The STRIDES project uses state-of-the-art technology and natural language processing (NLP) models to provide teachers with detailed evidence of students’ progress in achieving the multi-dimensional proficiency called for by the Next Generation Science Standards (NGSS). The Teacher Action Planner (TAP) in the STRIDES web-based curriculum environment presents patterns in students’ evolving understanding in real time and provides research-based activities for the teacher to respond to students’ ideas. STRIDES professional development activities guide teachers to customize the curricula to address diverse students’ evolving ideas. 

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**STRIDES Progress**

**STRIDES Unit: Musical Instruments and Physics of Sound Waves**

Students design, build, and experiment with a water xylophone to explore pitch and volume, how sound is created, and how sound travels. They use models and drawings to connect these ideas with ideas about wavelengths, frequency, and amplitude.

**Scoring Embedded Assessments to Inform Teachers in Real Time + Creating Summaries to Guide Customizations**

**Participants:**
- One teacher, two 6th grade classes, 56 students
- School serving predominantly Hispanic students (94%), 74% quality for free lunch

**Results:**
- All students are the DCI and CCC distinct?
- Initially they are slightly correlated ($r = 26$, $p = .049$). After instruction, they are more integrated ($r = 5$, $p < .001$).

**What does the TAP reveal & How did the teacher respond**
- Students had accurate ideas about pitch; were confused about how sound traveled.
- Teacher found the TAP informative: “Last year without report, right before they made the water syr, felt pretty scattered what the students understand and how they thought it was.”
- Recommended actions aligned with the teachers’ practice.

**Design and Test of the Teacher Action Planner (TAP) for Real-Time Use**

**Embedded Assessment:** Frequency

- Arlene has two glass cups. She leaves one empty and fills the other with water. She then uses a chopstick to gently strike each glass. What will she hear?
- There is no change; the pitch stays the same.
- The pitch of the tapped full glass is lower than the pitch of the tapped empty glass.
- The pitch of the tapped full glass is higher than the pitch of the tapped empty glass.

**Natural Language Processing (NLP)**

**Model**
- How are properties of sound wave (frequency, wavelength) correspond to an observable phenomenon (pitch)?

**DCI: Wave properties**
- No or incorrect conclusion about pitch or frequency or how pitch and frequency relate
- Emerging understanding: Accurate conclusion about pitch or frequency
- Full understanding: 2 (linked ideas): Accurate link between pitch and frequency or within the full or empty glass

**Sweeping Rubrics (NGSS Performance Expectation: MS-PS4-2)**

- Inaccurate conclusion only (water is denser than air, water is harder to vibrate, etc.)
- Accurate conclusion only (pitch is lower in glass with water, frequency is higher in glass with water, etc.)
- Full linked: 2 linked ideas: Accurate conclusion about pitch linked to accurate conclusion about mechanism or property of sound wave

- Composite linked: more linked ideas

**Category of Response**

**Linking density of the medium and vibrations, CCC = 3**

**Knowledge Integration: Linking DCI and CCC ideas**

1. Didn’t know or off topic; blank, repeats prompt, or “I don’t know”
2. Irrelevant, repetitive, off topic or vague
3. Partial link: 1 accurate idea
4. Full link: 3 linked ideas
5. Complete link: 3 or more linked accurate ideas

**Achieving the average score for individual students**

**Curriculum Customizations During Professional Development Courses**

- During PD, teachers use the TAP and additional logged student work to plan customizations to refine the unit.
- They explore the KI rubric to deepen their understanding of the impact of their guidance and the unit.
- They use Curriculum Visualizer to plan customizations.

**Curriculum Visualizer**

- Each slide represents an activity. Teachers can view full curriculum or zoom in to customize.
- Tool makes it easy to reorder, add, or remove activities or lessons.
- Color-coded slides indicate the KI process activities support. Helps to reflect on the sequence of activities, identify which over- or underrepresented processes.

**Review of Student Work**

- Teachers categorize small sample of student responses using the KI rubric.
- Compare their scores to those of a trained scorer.
- Sparks discussion of NIS assessments among teachers and researchers.