Interactive Technology in Math and Science

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Time Frame 120-135 minutes

Essential Question(s)

How can I incorporate interactive technology into my instruction to enhance student learning?

Summary

This professional development activity is designed with math and science teachers in mind. Its aim is to provide teachers with research and an action plan for incorporating interactive technology, such as simulations and models, as an instructional tool. Simulations and Models in Math and Science Conversations is a related activity.

Learning Goals

- Participants will apply research-based practices to support the use of interactive technology, such as simulations and models, in curriculum.
- Participants will explore the effects of interactive technology on student learning.

Attachments

- Concept-Map-Cards-1-set-per-page-Interactive-Technology-in-Math-and-Science.docx
- Concept-Map-Cards-1-set-per-page-Interactive-Technology-in-Math-and-Science.pdf
- Concept-Map-Cards-2-sets-per-page-Interactive-Technology-in-Math-and-Science.docx
- Concept-Map-Cards-2-sets-per-page-Interactive-Technology-in-Math-and-Science.pdf
- Instructional-Strategy-Note-Sheet-Interactive-Technology-in-Math-and-Science.docx
- Instructional-Strategy-Note-Sheet-Interactive-Technology-in-Math-and-Science.pdf
- Presentation-Slides-Interactive-Technology-in-Math-and-Science.pptx
- What-So-What-Now-What-Interactive-Technology-in-Math-and-Science.docx
- What-So-What-Now-What-Interactive-Technology-in-Math-and-Science.pdf

Materials

- Presentation Slides (attached)
- Instructional Strategy Note Sheet (attached, one per participant)
- What? So What? Now What? handout (attached, one per participant)
- Concept Mapping card sets (attached, one set per group)
- Determining Probability With Candy (linked, one per participant)
- Determining Spinner Probability (linked, one per participant)
- Poster paper
- Markers
- Tape
- Devices with internet access for participants

Engage

Display **slide 2** from the attached **Presentation Slides**. Introduce the session topic and yourself.

Display **slide 3**. Introduce the goals for the session.

Presenter's Note: Technology Integration

Some teachers see technology as difficult or frivolous to incorporate into instruction, but there is legitimate research supporting the use of technology that students can interact with as an effective instructional tool. Technology also can be integrated fairly easily into lessons without significant extra planning on the part of the teacher. The purpose of this activity is to introduce teachers to the research behind interactive technology and allow them time to plan for its inclusion in their instruction.

Display **slide 4** and ask participants to get out their internet-connected devices. Participants will interact with the PhET simulation Plinko Probability. They can access the simulation by opening a web browser and entering the bit.ly link provided on the slide.

From the simulation site, select the Intro option. Invite participants to do the same to follow along on their own devices. Ask them to predict which bin they think one ball will land in and ask them to justify their prediction. Allow one ball to fall through. Discuss who was correct and incorrect, and then ask participants where they think the majority of the next 10 balls will fall. Allow 10 balls to fall through, and then discuss the results.

Switch to the Lab option and have participants do the same on their devices. Invite one participant to come to the front. Ask the participant to select one of the following challenge options to attempt:

- Have the most balls fall in the exact center. (Bonus points for all the balls to fall in a single bin!)
- Have every ball fall in one of the bins on the right side, or have every ball fall in one of the bins on the left side.
- Run a trial as close to the "ideal" as possible.

Allow participants time to work independently to select and interact with a challenge in the simulation. Afterward, bring the group back together and ask the following questions:

- What variables did you consider when attempting to complete the challenges?
- Did running more trials help or harm your ability to make predictions?
- From your teacher perspective, how successful would this activity be in your classroom?

Give participants copies of or links to the following handouts: **Determining Probability With Candy** and **Determining Spinner Probability**. After giving participants a few moments to review the handouts, ask them, "What did the simulation have to offer that the handouts don't?"

Transition Opportunity

Look for participant responses to the question that provide a transition opportunity toward a discussion of what interactive technology can do to enhance student learning.

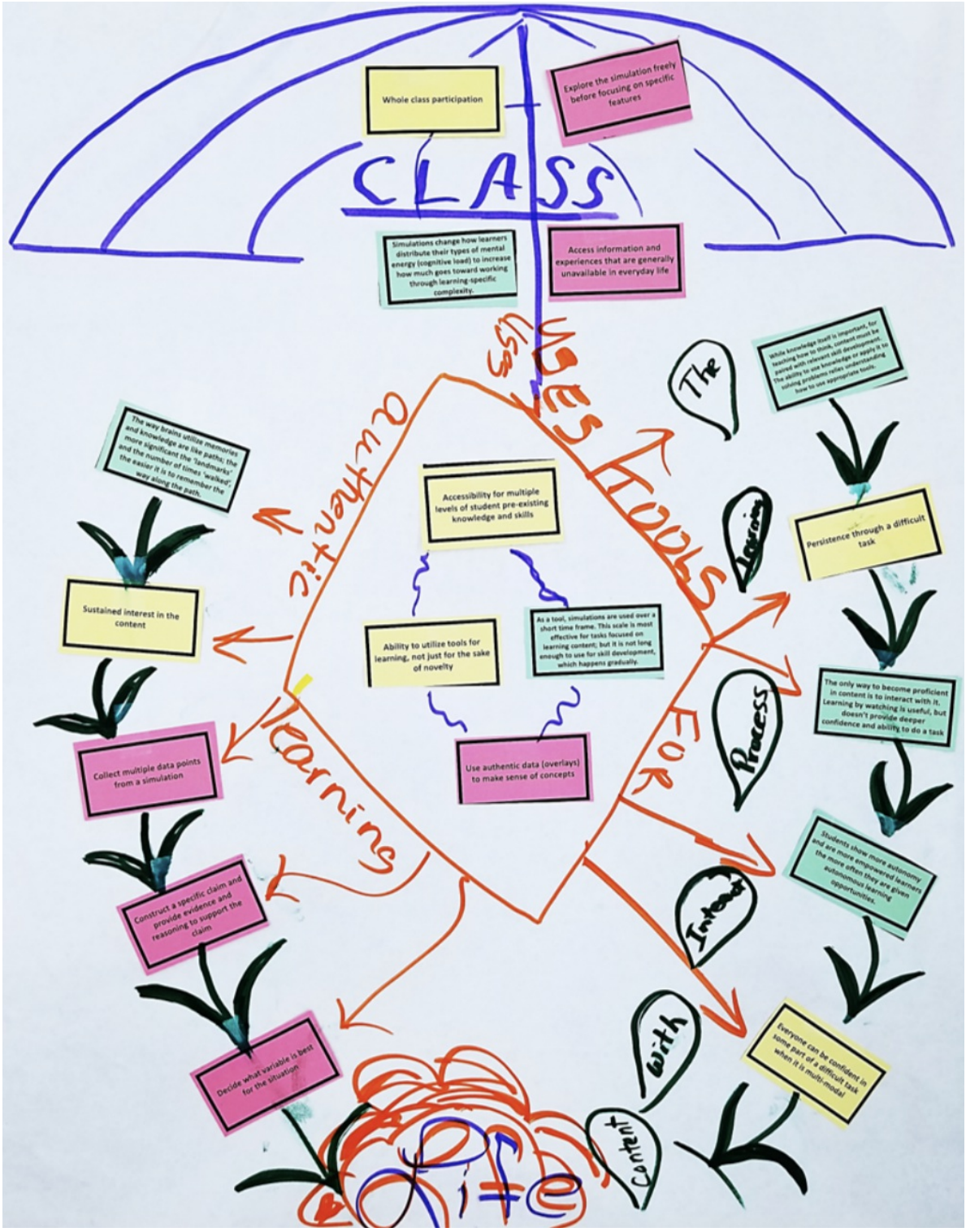
Explore

Presenter's Note: Preparation

The attached **Concept Map Cards** need to be printed, cut out, and bundled before the facilitation of this activity. There are two versions of these cards attached, with either two sets per page (one set has six cards per color/concept) or just one set per page.

If you are facilitating a two-hour professional development and are concerned about time, you could shorten the activity by giving each group only half of the concept cards (three of each color/concept) using the version with one set per page. For congruency with the concept colors on the Presentation Slides, copy the first page of cards on yellow paper, the second page of cards on pink paper, and the last page of cards on green paper.

Go to **slide 5**. Pass out the Concept Card Map cards to groups of three participants. Also provide each group with a sheet of poster paper, tape, and a marker. Invite groups to arrange the concept cards to show the connections they believe exist among the ideas presented. They should tape the cards down when they are happy with their map. Participants should then add arrows and labels to the poster paper to indicate how the concepts on the cards influence and interact with one another.



Concept Card Map example

Explain

Go to **slide 6**. Invite groups to find a place to post their Concept Card Map. Participants will complete a Gallery Walk to view the other maps around the room. This is an opportunity for participants to deepen their understanding of the research that supports technology as it relates to students' experiences and the specific tasks they are engaging in during the session.

Draw the participants' attention to the topic that each color of card represents (yellow = student experience or impact, pink = task element, green = research). Pose the following questions for participants as they formulate things they notice and wonder on their Gallery Walk:

- How do the other groups' Concept Card Maps compare to your group's?
- How are the three colors of cards related in the Concept Card Maps?

Presenter's Note: Time Constraints

If time becomes a concern in this activity, have groups view only one other poster as opposed to every group's.

After the Gallery Walk, invite participants to briefly share out of some of the things they noticed and wondered.

Go to **slide 7**. Discuss the major points of the research regarding simulations, virtual reality, and other interactive technology formats on the continuum. Address any specific questions and concerns participants might have at this point.

Transition into the Extend portion of the session by asking participants the following questions:

- What idea from the Concept Card Map do you feel most comfortable with?
- What idea might be the most difficult to implement?

Extend

Go to **slide 8**. Participants will use the What? So What? Now What? strategy to create a plan for integrating interactive technology into their instruction and will proactively address any obstacles that might keep them from doing so. Pass out copies of the attached **What? So What? Now What?** handout.

Pose the "What?" question for participants to consider the obstacles that could get in the way of their using interactive technology in the classroom (e.g., classroom layout or student behavior). Allow time for participants to discuss this question in their groups. Return to the whole group and solicit responses.

Go to **slide 9**. Pose the "So what?" question for participants to consider practical solutions or procedures they could use to address the obstacles that they identified. Allow time for participants to discuss in their small groups. Solicit responses from the whole group.

Evaluate

Go to **slide 10**. Pose the "Now what?" question for participants to develop an action plan that identifies how they will use what they've learned today with considerations from their "What?" and "So What?" responses.

Allow time for participants to each formulate a plan, and then discuss their plans in their groups. After their small-group discussions, invite any volunteers who want to share out to present their action plan for using interactive technology in the classroom.

Go to **slide 11** and pass out copies of the attached **Instructional Strategy Note Sheet**. Give participants time to use the sheet to reflect on how the various instructional strategies were used in today's session and how they might use them in their own classrooms.

Go to **slide 12**. Thank everyone for their participation and wrap up the session.

Follow-up Activities

The Simulations and Models in Math and Science and Conversations activity is a closely related professional development session that could be used to follow up on the topic of interactive technology. It includes a more complex simulation than Plinko Probability that is designed to empower participants to continue building their simulation and model toolbox.

Research Rationale

A major component of authenticity in education is a basis in the real world. While the direct observation of phenomena is not always readily accessible, virtual simulations and models allow educators a wealth of options. Games, simulations, and virtual worlds are shown to be effective in improving learning outcome gains (Merchant, Goetz, Cifuentes, Keeney-Kennicutt, & Davis, 2013). Findings have also indicated a significant difference in the performance achievement between students using desktop virtual reality and control groups (Lee & Wong, 2014).

Resources

- CommonCoreSheets. (n.d.). Determining probability with candy [Handout]. Math. https://www.commoncoresheets.com/Math/Probability/Determining%20-%20Candy/English/All.pdf
- CommonCoreSheets. (n.d.). Determining spinner probability [Handout]. Math. https://www.commoncoresheets.com/Math/Probability/Determining%20Spinner%20Probablity/English/All.pdf
- K20 Center. (n.d.). Concept card mapping. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f505c351
- K20 Center. (n.d.). Gallery walk/carousel. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f505a54d
- K20 Center. (n.d.). Simulations and models in science and math conversations. Activities. https://learn.k20center.ou.edu/pd/fc74060730ea745c8c4f356aa2076b35
- K20 Center. (n.d.). What? So what? Now what? Strategies. https://learn.k20center.ou.edu/strategy/b30762a7557ba0b391f207f4c6002113
- Lee, E.A., & Wong, K.W. (2014). Learning with desktop virtual reality: Low spatial ability learners are more positively affected. Computers & Education, 79, 49-58.
- Merchant, Z., Goetz, E.T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T.J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. Computers & Education, 70, 29-40.
- PhET. Plinko probability. https://phet.colorado.edu/sims/html/plinko-probability/latest/plinko-probability_en.html