Carnegie Foundation
for the Advancement of Teaching

Number Sequence Game Facilitator's Guide

Learning Goals

- Understand the role of documentation when testing
- Articulate the importance of theories, making predictions, iterative testing, and collecting data
- Describe how networks can accelerate learning

Materials

- Slide deck with number sequence cards (printed or projected)
- Number Sequence Recording Sheet (one for each team)
- Number Sequence Participant Instructions (one per person)

Description of Activity

This activity simulates disciplined inquiry for implementing a new instructional practice. As an imperfect analogy, a sequence of numbers will represent a promising instructional practice that improvement teams want to implement across their network. During the activity, the facilitator shares numbers in a sequence one-by-one, and working in small groups, participants run a series of Plan-Do-Study-Act cycles (PDSAs) to discover the rule for the sequence and try to predict the next number. In each cycle, groups assess their confidence in their theory and decide whether to gather more data to understand the sequence, test their prediction, or implement at scale.

Each round consists of moving through the following phases of the PDSA cycle to learn about the instructional practice:

> **PLAN**: In this phase, teams decide on the testing strategy (size of the test), develop a theory about the pattern represented by the number sequence, and predict the next number.
>
> **DO**: Facilitator reveals the next number.
>
> **STUDY**: Teams evaluate their prediction and determine if their theory is still useful.
>
> **ACT**: Teams decide whether they have enough confidence in their theory to implement the instructional strategy, or if more tests are needed.

As teams move through each phase of the cycle, they should document their tests on their recording sheet.

Testing Strategy: What size of test?

Throughout the simulation, teams will need to decide on an appropriate size for their test. This provides an opportunity for participants to discover the importance of starting small when testing changes. Starting with a small test and carefully figuring out how an idea works, heeding the lessons from failures, and learning our way into different contexts, leads us to greater confidence in those change ideas that will take hold and last.

Scoring: Scale vs. Payoff in Improvement Resources

Each team will start off with 200 points or "improvement resources," which represent time, money, will within the organization, etc. This allows participants to experience how testing a theory of

improvement inevitably involves the gain or loss of resources, but it can be worth it in the end, especially if testing small prevents a big failure later.

Teams will have three testing strategy options each round:

- **Understand:** This represents the need to learn more about the instructional practice by collecting data. It results in a small loss in improvement resources (primarily time and will).
- **Test Change:** This strategy involves great risk as the loss or increase in overall resources depends on the accuracy of a team's prediction. A particularly large disconnect between their theory and the results will lead to a large loss of improvement resources.
- **Implement**: If a team has high confidence in the instructional practice (i.e., their theory for the number sequence), they may decide to implement. This strategy poses the greatest risk, but also has the potential for the greatest payoff in improvement resources. Once a team chooses to implement they must run at least two additional cycles using the same theory. This is designed to simulate what happens when a system decides to go all in on a change – it could have great positive impact or be a huge devastation.

The gain or loss of improvement resources depends on the testing strategy teams commit to in each cycle (as indicated in the table below).

Strategy	Gain or Loss	
Understand	Prediction Correct OR Incorrect:	- 10
Test	Prediction Correct:	+ 10
	Prediction Incorrect:	
	miss by <2: -20 / miss by 2-4: -30 / miss by >4: -40	
Implement	Prediction Correct:	+ 30
	Prediction Incorrect:	- 80

Session Agenda

Activity	Materials
Introduction • Discuss the purpose of the activity and introduce the scenario (i.e., number sequence represents instructional practice) • Explain testing strategies and scoring (improvement resources) • Emphasize the importance of documenting tests	Slide deck with number sequence cards Number Sequence Participant Instructions

Facilitator Role Play: Example Testing Cycle
• Demonstrate the process of moving through a testing cycle while completing a recording sheet
  ○ Reveal the first number in the sequence (1)
  ○ Make a PLAN - articulating a testing strategy, theory,	

and prediction ○ Reveal the next number in the sequence (2) and record it in the DO section ○ Determine whether the prediction was correct (STUDY) and decide if whether to implement (ACT) ○ Account for how many improvement resources were gained or lost	
Small Group Testing ● Facilitate rounds of testing, revealing the next number in the sequence for each cycle ● Repeat as needed until at least one team determines the rule for the sequence	Number Sequence Recording Sheet
Debrief ● Invite participants to discuss the following questions: ○ What did you learn about testing ideas through the simulation? ○ What did you consider when deciding whether to understand, test or implement? ○ What did you notice about the team dynamics?	

Description of the Sequence

The sequence is: 1, 2, 3, 6, 7, 8, 21, 22, 23, 66, 67, 68, 201, 202, 203, 606, 607, 608, 1821, 1822, 1823, 4007, 4008, 4009…

The sequence has recurring "clusters" of three consecutive numbers. There is a "gap" between clusters, which is equivalent to the sum of the first two numbers of the immediately preceding sequence.

3 consecutive	3 consecutive	3 consecutive	3 consecutive	3 consecutive
1, 2, 3	**6, 7, 8**	**21, 22, 23**	**66, 67, 68**	**201, 202, 203**
GAP 1 + 2	6 + 7	21 + 22	66 + 67	
Next # 3+3=**6**	13+8=**21**	43+23=**66**	133+68=**201**	

Possible Adaptations

- This activity can be run so that there are individual facilitators at each table who provide the next number in the sequence. This allows for each team to test at their own pace.
- Consider displaying a public score sheet (on white board, projector, or chart paper), so teams can see other teams' gains and losses of improvement resources and to encourage "network" learning.
- This activity can be facilitated virtually. Assign teams to different breakout rooms and have one person from each room come back to the "main room" to receive the number for each round. Teams can track their scores on a shared online spreadsheet.
- If some members of your group already know the rule for this number sequence, you can use a different number sequence to engage in the same activity.