

1) Student Learning Results
Findings and Conclusions

Quantitative data

- Data analyzed indicate positive improvement in student growth in the 2017-18 school year (assessed the first year of implementation of a revised K-8 math curriculum realigned to the NJSLS for Mathematics).
    - Gains in Performance and Student Growth reflect curriculum realignment to NJSLS
    - Student Growth at the elementary also attributed to:
        - Implementation of a grades 4-5 daily instructional period - dedicated time for intervention and enrichment.
        - Collaborative interventions for academics as part of the District's Response to Intervention [RTI] programming.

- While improvements in overall student performance and growth were noted across the District, the 68.4% districtwide performance on the state standardized test highlights the need for programmatic improvements.
    - 2016-17 and 2017-18 Mathematics Assessment data, highlight Grades 6-8 Math courses as immediate areas for improvement.
    - Equity among these subgroups should be a focus of improvement efforts. The quantitative data identify achievement gaps K-8 among the subgroups:
        - Students with Disabilities
        - English Learners

1) Student Learning Results
Findings and Conclusions

Qualitative Data

Student Engagement in Mathematics:

- 73% of elementary students surveyed articulated that learning math is interesting. 9.1% of elementary students disagreed with this statement.
- 54% of middle school students surveyed indicated they found math learning to be engaging and/ or interesting. 23.8% of middle school students were forthright in stating they disagreed with this statement.
- Students articulated factors that contribute and detract from engagement and interest in mathematics learning.

Student Effort and Motivation in Mathematics:

- 89.4% of Elementary students and 83.4% of Middle School students identify they work as hard as they can in math class. Only a small margin of elementary (1.7%) and middle (2.7%) indicate that they do not usually work as hard as they can in math class.
- Students articulated factors that contribute and detract from effort and motivation in mathematics learning.

1) Student Learning Results
Findings and Conclusions

Qualitative Data

Student Learning Preferences

- Students were able to identify how they believe they learn math best that extend to:
  - ▷ Learning activities
  - ▷ Conditions: Culture and climate of classroom
  - ▷ Social-emotional factors

1) Student Learning Results
Findings and Conclusions

Conclusions

- An analysis of data indicates that the deep and transfer learning phases do not consistently serve as the goal of mathematics learning in FLPS.
- Surface level coverage of content, concepts and skills appears to be the current norm rather than the exception due to expectations set previously with the adoption/ implementation of the current curricular resource. Unintended consequence of the directive to "exceed the standards" included:
  - Presentation of content/ concepts that, at times, was accelerated and therefore, ahead of students' levels of cognitive development and the expectations for the major work of the grade.
  - Time pressure for teachers to cover resource's scope and sequence within the school year.
  - As a result, opportunities for deep and transfer learning are relegated to extensions and enrichment when the situation calls for it.
- Student engagement and Social-Emotional Learning are other critical elements that should immediately be addressed throughout mathematics learning, as these serve the foundations for learning to occur and accelerate.

2) Assessment
Findings and Conclusions

Qualitative Data/ Assessment Practices:

From the vantage point of middle school students, reporting of a grade is the main purpose of assessment. Meanwhile, it is well established that when the goals of assessment are to provide students with timely and specific qualitative feedback for learning, there is great potential to increase student learning - especially when learners are provided with clear guidance about how to improve.

- Students perceive assessment types and purposes to be more summative as they progress up through higher grade mathematics.
- Students express a desire to improve the current grading system/ assessment philosophy.
- Some students understand that assessments have potential to clarify for teachers the extent of a student's understanding of a concept or ability to apply skills.
- Non-traditional assessments (i.e., performance-based tasks and/ or projects) yield more feedback and offer enhanced opportunities to demonstrate understanding.
- Mathematics assessments are a source of stress for students, particularly those in accelerated and advanced courses.
- Untapped opportunities exist to actively involve students as part of assessment practices,

2) Assessment
Findings and Conclusions

Qualitative Data/ Assessments:

Regarding the design and quality of assessments administered in the classroom, it is important that the quality be evaluated for the following criteria:

- Assessment on the major work of the grade as per the NJSLS for Mathematics
- Rigor - items reflect the balance in conceptual understanding, procedural skill and fluency, and application to problem-solving that the mathematics standards demand.
- Diversity in assessment types including non-traditional assessments (i.e., performance-based tasks and/ or projects), which support assessment of deeper levels of learning and assess 21st century competencies.

3) Curriculum
Findings and Conclusions

- An interleaving approach (vs. mastery-based approach) to curriculum design can improve learning and retention because it spaces out learning and practice over time.
- Students must have equitable access to the curriculum despite ability, readiness, and backgrounds.
- Curriculum documents and resources should emphasize "major" work of the grade level at 65% of the year.
- Parents and caregivers should be given proper supports to help their child at home.
- The three areas of rigor should be balanced within the curriculum.
- Weaving mathematics content with other content areas helps make the math more meaningful, engaging, and relevant.

The Forgetting Curve

Memory (y-axis) vs. Time remembered (days) (x-axis)
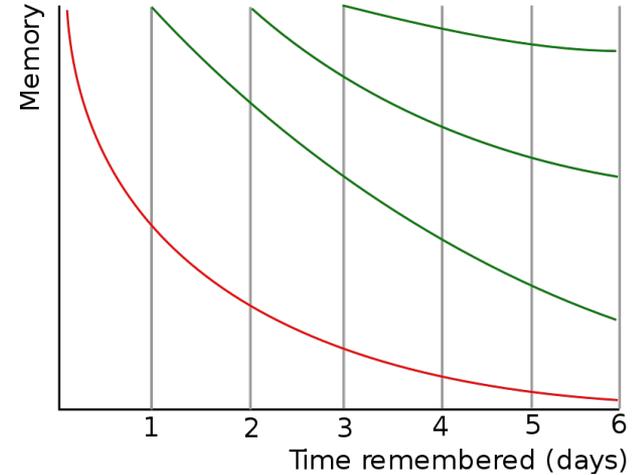
4) Instructional Practices Findings and Conclusions

- The National Council of Teachers of Mathematics recommends 8 effective instructional practices for teaching mathematics.
- Specific instructional practices should be utilized at different times to help students engage in surface, deep, and transfer learning.
- Students have articulated that they learn best in different ways, so it is important for teachers to be aware of these differences and to plan instruction in a way that will best meet the needs of all learners.
- Curricular resources can often provide differentiation support for teachers.
- A good curricular resource has a balance of all 3 aspects of rigor: conceptual understanding, procedural fluency, and application. Deep learning takes place when lessons connect the conceptual understanding to the procedural fluency in such a way that students can later transfer these skills to a variety of situations and applications.

5) Professional Development Findings and Conclusions

- Collegial sharing across the district helps to ensure consistent instructional practices throughout the district.
- Teachers are more invested in professional learning when there is some degree of choice.
- Revisiting the standards, including the practice standards, has provided teachers with meaningful guidance on skill progressions and expectations of students at each grade level.
- Formative and summative data drives decisions regarding differentiated instruction in order to ensure all learners have access to the content.
- The pacing of content at some grade levels can impact teachers' decisions regarding depth of knowledge.
- Moving from surface to deep and transfer learning with our students can be modeled within the professional learning opportunities and follow up supports provided to teachers.
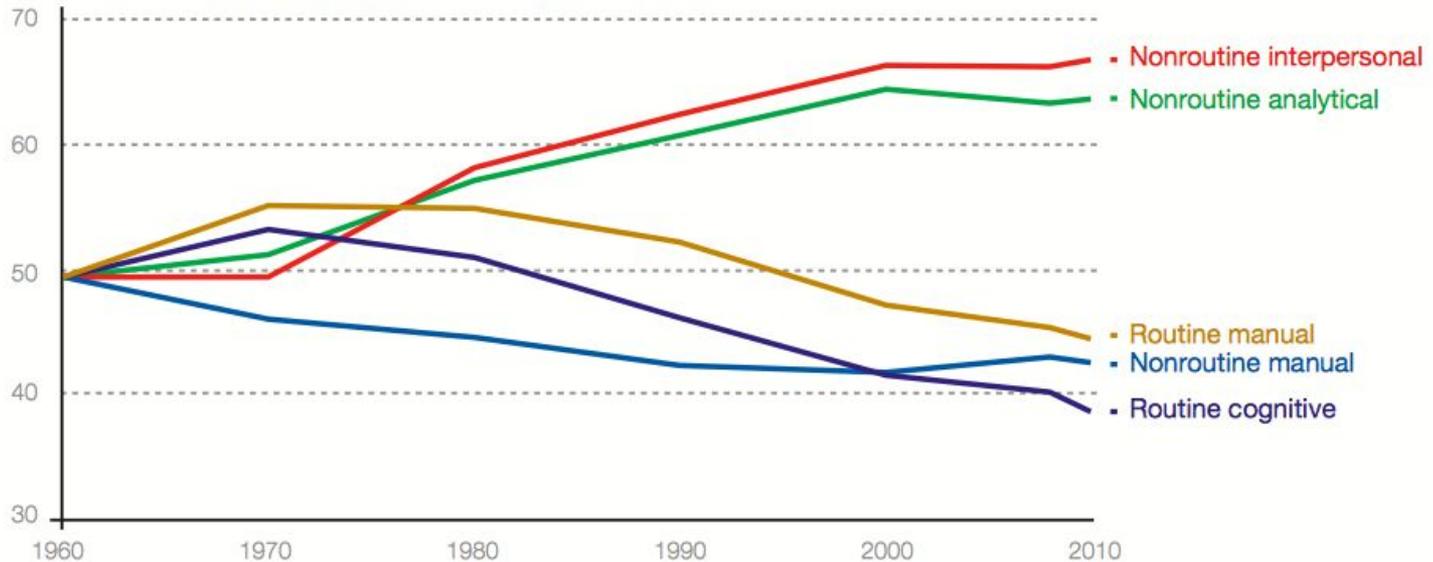
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Recommendations

Mathematics Program Evaluation

A Vision to Prepare Students for the Future

Exhibit 1: The labour market increasingly demands higher-order skills
Tasks by percentile for the US economy, 1960-2009

- Nonroutine interpersonal
- Nonroutine analytical
- Routine manual
- Nonroutine manual
- Routine cognitive

The chart above, World Economic Forum Exhibit 1, illustrates the change in skill sets that has occurred in the labor market from the years 1960-2010.

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Student Learning Vision Recommendations

Given the increased importance of nonroutine interpersonal and analytical skills necessary to experience success within the labor market, the District's vision for student learning should reflect this reality.

NJSLS for Mathematics.
- Surface, Deep, Transfer Learning
- Major Content of the Grade
- Rigor
- Standards for Mathematical Practice

21st Century Competencies:
- Critical thinking/ problem-solving
- Creativity
- Communication
- Collaboration

Character Qualities:
- Curiosity
- Initiative
- Persistence/ grit
- Adaptability
- Leadership
- Social and cultural awareness

Mathematics Learning Recommendations

1. Awareness/ Emphasis on Phases of Learning: Surface, Deep, and Transfer as appropriate per NJSLS

   a. Grades 6-8 math courses of study (2019-20)
   b. K-5 math courses of study (2020-21). Consider scheduling grade 5 earlier.
   c. Equity/ Achievement gaps
      - Students with Disabilities
      - English Learners

2. Classroom climate and culture of that nurtures and sustains student growth, motivation, effort, support, and understanding inclusive of students' mathematics identities and self-efficacy.

3. Target student engagement, which supports student curiosity, effort, and interest in continued learning. Students articulated many aspects of deeper/ transfer learning: connections between math concepts, real world application, projects, multiple methods to solve problems, etc.

4. Student learning preferences should be considered when presenting new mathematical content and for the provision of supportive practice. Educators should be mindful of what supports who and when, as they plan for student learning is designed, i.e., use of manipulatives/ visual aides, teacher modeling, note-taking, etc.

Assessment Practices Recommendations

1. In all aspects of mathematics learning, individual student growth relative to the learning standards should be the driving philosophy of all assessment initiatives.

2. Assessment practices from grades K-8 should be reviewed to ensure balance is struck throughout all mathematics courses, K-8 across assessment purposes and types (i.e., formative, summative, etc.).

3. Classroom assessment practices should seek to develop assessment-capable visible learners, or students (Frey, 2018).

4. The design and quality of assessments administered in the classroom and across the District should be evaluated for the following criteria:

   ○ The extent to which students are assessed on the major work of the grade as per the NJSLS for Mathematics

   ○ Rigor: conceptual understanding, procedural skill and fluency, and application to problem-solving

   ○ Diversity in assessment types including non-traditional assessments (i.e., performance-based tasks and/ or projects).

Curriculum Recommendations

1. Utilize a resource with an interleaving approach to curriculum design.
2. Provide equal access to the curriculum through resources and materials.
3. Ensure that mathematics instruction focuses on the NJSLS "major" work of the grade at least 65% of the time.
4. Provide adequate curricular supports for parents to help their children at home.
5. Provide opportunities for interdisciplinary learning within the mathematics curriculum.

Instructional Practices in Place

1. Utilize a resource that supports differentiation and small group work.
2. Recognize the variety of learning styles in the classroom and plan lessons according to the unique dynamics of the given classroom.
3. Prioritize time spent on "linking lessons" that connect conceptual understanding and procedural fluency in order to facilitate deep learning.
4. Include tasks that blend multiple clusters of standards to allow for the transfer of learning.
5. Continue utilizing classroom and school/district wide data and trends to plan for instruction.

Professional Development

1. Provide continued professional learning opportunities focused on deep learning.
2. Continue to look for opportunities for teachers to collaborate with their peers across the district on a more consistent basis.
3. Provide a degree of teacher choice in selecting professional learning opportunities that cater to their specific needs.
4. Refine district, school, and individual goals that support common initiatives.
5. Continue to provide mathematics training for special education teachers in line with what is being provided to general education teachers.

There are two versions of math in the lives of many Americans: The strange and boring subject that they encountered in classrooms and an interesting set of ideas that is the math of the world, and is curiously different and surprisingly engaging. Our task is to introduce this second version to today's students, get them excited about math, and prepare them for the future.

-Jo Boaler