SCREENCASTING TO SUPPORT EFFECTIVE TEACHING PRACTICES

Vignettes from three classrooms—with access ranging from a single teacher tablet to one-for-one student devices—show how technology can aid learning.
Increasing availability of digital devices in elementary school classrooms presents exciting new opportunities for teachers to support the teaching and learning of mathematics. Although many of the math applications available for these devices focus on drill and practice of mathematical procedures, screencasting apps can help support effective teaching practices that promote problem solving and deeper learning of elementary mathematics.

To support and facilitate student learning of meaningful mathematics, *Principles to Actions: Ensuring Mathematical Success for All* (NCTM 2014) articulates a research-informed framework of effective teaching and learning practices, guided by six principles. Here, we explore three vignettes of practice that highlight affordances of screencasting applications in alignment with the NCTM Tools and Technology Principle, which states,

An excellent mathematics program integrates the use of mathematical tools and technology as essential resources to help students learn and make sense of mathematical ideas, reason mathematically, and communicate their mathematical thinking. (p. 78)
The vignettes in this article specifically relate to the three practices identified and described below.

**Three of eight Effective Teaching and Learning Practices from Principles to Actions: Ensuring Mathematical Success for All (NCTM 2014, p. 10)**

<table>
<thead>
<tr>
<th>Mathematics Teaching Practice</th>
<th>Description</th>
<th>Vignette</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitate meaningful mathematical discourse.</td>
<td>“Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments” (p. 29).</td>
<td>Screencasting with a teacher device</td>
</tr>
<tr>
<td>Use and connect mathematical representations.</td>
<td>“Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving” (p. 24).</td>
<td>Screencasting with shared student devices</td>
</tr>
<tr>
<td>Elicit and use evidence of student thinking.</td>
<td>“Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning” (NCTM 2014, p. 53).</td>
<td>Screencasting with one-to-one student devices</td>
</tr>
</tbody>
</table>

These vignettes specifically relate to the three Effective Teaching and Learning Practices (NCTM 2014) identified and described in table 1.

**What is screencasting?**

Screencasting captures audio from those using the app as well as video of what is written or presented on the screen. Popular screencasting apps and online tools, such as ShowMe®, Educreations, Explain Everything®, ScreenChomp®, Knowmia®, and others, provide interactive whiteboard tools for tablets, with the added capabilities of importing images, documents, and other objects. The resulting video has the potential to document the process of what students write and say as they engage in mathematical problem solving. Screencasting tools present an opportunity to leverage technology for communicating mathematics and capturing students’ mathematical process rather than just their written product—capabilities that open up a variety of opportunities. This article highlights how screencasting might be leveraged for teaching and learning mathematics in classrooms that differ in terms of their access to technology, classrooms with (1) a single teacher tablet or device, (2) shared devices for students, and (3) one-to-one devices for each student.

**Screencasting with a teacher device**

The first vignette describes how a kindergarten teacher with limited technology access uses screencasting to facilitate mathematical discourse in a lesson focused on decomposing the number 5. The following description, discussion excerpt, and photos of student work illustrate how Mrs. Lester uses screencasting on a single mobile device to support student learning.

In Lester’s kindergarten classroom, children work at their seats with colored counters to decompose the number 5 into number combinations to later be connected with addition equations. Student desks are arranged in groups of four, but students begin the task working individually. Each child receives a tray of manipulatives, counts out five, and then uses his or her “break-apart stick” to decompose 5 into two addends. As Lester monitors students’ work, she asks those who are finished to compare their work with a neighbor’s. She
Bailey: Well, Andre had one and four, but I had four and one—so they aren’t the same thing.

Teacher: Is there another way you could represent the difference between what Andre and Bailey did? Anyone? Dan? Bailey, will you hand the iPad® to Dan, please?

Dan: Andre had one and four, which was one plus four equals five \[ \text{pointing at Andre's addition equation and work, then scrolling to Bailey's work} \], but Bailey had four and one, so the equation is four plus one equals five \[\text{writing the addition equation on the picture of Bailey's work } \text{(see fig. 2)}].

Teacher: I see. So Dan just explained two addition equations for Andre’s and Bailey’s pictures. But Andre, when I was at your table, you thought that they were the same. Can you explain what you meant by that?

Andre: I think that they are the same, kind of, because mine is one plus four and Bailey’s is four plus one, and they are the same numbers that both equal five \[\text{scrolling between the two} \].
A frame from each of Mr. Flint’s six videos accompanies a description of the subtraction strategy.

(a) A student used a counting strategy with images of base-ten blocks.

(b) This shows a counting strategy with ten-frames.

(c) Incorrectly applying the think-addition strategy (Van de Walle et al. 2016), this student compensated by adding one instead of subtracting one.

(d) Students in this small group used the standard subtraction algorithm.

(e) The bar model below includes counting with tally marks.

(f) Someone represented the think-addition strategy on a number line.

images and pointing at the screen to provide visual support for his argument.

Screeencasting supports Lester in facilitating mathematical discourse by displaying images of students’ approaches with manipulatives for analysis and comparison. Much like an interactive whiteboard, projecting images of student work from the screeencasting app allows students to refer and add to their own work, while explaining their thinking to the rest of the class. When wireless projection is available,
the portability of the tablet also allows students to present from their seat, which some teachers and students might find preferable.

**Screencasting with shared student devices**

In this second vignette, Mr. Flint’s second graders share devices as they use and connect mathematical representations and strategies for subtraction with two-digit numbers. The following description and examples of student work illustrate how he incorporates screencasting to prompt and facilitate small-group discussions and to support his own implementation of the five practices for orchestrating productive mathematics discussion (Stein and Smith 2011).

Flint’s second-grade class has six tablets to share among twenty-four students. Before class, he prepared six short screencasts that demonstrate strategies and representations for subtracting two-digit numbers. At the beginning of class, he poses the following subtraction problem to students:

Evie had a bag with 48 candies. She shared some with her friends, and now she has 19 candies left. How many candies did Evie share with friends?

Flint asks students to solve the problem on their individual whiteboards. He circulates around the room to view students’ responses and strategies. While he observes students’ strategies and representations, he selects students to work together in groups of four. Each group receives a tablet and is instructed to open the screencasting app and choose a file that Flint prepared before class (see fig. 3).

Each group watches the screencast video that shows and explains how a fictitious student represented and reasoned about the same subtraction problem that students had just solved. Students can watch, pause, and review the video files that the teacher prepared, and they are able to not only see the fictitious student’s representations but also hear the verbal explanation for those representations and problem-solving strategies. Each group is asked to make sense of the representation and strategy described in the video and to evaluate the accuracy of its results.

After all groups have watched and discussed their assigned video, Flint transitions the class back to a whole-group discussion during which each group describes and justifies the representation shown in their video. Before class, Flint had already decided on the sequence of videos that would best meet the mathematical goals of the lesson. As groups explain their video’s representation, the rest of the class is asked to compare the video’s representations to what they did individually to solve the problem. At the conclusion of the discussion, Flint assesses students’ understanding by asking the class to solve a different subtraction problem using a representation of their choice.

Flint’s screencasts encourage students to use and connect mathematical representations. Particularly for early-career teachers or those who are new to discourse-rich mathematics classrooms, this use of screencasts allows for purposeful selection and sequencing of representations in advance, rather than more in-the-moment decisions that may be challenging and unpredictable. The use of screencasting in this vignette also ensures that students have the opportunity to consider a wide variety of representations, which may or may not have emerged from students’ own solution strategies.

**Screencasting with one-to-one student devices**

The third vignette includes examples of student work and an account of screencasting in Ms. Hernandez’s third-grade classroom. Every
In a lesson focused on multiplication story problems, screencasts serve as a tool for eliciting and using evidence of student thinking. Hernandez teaches in a school that invested in tablets for each student. The school had purchased new printed textbooks two years earlier, and teachers tend to use their curriculum resources daily. Administrators encourage teachers to integrate the devices with the existing print curriculum as often as possible.

Hernandez decides to enhance the curriculum materials with an extension activity focused on multiplication. She uses screencasting as a way to capture individual students' mathematical reasoning and processes.

Hernandez's class has been learning about multiplication through story problems. She begins her lesson by asking students to individually make up a story problem that can be solved using one-digit multiplication and then solve the problem on their whiteboard. She notices that some students accurately write and solve their multiplication problems but document only the multiplication equation. Other students draw pictures to help them solve the problem but do not connect the picture with a multiplication equation.

Hernandez decides to use screencasting to gather more evidence about students' solution strategies. She displays her screen to the class and demonstrates how to write, draw, and record in the screencasting app. After this introduction to the technology, Hernandez invites students to spend a few minutes exploring and familiarizing themselves with the screencasting app. She asks them to type their story problems into the screencasting app. As students work, Hernandez circulates around the room to ensure that problems do indeed involve multiplication and that they are appropriate and accessible to students. She then instructs students to press record in the screencasting app and solve the problem using whatever strategy makes the most sense. She encourages students to draw pictures, diagrams, or equations, and she emphasizes how important it is for them to explain their reasoning aloud as they work. Students are asked to stop recording and save their videos when they are finished (see figs. 4 and 5).

When all students have finished solving their multiplication story problems and have saved their videos, Hernandez explains and demonstrates how to upload the videos to the class YouTube™ channel. Students are then asked to view a peer's screencast and comment with one question or constructive suggestion for the screencast's author. Referring to Kalyn's work (see fig. 4), a peer asks, "How do you know this is a multiplication problem? Because it looks like you used addition to solve it." During this exercise, students are "asking questions, responding to, and giving suggestions to support the learning of their classmates" (NCTM 2014, p. 56).

After class, the teacher views students' screencasts. Although she monitored and checked students' story problems and solution strategies during class, she is now able to see and hear students' full solution strategies and explanations. For instance, she finds that although Zara's written solution appears to indicate a known fact, Zara used skip counting by twos to...
tools can support effective practices in a variety of elementary school mathematics classrooms. In general, technology can and should be used to amplify current mathematical goals and practices, such as facilitating communication, presenting new ideas, and documenting student reasoning. When elementary school teachers use screencasting strategically, they support the Tools and Technology guiding principle “to help students make sense of mathematics, engage in mathematical reasoning, and communicate mathematically” (NCTM 2014, p. 78).

**References**


Amanda Thomas, amanda.thomas@unl.edu, is an assistant professor of mathematics education at the University of Nebraska–Lincoln. Dr. Thomas works with practicing and prospective elementary school teachers, and her research focuses on classroom use of technology to support mathematics teaching and learning.

---

**Extensions and other applications**

These three vignettes highlight possibilities for using screencasting to support specific teaching and learning practices as described in Principles to Actions (NCTM 2014). Additional uses of screencasting in elementary school mathematics classrooms include collecting evidence and artifacts of student work for portfolios and parent-teacher conferences, formatively assessing student learning, “flipping” the classroom, and documenting students’ project-based work. Screencasting is also a strategic tool for supporting and assessing the Common Core’s (CCSSI 2010) Standards for Mathematical Practice (SMP). Consider, for instance, how screencasting might support students as they engage in the following practices: SMP 4, *Construct viable arguments and critique the reasoning of others*, or SMP 2, *Reason abstractly and quantitatively*. 

**Enhancing lessons even with limited technology**

Expanding student access to powerful digital tools presents new and exciting opportunities for teaching mathematics, but even when access to technology is limited, screencasting on a single device can enhance elementary mathematics lessons. These three vignettes of screencasting offer examples of how digital tools can support effective practices in a variety of elementary school mathematics classrooms. In general, technology can and should be used to amplify current mathematical goals and practices, such as facilitating communication, presenting new ideas, and documenting student reasoning. When elementary school teachers use screencasting strategically, they support the Tools and Technology guiding principle “to help students make sense of mathematics, engage in mathematical reasoning, and communicate mathematically” (NCTM 2014, p. 78).