Open Your Class With This Tomorrow
Range: ***Why Generalists Triumph in A Specialized World***

Duncker's Radiation Problem

Directions: Provide your students with the first scenario below. This is an exercise in creative thinking rooted in a real-life situation. This problem-solving activity uses the process of interleaving (which involves finding connections between content or in this case the different scenarios) by presenting the complicated *Duncker's radiation problem* first, which only about 10 percent of people solve initially.
If you read 1 alone = 10% solve
If you read 1 and 2 = 30% solve problem 1
If you read 1, 2 and 3 = 50% solve problem

Situation #1
Suppose you are a doctor faced with a patient who has a malignant stomach tumor. It is impossible to operate on this patient, but unless the tumor is destroyed, the patient will die. There is a kind of ray that can be used to destroy the tumor. If the rays reach the tumor all at once at a sufficiently high intensity, the tumor will be destroyed. Unfortunately, at this intensity, the healthy tissue that the rays pass through on the way to the tumor will also be destroyed. At lower intensities, the rays are harmless to healthy tissue, but they will not affect the tumor either. What type of procedure might be used to destroy the tumor with the rays, and at the same time, avoid destroying healthy tissue?

Situation #2
There was once a general who needed to capture a fortress in the middle of a country from a brutal dictator. If the general could get all of his troops to the fortress at the same time, they would have no problem taking it. Plenty of roads that the troops could travel radiated out from the fort like wheel spokes, but they were strewn with mines so that only small groups of soldiers could safely traverse any one road. How can the general devise a plan in which his men successfully capture the fortress?

Answer: The general divided the army into smaller groups, and each group traveled a different road leading to the fortress. They synchronized their watches and made sure to converge on the fortress at the same time via their separate roads. The plan worked. The general captured the fortress and overthrew the dictator.

Now try and go back and solve the first scenario again.

Situation #3
Years ago, a small-town fire chief arrived at a woodshed fire; he was concerned that it would spread to a nearby house if it was not extinguished quickly. There was no hydrant nearby, but the shed was next to a lake, so there was plenty of water. Dozens of neighbors were already taking turns with buckets throwing water on the shed, but they weren't making any progress. How can the fire chief use the neighbors to effectively put out the fire?

Answer: The fire chief told the neighbors to stop, and all go and fill their buckets in the lake. When they returned, the chief arranged them in a circle around the shed, and on the count of three had them all throw their water at once. The fire was immediately dampened and eventually extinguished.

Now try and go back and solve the first scenario again.

Debriefing

The answer to Situation #1 is as follows:
The doctor could direct multiple low-intensity rays at the tumor from different directions, leaving healthy tissue intact, but converging at the tumor site with enough collective intensity to destroy it.

Students should see the connections between the scenarios, and by providing solutions to similar situations, students should be able to see the similarities to the proposed problem in the first scenario. This is what Epstein suggests is occurring when he discusses interleaving, using knowledge from one situation to apply to other similar situations. This task also necessitates lateral thinking and creative abilities.