# Office of Professional Learning

# — November 2024 Education Bulletin —

Welcome to the November 2024 edition of the **Luzerne Intermediate Unit (LIU) Office of Professional Learning's (OPL)** monthly education bulletin. This special edition of the OPL Education Bulletin is dedicated to all of the teachers that teach mathematics in grades K—5. We hope this issue gives you a few ideas to dig into to improve your practices.

## Why Elementary Math? - Part I

## *Math Teaching Pedagogy*

Mathematics instruction is a subject where there is often room for student growth. A quick trip to the Future Ready PA Index will often find school scores where the inclusion of research-based practices can help. While there are many obstacles beyond the control of the classroom teacher that contribute to student struggle with mathematics, the next four editions of the OPL Bulletin will each focus on a specific instructional practices - something an instructor does control. The following topics will be described in each of the next editions:


- **Student Readiness using the Instructional Hierarchy Framework**
- **Interleaved Mathematical Practice**
- **Solving "Word Problems" using Schema-Based Instruction in Lieu of Keywords**
- **Student Mimicking versus Student Thinking**

By integrating these evidence-based strategies into your teaching, you can increase the efficacy of your learning environment. Each strategy will be highlighted as a specific teaching method, backed by research, actionable tips for implementation, and adaptions to meet diverse student needs. We encourage you to fall down the rabbit hole and explore the research provided you deeper understanding of each topic.

In this edition, the focal instructional technique is the Instructional Hierarchy in K-5 Mathematics. This progression describes the stages of learning and skill development that students go through as they master mathematical concepts and procedures. This framework helps teachers identify where students are in their learning journey and tailor instruction accordingly. The instructional hierarchy typically consists of the following stages: Acquisition, Proficiency/Fluency, and Generalization/Adaption.

# Acquisition Stage

## *The Instructional Hierarchy Framework*

At this stage, students are first introduced to new mathematical concepts and skills. Their performance is often slow and inaccurate as they begin to grasp the fundamentals. Key aspects of instruction at this stage include:

- Heavy use of direct and explicit instruction
- Demonstration and modeling by the teacher
- Guided practice opportunities like "Cover, Copy, Compare" where the student is given a sheet containing math facts to practice. The student studies each math fact with an answer that appears on the sheet, briefly covers the fact, and copies it from memory. Then, the student compares the student-copied math fact and answer to the original correct model.
- Immediate, specific corrective feedback where (1) the error is identified, (2) the error is corrected, (3) an explanation of the error is provided (4) along with detail on how the error can be corrected.
- Use of concrete manipulatives (e.g. base ten blocks, counter chips) to support understanding

In this stage, the educator must also be mindful of the prerequisite skills necessary to for students begin to develop new knowledge. This establishes a spiral where mastery of the prerequisite skill is necessary to "acquire" the intended new skill. For example, a student must master counting before they can enter the world of addition and subtraction.

# Proficiency Stage

## *The Instructional Hierarchy Framework*

During the Acquisition Stage, students eventually become more accurate but may still be slow in their performance. This is where students between to transition from Acquisition to the Proficiency Stage. Students readiness is determined by an increasing reduction in errors coupled with an increase in speed. Students here often start to choosing between different solution strategies based on their perceived efficiency. This stage is meant to develop increasing levels of student automaticity. Class time at this stage should include:

- Independent Practice: With a reduction in errors and less of a need for correction, students can now begin to experiment with strategies and faster recall.
- Interleaved Practice: Used when learning two or more related concepts or skills. Instead of focusing exclusively on one concept or skill at a time, it can be helpful to alternate between them. For example, a student is learning topic A and topic B. Rather than practice only A on one day and only B on the next, students practice both on each day by incorporating a mixture of the two topics or by switching back and forth between them.
- Timed Trials: These are meant to measure a student's speed and accuracy across a set number of tasks. Timed trials should measure task completion - NOT how many problems can be completed in a set amount of time. The resultant goal is to reduce the time the student needs to complete a single or series of tasks while maintaining accuracy.
- Peer Tutoring: This form of instruction allows the student greater access to communicate task completion. Doing so allows for reinforcement of knowledge and increases student engagement.

# Mastery Stage

## The Instructional Hierarchy Framework

The Mastery Stage, sometimes referred to as the Generalization/Adaption Stage, is when students can perform skills accurately and fluently over time. They are now ready to apply their skills and knowledge to various contexts and problem types. It is inappropriate to ask the students to commit to the following tasks unless they have met the requirements of this stage. Students that have achieved the Mastery Stage are now prepared to engage in:

- The synthesis or the merging of two or more mastered skills. For example, once students have shown accuracy and adequate speed in adding fractions with equal denominators and conjuring a least common multiple of a set of numbers, they will be much more prepared to enter the Acquisition stage of adding and subtracting two fractions with unlike denominators.
- Students are now ready for "word" or "story" problems related to the skill. This is not to say that word problems should not be introduced during the Adequacy or Proficiency Stages. However, prior to the Mastery Stage, students will require a great deal of scaffolding to support their ability to derive a solution to a problem based on the context of a situation.
- Readiness to apply the learned skills to a range of situations. For example, the depth of knowledge of classroom tasks can increase to include more project-based forms of assessments.

# Info Graphic & Research

## The Instructional Hierarchy Framework

As you can see from the infographic below, the Instructional Hierarchy is not a new concept. It's been an evidenced-based that has received positive research since 1978. Below are some additional resources for you to access if you wish to learn more about this topic.

- Intervention Central, The Instructional Hierarchy: Linking Stages of Learning to Effective Instructional Techniques
- Advancing Evidence Improving Lives, Instructional Hierarchy Infographic
- PaTTAN, Instructional Hierarchy Overview
- The Science of Math, How Teachers can Make Learning Happen Based on the Science of Learning
- University Digital Conservancy, Relationship between the Learning Hierarchy and Academic Achievement on Strategies Used by Third-Grade Students when Solving Multiplication Word Problems

**INSTRUCTIONAL HIERARCHY** (HARING & EATON, 1978)

| | Acquisition | Proficiency | Generalization & Adaption |
|---|---|---|---|
| IF<br>***Learning Hierarchy*** | Slow & Inaccurate<br>Frustrational<br>**Goal:** repeat skill consistently and accurately | Slow & Accurate<br>Instructional<br>**Goal:** Maintain accuracy, increase speed | Fast & Accurate<br>Mastery<br>**Goal:** Apply to appropriate word problems and novel problem-solving situations |
| THEN<br>***Instructional Hierarchy*** | • Explicit Modeling (of correct performance)<br>• Guided Practice<br>• Think Alouds<br>• Immediate corrective feedback<br>• Praise/ Encouragement | • Independent practice<br>• Peer Tutoring<br>• Interleaved Worked Examples<br>• Timed trials<br>• Taped Problems<br>• Self-Correcting Materials | • Self-Regulation<br>• Schema-based Instruction<br>• Simulations<br>• Discrimination training<br>• Differentiation training |

Did you know that the Office of Professional Learning regularly offers network meetings where mathematics teachers can meet and discuss standards and practices that align to their grade levels. Presently, we hold network meetings with grades K-2 and grades 3-5. Below are the remaining dates and registration information.

- **Grades K-2: LIU Math Elementary Teacher Collaborative:**
  - Registration: https://www.mylearningplan.com/WebReg/ActivityProfile.asp?D=15128&I=4863184
  - Dates: November 25, January 27, February 25, and March 31
- **Grades 3-5: LIU Math Elementary Teacher Collaborative:** October 1, 2024, 8:30 AM to 3:00 PM.
  - Registration: https://www.mylearningplan.com/WebReg/ActivityProfile.asp?D=15128&I=4863260
  - Dates: February 4, March 4, and April 1

# Past OPL Bulletins

## *Where Can I Find them?*

All prior OPL Education Bulletins can be found on our LIU website. Our website address is www.liu18.org. From here, select "District Services" under the "Departments" dropdown. This space will provide you with information about our professional group. Select the "Office of Professional Learning" and then head down the page to "OPL Education Bulletin". Prior to doing so, feel free to look around any of the other informational items on this page like Assistive Technology, Career Development, the Guest Teacher Program and many more. See you next month.

**OPL Education Bulletin**


***Assistant Directors***

Dr. Rich Mackrell
rmackrell@liu18.org
(570)991-1121

Dr. Jessica Jacobs
jjacobs@liu18.org
(570)718-4631


*If you wish to have further monthly bulletins delivered to your inbox via email…*

**Subscribe**