Every Lesson Needs a STORYLINE

Planning for coherent instruction not only engages students, but also leads them toward mastery.

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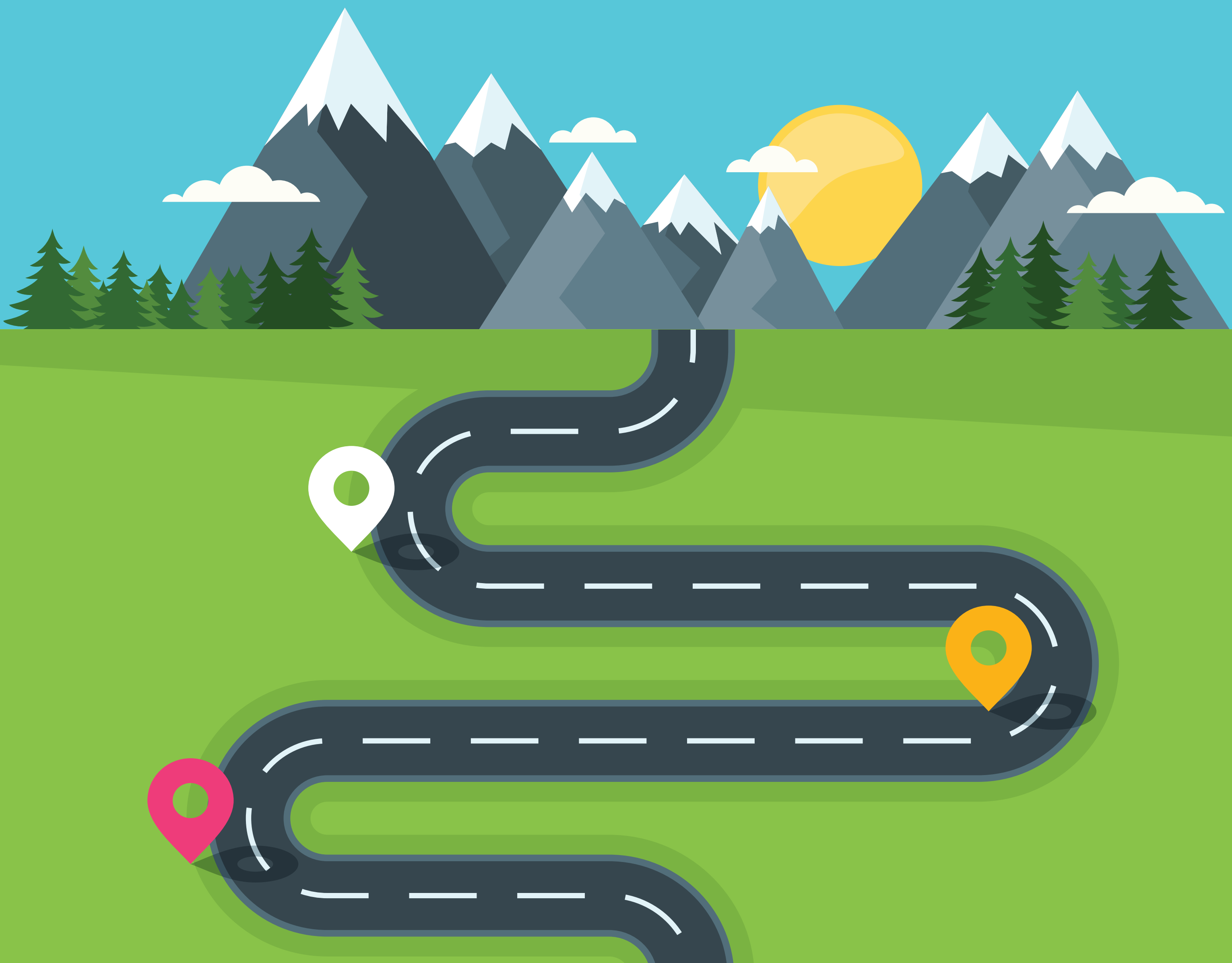

More than a decade ago, after comparing hundreds of classroom videos across five countries, researchers from the Trends in International Mathematics and Science Studies (TIMSS) made a disturbing observation about science lessons in the United States. U.S. classrooms, they said, commonly focused on "high-interest activities" (games, puzzles, excursions, humor, dramatic presentations, and so on) to increase student engagement—but teachers rarely used these activities to "support the development of content ideas in ways that were coherent and challenging for students."[1]

Moving Beyond Activity

These international studies reminded us that teaching is a cultural activity, and culture does not change easily. During the last 10 years, we've conducted research and worked with teachers in both elementary and secondary schools in planning instruction with less emphasis on activities and more emphasis on developing a coherent *lesson storyline*—the overall sequence or progression of lesson elements that helps students advance toward specific learning goals. Our observations suggest that "activity" and "engagement" are still the primary drivers of lesson content in many U.S. classrooms—not only in science, but also across other subject areas. But we've also found that teachers, with support and practice, can move beyond this focus on activity.

Here's an example. A group of high school English teachers wanted to teach students to revise their own writing with less attention to mechanics and more emphasis on clarity of written arguments. The teachers were developing a lesson to help students revise their first drafts of a research paper. One teacher proposed that they build the lesson plan around a new peer-revision strategy in which students would work in groups, with each student filling a specific role: the *reader* would read the paper aloud; the *commentator* would stop the reader to discuss specific errors of clarity or content; and the *recorder* would keep notes from the discussion and preserve any specific suggestions for improvement. The teachers' initial rationale for selecting this activity was that introducing more variety into the peer revision process would increase student interest and engagement. They also hoped it would help students pause and think more carefully about the revision process.

As we worked with these teachers, however, they realized that their initial lesson plan lacked a coherent storyline that would move students toward the lesson objective. For students to master the skill of revising their writing to clarify their arguments, the teachers needed to create a more thorough lesson plan to explicitly teach students what revising for clarity actually looked like.

U.S. classrooms commonly focus on "high-interest activities," but too rarely use them to develop content ideas that are coherent and challenging for students.

So the teaching team developed a sequence of exercises in which students would individually study a writing sample with a number of proposed revisions, rank these revisions on how well they improved the clarity of the sample's arguments, and justify their rankings. Then, in a whole-class discussion, teachers would discuss the sample revisions, noting particularly strong student justifications and modeling their own thinking as they ranked the revisions. The teaching team anticipated that this series of modeling and analysis tasks would help students understand the desired shift from mechanics to clarity of content.

The teachers would end the lesson with their original peer-revision idea of group role assignments (reader, recorder, commentator), but now with an explicit emphasis on helping students pause and think more carefully about the quality of their revision work. Teachers would instruct the group commentators to stop the readers whenever they noticed specific errors in clarity or content, drawing on their earlier whole-class

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discussion of sample revisions.

The teachers found that after they implemented this lesson, students' error recognition and attention to clarity improved. As the teaching team reflected on the lesson results, they agreed that without the development of a coherent lesson storyline that incorporated modeling and ranking exercises, the peer revision activity would have engaged students—but it would likely not have enabled students to achieve the lesson goal.

Establishing a Design Rationale

A coherent lesson storyline requires that teachers develop and articulate a *design rationale* for the lesson. As teachers construct and combine lesson elements and activities, they must consistently ask, How will this sequence of learning activities support the learning goal and advance students toward deeper understanding?

For teachers who have little or no experience articulating a design rationale, the connections between an instructional activity and the desired outcome are often assumed. The teacher may simply state, "Students will be engaged with ___, so they will understand ___," or "Because we carefully reviewed ___, students will understand ___." These rationales do not explain the complex thread of teaching and learning that is woven together through each lesson activity and component. But teachers can learn to create a more complete rationale.

Here's another example. We worked with a team of math teachers who were discussing ways to help students "visualize and understand the context of open-ended trigonometry problems" instead of memorizing solutions. They planned a lesson focused on solving right triangle problems with trigonometry and inverse trigonometry. At first, the teachers' discussions focused on increasing student interest in the content. To accomplish this, they planned to have students locate right triangles in architecture and other objects on the school campus; take pictures of the triangles; upload the images to an app called VoiceThread, which allows users to annotate uploaded images with recorded voice, text, audio, or video commentary; and analyze the triangles' unknown angles and side lengths using trigonometry and inverse trigonometry.

When the teachers first discussed the rationale for the lesson, they focused on how the high-interest activities would increase engagement. The teachers believed that getting students out of their seats to find triangles in their immediate surroundings would offer a change of pace, increase student interest, and make the mathematics concepts seem more relevant. They assumed that this increased engagement would increase students' ability to visualize and conceptualize solutions to inverse trigonometry problems. But when prompted to further explain their rationale, the teachers realized that engagement alone would not help students become fluent with these complex concepts.

The teachers shifted the focus of their discussion to the potential of VoiceThread, not just to get students excited about the activity, but also to enable students to explain and monitor their own thinking. After uploading the images of triangles they found and analyzing their lengths and angles, students narrated their problem-solving process while sketching out each of their mathematical steps with VoiceThread's integrated pencil tool. The teachers' central question became, How will students' preparation for annotating their right triangles help them learn the concepts? The new lesson rationale was that as students annotated solutions and recorded their commentary (in writing and speaking) for various right triangle images, they would actually be teaching the concepts to themselves and their peers.

In previous years, teachers had occasionally asked one or two students to demonstrate their problem-solving process on the board and questioned those students to elicit their thinking. Teachers hoped that other students would vicariously think through the process while they watched and listened to these examples from peers—but in actuality, only the presenters were engaged in the heavy lifting of articulating mathematical reasoning and receiving direct feedback to advance their understanding of trigonometry.

By incorporating the voice-overlay function in VoiceThread, teachers moved beyond the constraints of this traditional method. They directly engaged all students in narrating their mathematical ideas about the triangles and broadened the range of examples available for teaching core concepts, such as congruence, similarity, and symmetry. Student results exceeded teachers' expectations: 90 percent of students demonstrated effective use of "inverse trigonometry to find one missing angle," and 90 percent used the Pythagorean theorem to solve the remaining side.

As both the English and math examples illustrate, learning to develop and articulate a lesson rationale requires facilitation and practice. Figure 1 provides two more specific examples from teaching teams. One

FIGURE 1. From Incomplete Lesson Rationales to Advanced Rationales: Two Examples

Subject	Incomplete Rationale	Advanced Rationale
6th Grade Science	By being engaged in learning stations about the structures of the eye, students will better understand how these individual structures are related to their functions.	By giving students time to study the introductory video on their tablets, we will enable them to gain basic familiarity with the essential structures and functions of the eye. By engaging in learning stations about each of these structures, groups of students will further explore and discover the relationship between the specific structures and functions. Because these stations will break the eye into individual components, students will more easily relate each structure to its function. By using the Socratic method (questioning and dialogue) at each station, students will develop deeper understanding of the structure and function than they might through simply memorizing information.
High School Social Studies	By being taught the definition of *inference* and engaging in feedback with small groups, students will recognize and distinguish levels of inference.	By initially learning about the definition of *inference* through direct teaching, students will gain a foundation for recognizing and distinguishing levels of inference in their subsequent activities and writing. Whole-group modeling and categorizing will allow the teacher to guide and develop students' understanding and application of inference before they collaboratively write a paragraph in small groups. By writing a paragraph in groups, students will receive continued support from peers while increasing their responsibility for independently generating inferences and placing these ideas in paragraph form. As groups study and evaluate one another's paragraphs, students will better understand how their writing will be evaluated and will further develop their understanding of the nature and quality of inferences and connections in written text.

column shows an incomplete design rationale; the other column shows how teachers revised their original lesson design to produce a more thorough storyline, clarifying how the combined sequence of learning activities is expected to advance students toward the learning outcome.

What Professional Learning Communities Should Ask

Many of the teaching teams that we observe focus on isolated tasks, such as unpacking standards, designing assessments, analyzing student work, or reflecting on assessment results. When they discuss teaching, these teams often gravitate toward brief exchanges of so-called "best practices" and ideas for increasing variety and engagement. They rarely take time to articulate rationales for their instructional plans or to develop coherent lesson storylines that connect instructional activities with desired outcomes.

In contrast, professional learning communities or even pairs of teachers that are engaged in collaborative instructional inquiry or lesson study spend significant time planning, observing, and reflecting on the intricate elements of teaching. They work through a series of nuanced questions and tasks, such as the following:

- What do we want students to understand or be able to do at the end of this lesson or series of lessons? What evidence will we collect during and after the lesson to help us evaluate student progress and study the relationship between teaching and learning?
- What prior knowledge and background experience will students bring to this lesson? What will most students already know? What assumptions will they have? What common misconceptions might we expect? What related content or prerequisite knowledge will be covered before the lesson?
- What combination and order of learning activities will help students progress toward these learning goals? How will each activity connect and build on the previous activity? How will it pave the way for subsequent learning activities? What specific teacher and student roles for each activity will best facilitate the desired outcome?
- What does the evidence from observations and student work suggest about students' strengths and continuing needs? How did our instructional plan contribute to this, and what teaching is required to address continuing needs?
- What did we learn about our design rationale? How would we revise the rationale on the basis of our latest evidence and insights? How should we revise this lesson for future use? What key insights about teaching and learning did we gain from this lesson that might apply to our general teaching practice?

Learning to develop and articulate a lesson rationale requires facilitation and practice.

Start with a Few Lessons

Teachers are responsible for planning hundreds of lessons each year, and most of these lessons cannot be planned or analyzed with the level of detail described above. But teachers and teacher teams *can* strategically select a few key lessons for each unit or quarter and treat these as research lessons that they use to address the questions described here. As Hiebert, Morris, and Glass[2] explain, selecting a few lessons as experiments provides a systematic way to engage teachers in ongoing learning and improvement by focusing attention on, and making more explicit, the process of developing instructional plans, articulating the rationale for each activity, and testing and refining hypotheses about teaching and learning.

Just as a rich drop of food coloring gradually diffuses through water, this type of deep planning and reflection with selected lessons has a rich, permeating effect on practice. It shifts the emphasis from cursory selection of activities and spontaneous classroom decisions to careful analysis of cause-and-effect relationships and coherent instruction. EL

[1]Roth, K., & Garnier, H. (2006). What science teaching looks like: An international perspective. *Educational Leadership, 64*(4), p. 20.

[2]Hiebert, J., Morris, A. K., & Glass, B. (2003). Learning to learn to teach: An "experiment" model for teaching and teacher preparation in mathematics. *Journal of Mathematics Teacher Education, 6*(3), 201–222.

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