Professional Development Situation: Virtual Training
Skill Focus: Reflecting and Processing Experiences
Time Required: 95 minutes

SEEING PATTERNS

Participants will learn how to help youth reflect and process experiences with patterns and trends in data to assist them in computational thinking.

Agenda

Welcome & Introductions – 10 minutes

Define Pattern Recognition – 5 minutes

Hands-On Learning – 30 minutes

- Artificial Intelligence Activity (pg. 31-34)

Discussion – 15 minutes

Analyze Data – 15 minutes

Describing Patterns – 5 minutes

The Reflective Process – 15 minutes

Computational Thinking – 5 minutes

Conclusion – 5 minutes

Materials

- Documents/Links:
  - AI Worksheets (pg. 9-10 of this guide)
  - The Reflective Process Handout (pg. 11-12 of this guide)
  - Code Your World Facilitator Guide: https://4-h.org/wp-content/uploads/2018/08/2018_nysd_facilitators_guide-DEV4-one-page-print.pdf
  - Click2ComputerScience self-directed learning on Develop or Improve Your Computer Science Program.

- For Presenter:
    - Computer with internet connection, camera and speakers
    - Paper and pens/pencil for notes
    - Headphones are recommended
- For Participants
    - Computer with internet connection, camera, and speakers
    - 1 dice (if doing in person 1 dice for each group)
    - 1 coin (if doing in person 1 coin for each group)
    - Paper and pens/pencil for notes

Before the Session

- **Read this training guide** to familiarize yourself with the content and to personalize the activities to best suit your style. Watch all videos and read informational materials.
    - *Italics indicate text that can be read aloud or emailed to participants.*
- Send a reminder email about the meeting. Determine if any participants require accommodations (sight; hearing; etc.). You can set up a meeting and send an email about the meeting through Zoom. The following should be included with the Zoom invite you send.
    - *The next professional development opportunity to enhance our STEM skills will be on DATE at TIME. Our focus for this session will be "Seeing Patterns". This is a virtual training, so before we begin the session, gather the materials and print the attached handouts.*

      You will need a computer with an internet connection, a camera and speakers or headphones. Please try to avoid calling in on a phone. You will not be able to participate fully in the training with a phone.

      We will be using Zoom (or another video conferencing tool) *for this training. Be sure you have Zoom installed on your computer before the session. The Zoom help center has instructions for joining a meeting and using Zoom.*

      Please have paper and a pen or pencil for taking notes and a dice and coin collected before the meeting.

      There are three attachments to print. You should not fill them out before the session—we will do that during the training.
        - AI Worksheets
        - The Reflective Process Handout
        - Code Your World Facilitator Guide

Let me know if you require any accommodations to participate in the training. I am happy to answer any questions you have and look forward to seeing you at the workshop. I can be reached at CONTACT INFO. [If you are doing an in-person training, adjust the email accordingly.]

- Gather all materials and download handouts before the session to use as visual aids if necessary.
- Test your audio and video equipment.

Training Outline

Welcome. Introduction, and Explanation of Zoom (10 min)

- Greet participants as they join the meeting and ask them to introduce themselves in the chat by sharing their name and where they are from. Encourage everyone to turn on their video. You may want to record the training, especially if someone is absent.
- Introduce yourself and the topic for this training: "Seeing Patterns".
    - *Today, we may be using Zoom (or another platform you've selected) in ways you may not have experienced before. We are going to [what you say will depend on the size of your session, options listed blow]*
- **If you have less than 12 participants**, have each person introduce themselves and share one expectation or hope for today's workshop as you say their name. This will assist people in knowing when it their turn to speak.
- **If you have 12 or more participants**, explain how breakout rooms work. Explain that everyone will introduce themselves and share one expectation or hope for today's workshop in their breakout room. Tell them you will bring them back from their breakout room in 8 minutes.
    - After 6 minutes, use the "Broadcast a message to all" button and tell the participants they have 2 minutes left to finish introductions.
    - After 7 minutes, click the "Close All Rooms" button. This will give each breakout room a 60-second countdown and will automatically end the breakout session and return them to the main room when the timer ends.
- Direct participants to https://support.zoom.us/hc/en-us/articles/115005769646-Participating-in-Breakout-Rooms if they need help with the breakout rooms.

Define Pattern Recognition (5 min)

- Ask participants:
    - *What is a pattern?*

- Facilitate a discussion of patterns in any context (i.e. quilting, math, cooking, etc.)
    - *Patterns are things that repeat. A dictionary definition is a repeated decorative design or an example for others to follow.*
- Discuss:
    - *What could pattern recognition mean in computer science?*
- Pattern recognition involves finding patterns among small, decomposed problems that help solve more complex problems efficiently.
- Pattern recognition is one of the four cornerstones of computer science
- Discuss:
    - *Why is pattern recognition important for youth to learn?*
- There can be several different answers here including using pattern recognition to read faster, being better at math, identifying people, retrieving objects or finding your way around a city. A computer scientist could program a device to be able to do these things and pattern recognition could help in doing the programming.

Hands-on-Learning with Artificial Intelligence Activity (30 min)

- *Now we are going to do a hands-on activity from the 2018 National Youth Science Day (NYSD) Challenge, Code Your World. The activity is called Artificial Intelligence.*
- *What do you think of when you hear the term artificial intelligence?*
- Possible Answers: Some famous examples include IBM's Deep Blue or Watson. Deep Blue was the first AI to beat a human Grandmaster chess player, and Watson beat the "Jeopardy!" game show champion. AI chess players. A "chatbot" that can have a conversation with you on a company web site. Spam filters that keep unwanted emails out of your inbox.
    - *An artificial intelligence (AI) is something that can make rational decisions, usually when solving one specific kind of problem. We may interact with a lot of AI without realizing it. Most AI systems are built using computers, but an AI is anything we create to follow rules, make choices, and make a decision. There are now AI systems that can drive cars.*
- Have participants find their handout, AI Worksheets.
- Share a link to the Code Your World Facilitator Guide.
    - *We are going split up into breakout rooms and work in groups of four to complete the activity. You will have 25 minutes to do parts 1 and 2 of the Artificial Intelligence activity, found on page 31-34 of the Code Your World Facilitator Guide. In this activity, you will play rock, paper, scissors with a partner and then use dice and coins to play against an AI. Use the AI Worksheet to record your data so that you can share it with the whole group. Make sure you fill out the entire worksheet.*

- *You will need your worksheet, a dice and a coin. Start out on page 31 and decide who will be partners. Do the activity step-by-step with your partners.*
- *Record your results on the handout to discuss when we come back together. Come back to the main room when you get finish page 34.*

- Divide participants into break out rooms (4 per room) and move between the rooms answering questions. Use "broadcast message to all" to let participants know when 5 minutes remain. When one-minute remains click the "close all rooms" button and the rooms will automatically close in one minute.

Discussion (15 min)

- Process experiences with the AI activity. There may be additional questions you want to ask your group if they struggled with a particular part of the activity to make sure they understood what they were doing. See page 35 of the Code Your World Facilitator Guide for tips on reflecting and processing this experience
  - *Now let's take some time to process what we experienced.*
  - *Is there a pattern you can predict when you roll the dice?*
  - *Does the coin flip AI make fair choices among rock, paper and scissors?* Answer is no
  - *Do you think both strategies generate the same patterns in the choices? How could we find out?*
  - *Playing all those rounds of Rock, Paper, Scissors to record the results is called data collection, and it's an important part of computational thinking. Doing the math to find the percentages is called data analysis.*
  - *Computer scientists might write code to have two computer–based artificial intelligences play against each other billions of times, and record and analyze the data very quickly using a computer program.*

Analyze Data (15 min)

- *Now we will extend the AI activity and look more closely at the data we gathered by flipping coins and rolling die. We discussed earlier if there were any patterns that you noticed in looking at your own data. Now we are going to merge out data to generate larger data sets and see more data helps us see patterns.*
- *In your breakout room, share your data and complete part 2 of the AI worksheet to tally everyone's data. Then total up how often your AI chose rock, paper and scissors and convert it to a percentage. Do the same for the coin tosses. Discuss what patterns you see. Be ready to share your percentages when the whole group comes back together.*

- After giving instructions, send participants into two breakout rooms to combine their data and discuss their findings. If you are doing this training in person divide the room in half.
- Move between the rooms answering questions.
- Use the "broadcast message to all" button to let participants know when 3 minutes remain. When one-minute remains click the "close all rooms" button and the rooms will automatically close in one minute.

Describing patterns (5 min)

- As the group comes back together, encourage each breakout group to share what they discovered in that chat.
- Discuss:
    - *What questions do you still have? How did the results differ for each AI? Why? How could we make a better AI for Rock, Paper, Scissors?*
- After discussing the data and the possible patterns that emerged, it is important to connect participants learning to the real world and allow them to apply what they are learning.
- Discuss:
    - *What patterns do you see in everyday life?*
- Possible answers: art, architecture, colors, nature, Fibonacci sequence
- Ask participants:
    - *How does being able to recognize patterns help you in your everyday life?*

The Reflective Process (15 min)

- Have participants find their handout, The Reflective Process.
- Discuss:
    - *How does this process reflect the Artificial Intelligence activity and discussion we had today? Did our activity skip some of these phases?*
- Make it clear that there may be times that you don't cover each part of the process.
    - *Think about how much time we spent on the activity, and how much time we spent discussing, analyzing our data and describing patterns. Where do you feel like the learning was for you in this experience?* (Pause for feedback.) *Does it make sense to spend as much time reflecting and processing your experience as you do in the experience itself if many of us felt we learned more after we finished the hands-on part of the activity?*

- *We often rely on discussions when it comes to reflecting and processing experiences. A large group discussion is probably the easiest way for you, as a facilitator, to learn what all your participants are thinking – but it may not be the best way for individuals to process their experiences. And – especially in afterschool – it is not very productive to have all the reflection at the end of the activity because you will have participants leaving throughout the activity. So, what are our options? Let's brainstorm different strategies for reflecting and processing computer science learning experiences. Please share your ideas in the chat. That will make it easy for me to capture and share those ideas with the whole group.* (Pause so participants can type.)

- Potential strategies include: Science Journaling, writing or drawing; Explaining to others what happened; Demonstrating the solution you've developed; Create a marketing pitch for the solution you've developed

Computational Thinking (5 min)

- Now, I want to step back and review what we've covered today because we've been learning about both strategies to facilitate learning and computational thinking strategies.
  - *Computational thinking is a way of thinking in STEM, like the engineering design process, that helps solve problems. Specifically, it is the process of devising solutions that a computer can execute. However, you don't have to use computers to learn about computational thinking practices. The strategy we've explored today is pattern matching. Pattern Matching describes the thinking practice of finding similarities, or patterns, between things. Before we finish up, does anybody have observations they want to share about computational thinking or pattern matching?*
  - *What is the value of youth being able to find patterns?* (Pause so participants can type.)
  - *What other activities have you done that help youth explore patterns in computer science?* (Pause so participants can type.)

Conclusion (5 min)

  - *I will share these great ideas with you in my follow-up email, but right now, I want everyone to take a couple minutes to scroll through the chat, read each other's responses and comment on them. You can make your chat window larger so that it is easier to read.*

- Pause so participants can read and type.

- Comment on ideas shared as appropriate and as time allows.
    - *Thank you for being active participants in today's virtual training. We learned how to find patterns and see trends in data to assist in writing algorithms in computer science. We practiced reflecting and processing learning experiences and brainstormed strategies we can use. For more ideas and suggestions about developing a computer science program you can refer the self-directed learning on Click2ComputerScience Develop or Improve Your Computer Science Program. Following the session, I will share the notes from our brainstorming and discussions today. Please stay online for a few minutes if you have any questions for me.*
- Answer any final questions participants may have.
- **Remember to save the chat** before you close the meeting.

After the Session

- Compile ideas from the chat boxes.
- Within two weeks of the training, send an email to participants with the message below and the lists they generated in the workshop.
    - *Thank you for your participation in the recent Click2Science training on "Seeing Patterns". I hope you found it useful. For more ideas and suggestions about developing a computer science program you can refer the self-directed learning on Click2ComputerScience Develop or Improve Your Computer Science Program. Consider meeting with a co-worker, supervisor, or friend to share what you learned.*

      I look forward to continuing our learning at the next session on SKILL/FOCUS on DATE at TIME at LOCATION. Please let me know if you have any questions. I can be reached at CONTACT INFO.

Want to Earn Credit? Click2Science has teamed up with Better Kid Care to provide continuing education units. Check it out at: http://www.click2sciencepd.org/web-lessons/about

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AI Worksheet Part 1

Results of 15 dice rolls (number rolled)	What the roll meant (rock, paper, of scissors)	Results of 15 sets of coin flips	What the flip meant (rock, paper, of scissors)

AI Worksheet Part 2

Dice rolls

Number of times 1 was rolled		**Number of times the AI chose rock**	
Number of times 4 was rolled			
Number of times 2 was rolled		**Number of times the AI chose paper**	
Number of times 5 was rolled			
Number of times 3 was rolled		**Number of times the AI chose scissors**	
Number of times 6 was rolled			

Coin Flips

How many times did the AI choose rock?	
How many times did the AI choose paper?	
How many times did the AI choose scissors?	

The Reflective Process

When facilitating the Reflective Process (with learners or facilitators), the following sequence is suggested as a way to create an expectation of participation and sharing among individuals.

Each person should be asked to answer each question before the next question is asked of the group. This approach allows the reflection and processing to 'build' on each person's experience and interpretation. As the group becomes more accustomed to sharing ideas, you can be more flexible, but initially this approach provides structure to the reflective process. Don't wait until the activity is finished; **reflection should happen during all parts of the activity**.

Resources: Reflecting and Processing STEM

The importance of Reflection:

Bell, P. (2010). Scientific arguments as learning artifacts: designing for learning from the web with KIE. International Journal of Science Education, 22 (8), pp. 797-817. https://www.tandfonline.com/doi/abs/10.1080/095006900412284

Driver, R., Asoko, H., Leach, J., Scott, P., Mortimore, E. (1994). Constructing scientific knowledge in the classroom. Educational Researcher, 23 (7), pp. 5-12. http://journal.naeyc.org/btj/vp/pdf/Voices_Abramson_Co-Inquiry.pdf

Costa, A. & Kallick, B. (2008). Learning Through Reflection. Learning and Leading with Habits of Mind: 16 Essential Characteristics for Success. pp. 221-235. http://www.ascd.org/publications/books/108008/chapters/Learning-Through-Reflection.aspx

The importance of questions:

Strasser, J. (2019) Conversations with Children! Asking Questions That Stretch Children's Thinking. Teaching Young Children, 12 (3). https://www.naeyc.org/resources/pubs/tyc/feb2019/asking-questions-stretch-children%27s-thinking

Danko-McGhee, K. & Slutsky, R. (2007). Floating Experiences: Empowering early learnerhood educators to encourage critical thinking in young learner through the visual arts. Art Education, March, pp. 13-16. https://www.tandfonline.com/doi/abs/10.1080/00043125.2007.11651631

Asking questions:

http://teachingmahollitz.wordpress.com/2011/05/16/teaching-kids-how-to-ask-good-questions/

http://www.scilearn.com/blog/6-steps-to-help-students-ask-better-questions.php

http://www.ascd.org/publications/educational-leadership/nov99/vol57/num03/Helping-Students-Ask-the-Right-Questions.aspx

Experiments and Explanations:

http://kids.niehs.nih.gov/