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The E in STEM   Online Problem-Solving Assignment

1. Which problems did you work through?
I worked through the Three Jugs Problem, the Tower of Hanoi and the Wolf, Sheep and Cabbage problems.

2. Which problem was the easiest to solve?
For my experience, the Tower of Hanoi was the easiest. It only took me 2 tries to get the correct answer, and even when I tried to beat my original score by repeating it, I ended up taking the exact same number of steps to complete it.

3. Why was it easy to solve?
To me, it felt like I could take the same step-by-step solving strategy each time and end up with the correct answer. Additionally, the website was easy to manage so there was not a huge learning curve. As a visual learner, I felt like I could easily move things around and start to see "openings" where I could more some discs and rearrange it to solve the problem smoothly. Things simply came together!

4. What type of problem was it (see Kirkley, 2003 article pg. 8)?
I would classify this as a well-structured problem because it seemed to be convergent. No matter how many times I tried a new strategy, I ended up with the same technique (though maybe my brain was extremely honed in on my one way of solving the issue, and there is another perspective I'm missing! Even so, this would be an example of memorizing and becoming automated, which is aligned with well-structured problems). Even as I added more discs, the same strategy came into play. I did feel that "the skills for these are limited to similar types of problems." If the problem was at all different (ex: another pole) my strategy might not work the same way.

Explain. 5. What strategy did you use to solve the problem?
I did find myself using metacognition strategies of talking out loud and visualizing. I also employed some trial and error. When I combined the two, I would talk out loud as I tried a strategy and I re-evaluated the new scenario as I moved things.

6. How did you develop this strategy?
I developed this strategy because I knew I needed to move the small disc to open up the medium disc, however I quickly realized that I needed to move the small disc back to the original pole to move the medium disc to the

second pole. Once my trial and error opened up this possibility, it became clear that this rearrangement was key.

 7. What declarative knowledge was needed to solve this problem?
The concept that I could move the small disc back onto the large disc was huge. This was a fact- the rules only stipulated that you couldn't put a large disc on top of a small disc. However, it also was more of a concept since it allowed one pole to be open.   By moving the medium disc onto the second open pole, you could then place the small disc on top of that, and move the largest disc to pole 3, which is the goal of the simulation.

8. What procedural knowledge was needed to solve this problem?
Once I could see the pattern, I felt like this process and procedure could be used for any situation. Therefore, when I realized I could add more discs, I was able to repeat the same mentality and arrive at a successful outcome. The information necessary was part of the problem statement, and I found the strategy to be predictable in nature.

9. Which problem was the most challenging for you to solve?
The 3-jug problem was the most challenging and most frustrating. After at least 10 tries, I finally gave up, but the problem kept lingering in my mind. It was hard to resist the urge to google it and finally uncover how to solve this problem!

10. Why was it difficult to solve?
At first, I struggled navigating the website. For some reason, I had to try a few times to understand how much water was moving into each glass each time. Was it half of the original glass? Was it the entire 3-ounce glass? There was a bit of a learning curve at first before I even applied problem solving skills to get to the root of the issue. I also found it was challenging and frustrating to get from an odd amount of water to an even amount of water.

11. What type of problem was it (see Kirkley, 2003 article pg. 8)? Explain.
In my (defeated) opinion, it was an ill-structured problem. There wasn't an agreed upon solution—in fact, I couldn't decide if there was even a solution that is reachable. I also felt that it used some abstract reasoning. Even though you were able to manipulate the water, it involved some critical thinking.

12. What strategy did you use to solve the problem?
I used metacognitive strategies like talking to myself as I worked through the problem, though I ended up just voicing my frustrations after a good deal of time. I tried to draw the problem out on paper because I am a visual learner, and I do best putting pen to paper, but it didn't open up any solutions for me.

13. How did you develop this strategy?
I developed this strategy based on my previous experiences with problem solving and studying. Sometimes, seeing things on a computer screen doesn't work as well as seeing things on a piece of paper. I also found that clicking the computer screen could get confusing, but drawing it helped me visualize it better.

14. What declarative knowledge was needed to solve this problem?
I think there is some deeper level declarative knowledge needed to solve this problem. I actually spent a great deal of time doubting myself and wondering if this problem was even solvable. I kept repeating that the 8 oz of water could be poured into 3 or into 5 ounces of water, however, whichever one you poured into then left you with 3 or 5 ounces of water. Therefore, you could never get down to 4 ounces of water, so this problem was unable to be solved using my process.

15. What procedural knowledge was needed to solve this problem?
The procedural knowledge here felt as though it was more abstract than some of the other problems I did. It felt like there was some piece of information that was missing, that if I unlocked this information somehow, it would open up the problem in a new way and perhaps make the solution more attainable. At one point during the process, I accepted that I am a novice problem solver, as "Novices make more errors than experts, and their errors are mostly related to misconceptions rather than carelessness or random guessing." My trial and error strategy was not as effective here as it was in the Tower of Hanoi, and maybe there was a perspective I was missing.