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Thinking Inside the Box: Using Student Generated Puzzles as a Form of Assessment

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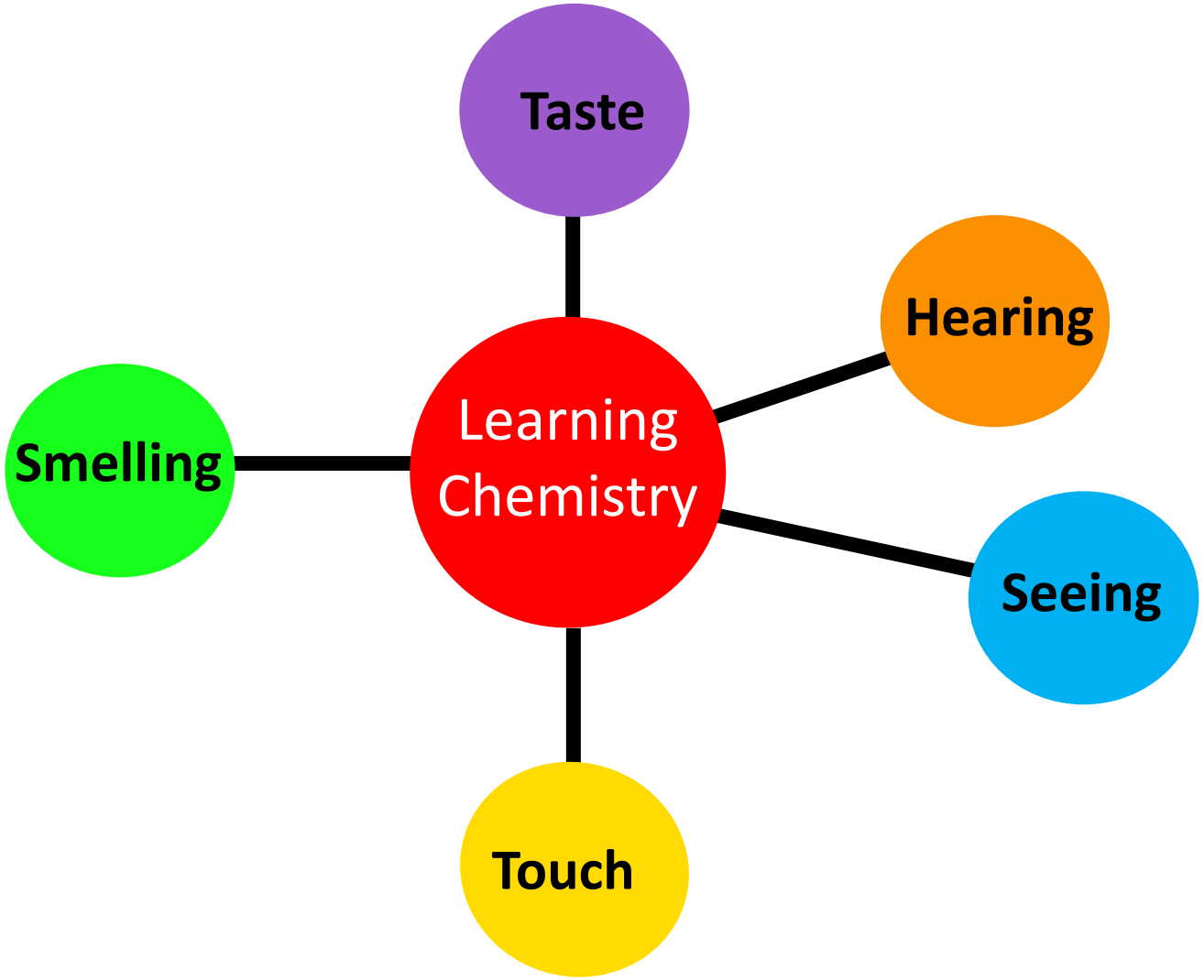
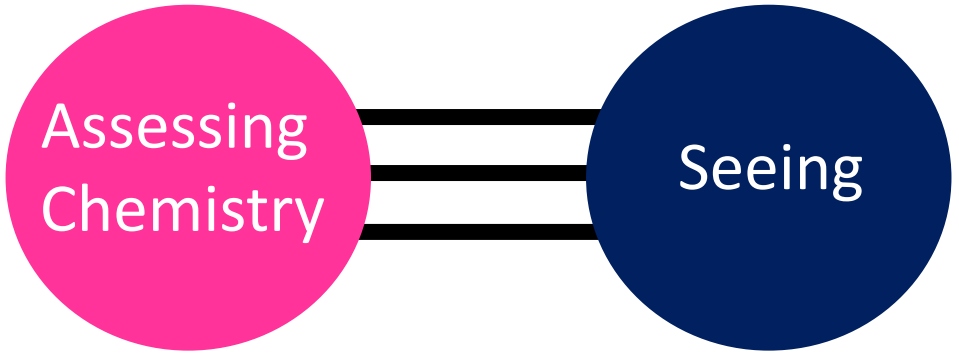
Thinking Inside the box: Using Student Generated Puzzles as a Form of Assessment

Comparison of Learning and Assessment



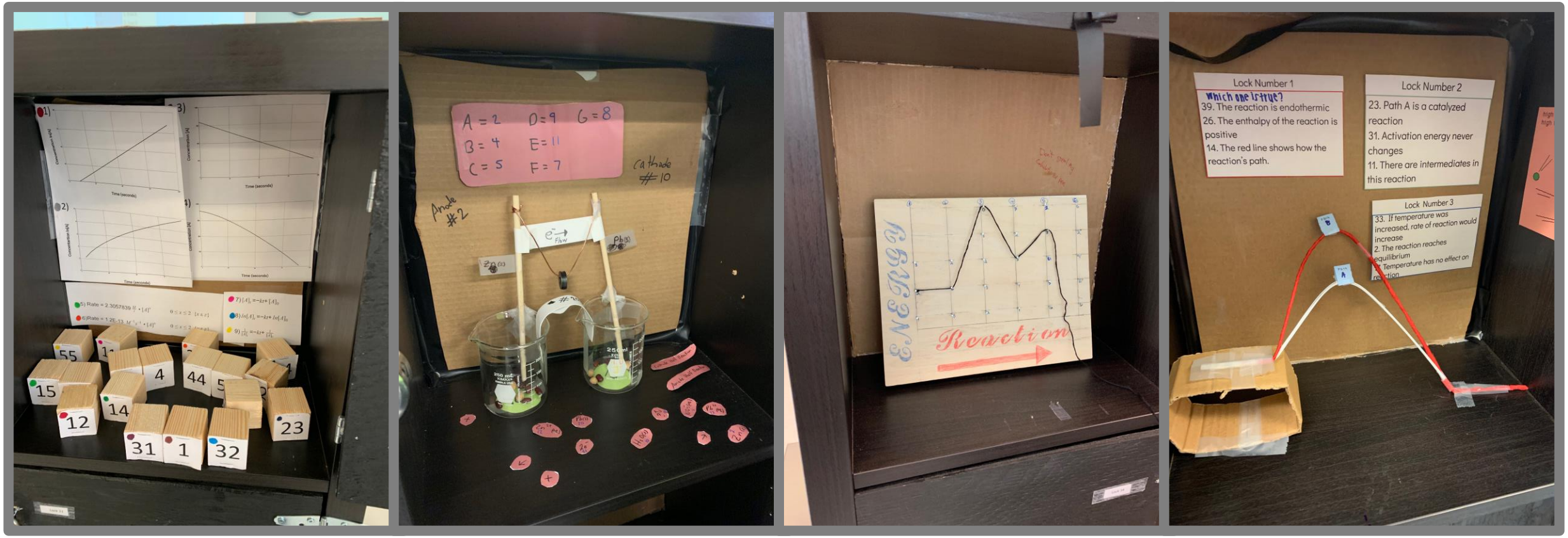
Learning and Researching Chemistry requires the student to use all their senses



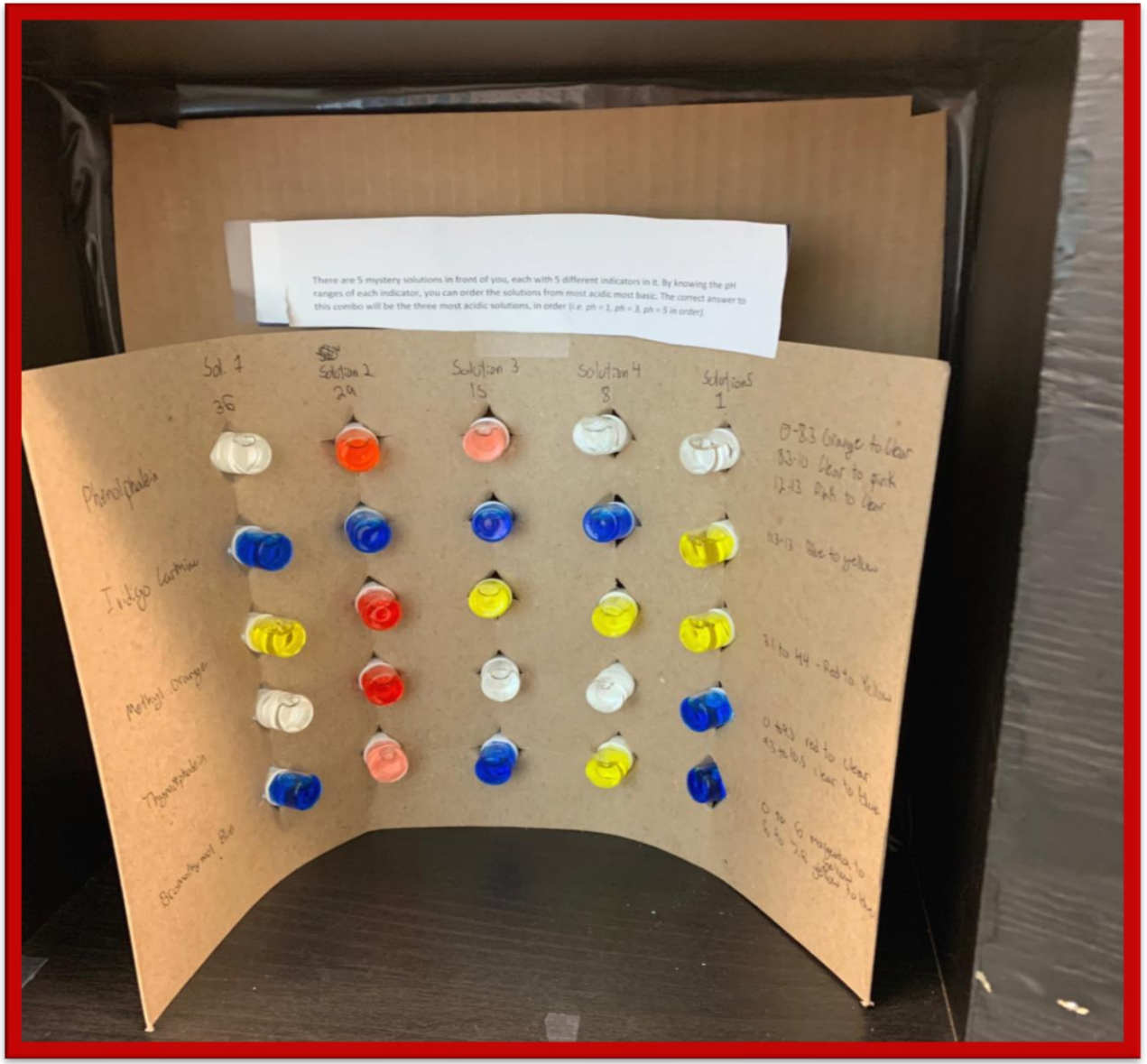
When students are assessed on examinations or tutorials they read. Does this truly represent what students know?

Research Question

1. How do educators identify student generated puzzles that demonstrate deep learning? How would student learning be assessed?



Activity 1: Solving A Students Puzzle



Get into groups of 2-4 and choose a puzzle with a pencil case and a worksheet.

The solution to the puzzle will be put into the locks on the pencil case

You have 10 minutes to solve the puzzle.

Activity 1: Discussion of Student Generated Puzzle

Why would the puzzle be a good to assessment tool?	What modifications to the puzzle would make it a assessment tool?

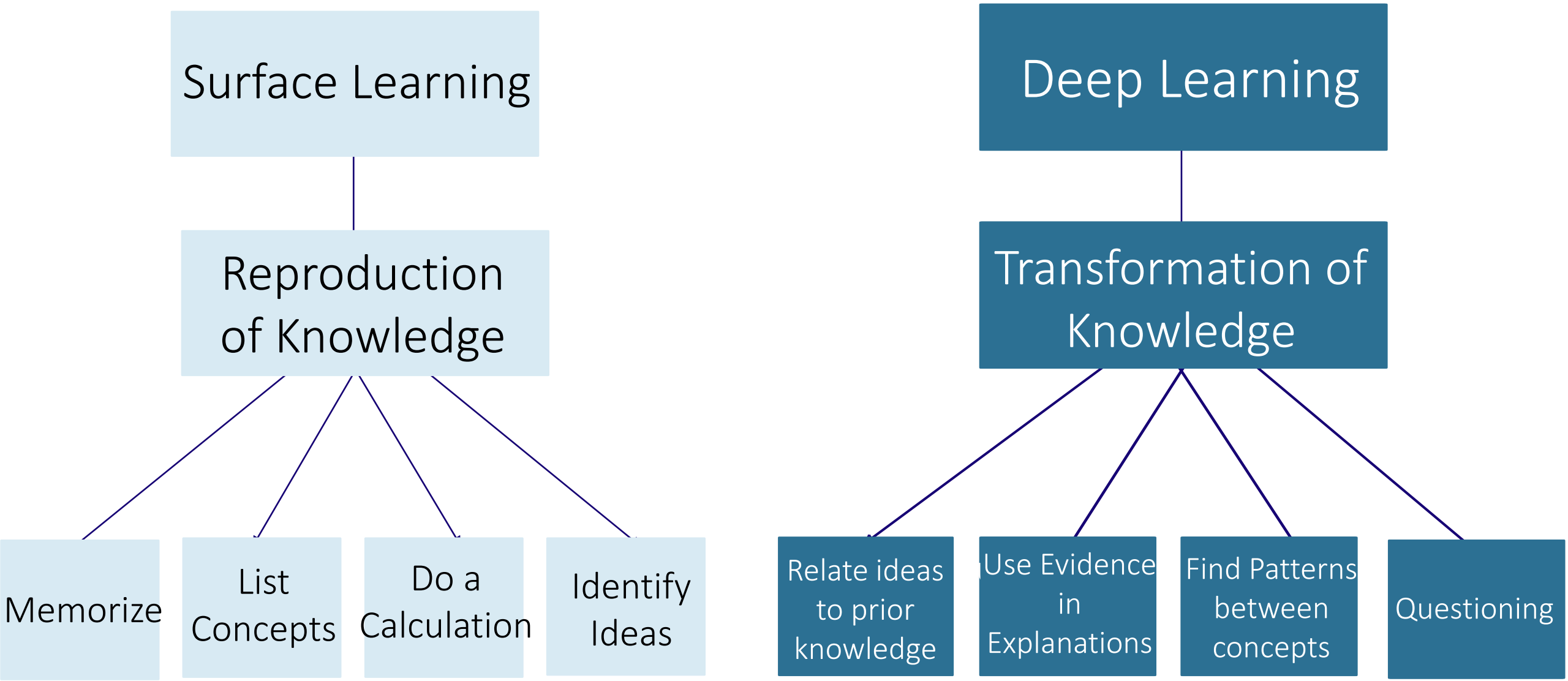
Activity 2: Discussion of Deep Leaning

What Demonstrates Deep Learning?

On your chart paper with your groups answer the question above.

Take 5 minutes to brainstorm answers with your group

Students Approaches To Learning



6. Entwistle, N. Promoting deep learning through teaching and assessment: conceptual frameworks and educational contexts. *TLRP Conference, Leicester.* 2000, 1-11.
7. Beattie, V.; Collins, B.; McInnes, B. Deep and Surface Learning a Simple or Simplistic Dichotomy. *Accounting Education.* 1997, *6*, 1-12.
8. Smith, T.W.; Colby, S.A. Teaching for Deep Learning. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas.* 2007, *80*, 205-210.

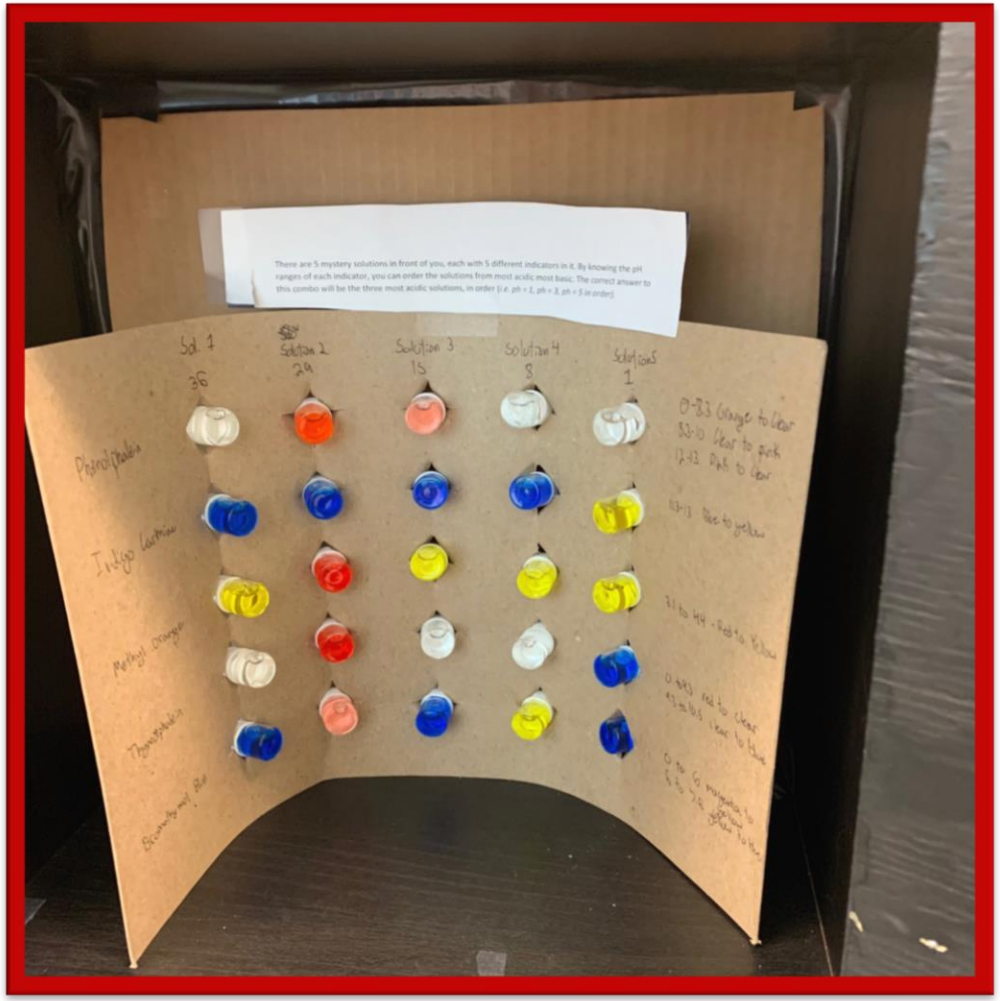
Activity 3: Puzzle Creation Walk Through

a. Define the audience who will solve the puzzles?

420 first year engineering students in the course chemistry 209

b. Define the learning objective that will be used to create the puzzle?

Compare the relative strengths of acids or bases using pH

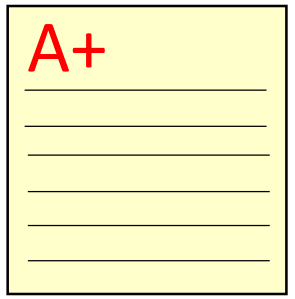


Activity 3: Puzzle Creation Walk Through

On your worksheet fill out the answers as we walk through the questions

c. What is the purpose of using the puzzle activity within your classroom?

Engagement and assess students learning within the course



1. What skill or knowledge are you attempting to evaluate with your puzzle?

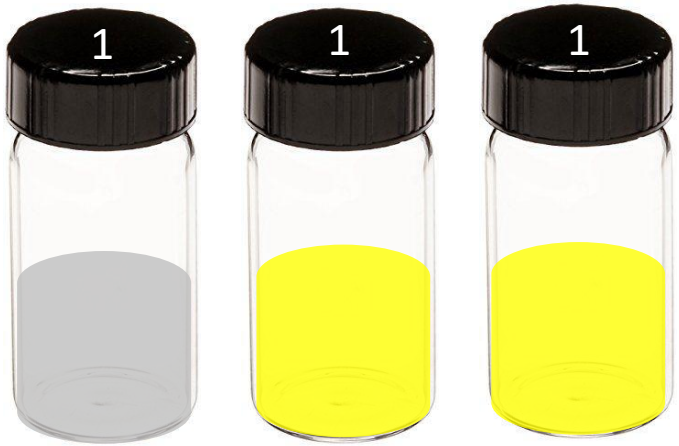
Understand how to rank acids and bases

Relate pH of a solution to an indicator

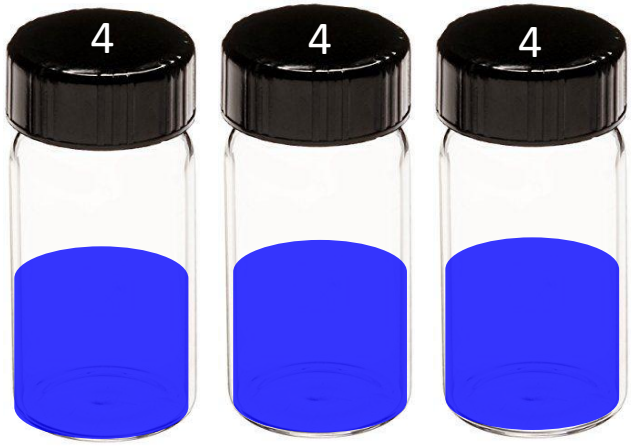
Activity 3: Puzzle Creation Walk Through

Interactive Components

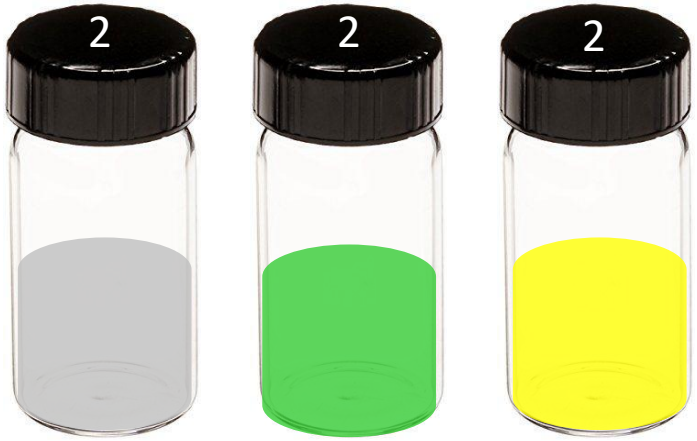
Unknown Solution 1



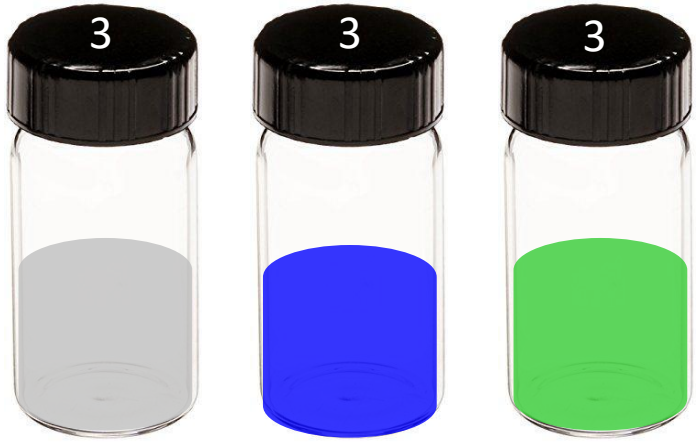
Unknown Solution 4



Unknown Solution 2

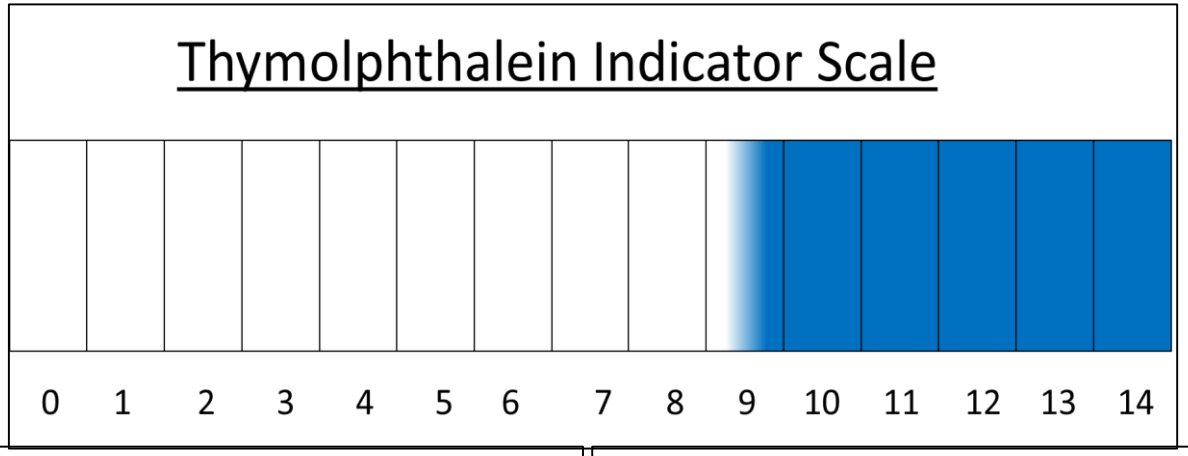


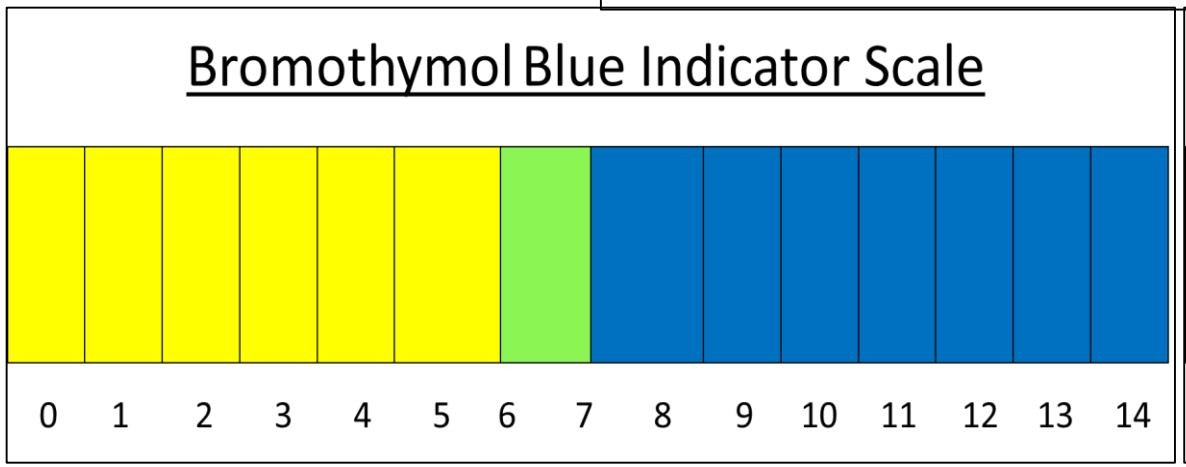
Unknown Solution 3

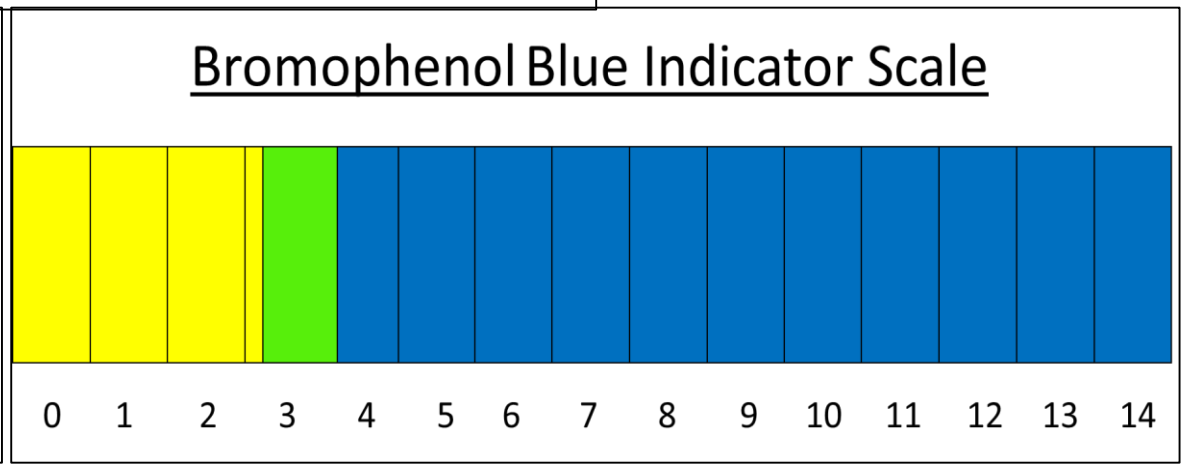


Activity 3: Puzzle Creation Walk Through

Clues: Clues are defined as information your students can use to solve your puzzle if they remember what course knowledge they need.

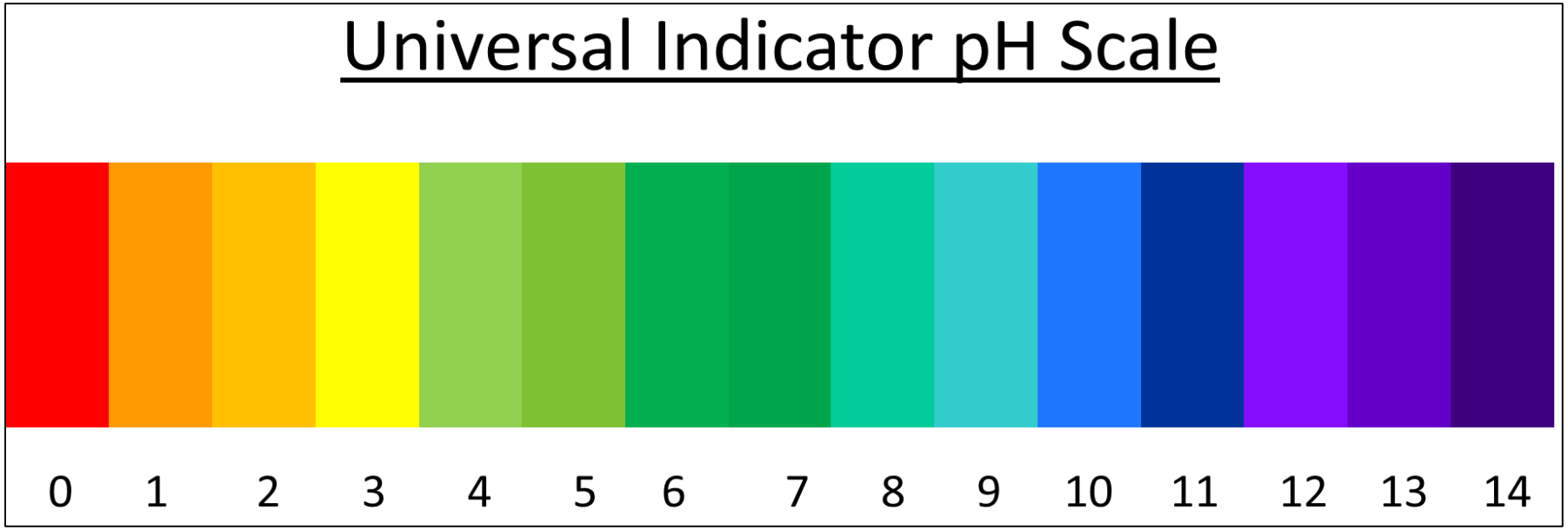






Activity 3: Puzzle Creation Walk Through

Hints: . A hint is a piece of information that adds knowledge to help your students solve the puzzle

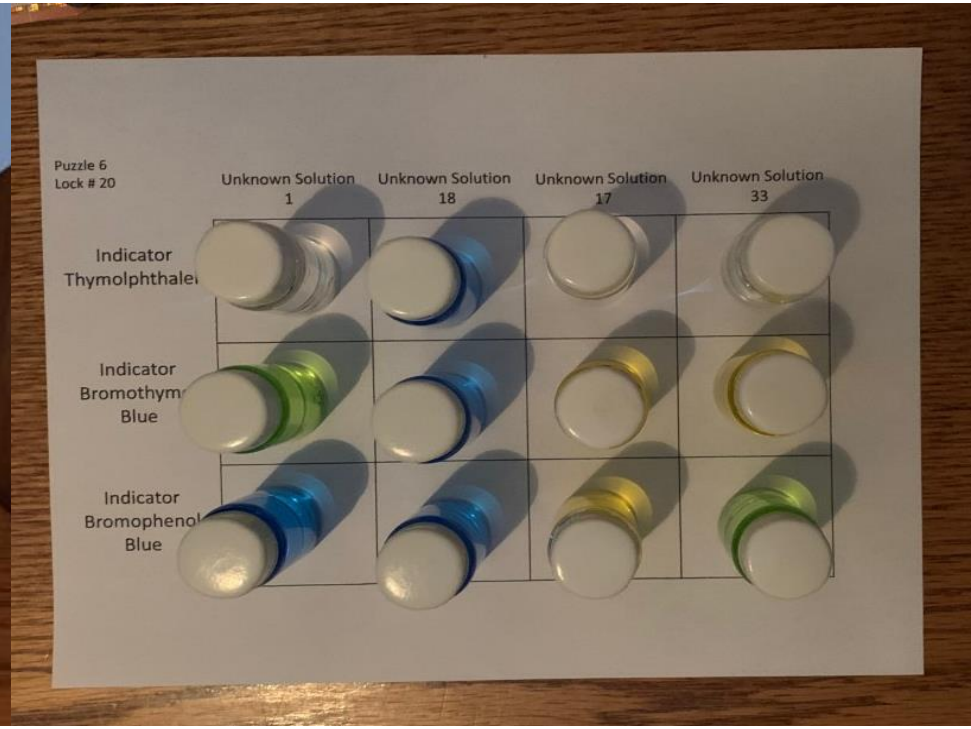


Solution 1 appeared to be red when universal indicator was placed into the solution

Activity 3: Puzzle Creation Walk Through

4. Describe how your students will solve your puzzle?

- Determine the pH of each solution (Vial and indicators)
- Rank the pH of each solution
- Enter the combination



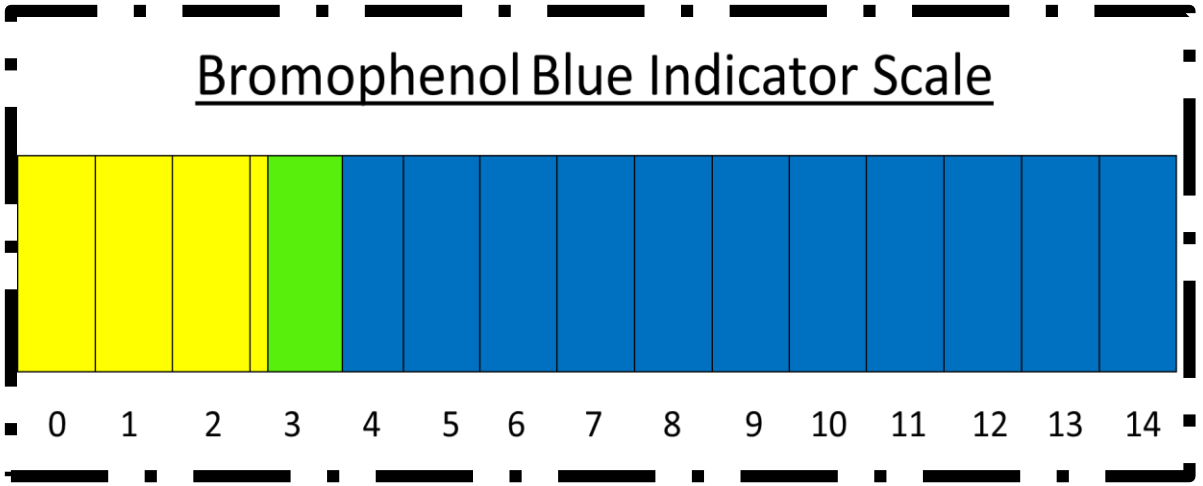
Activity 3: Puzzle Creation Walk Through

5. How might the students find alternate solutions to the information provided for each step of the puzzle? Is there a different way for you to communicate your clues and hints to reduce this issue?

Students Clue

0-6 solution is yellow
6-7.5 the solution is green
7.5-14 the solution is blue

Instructor Modified Clue



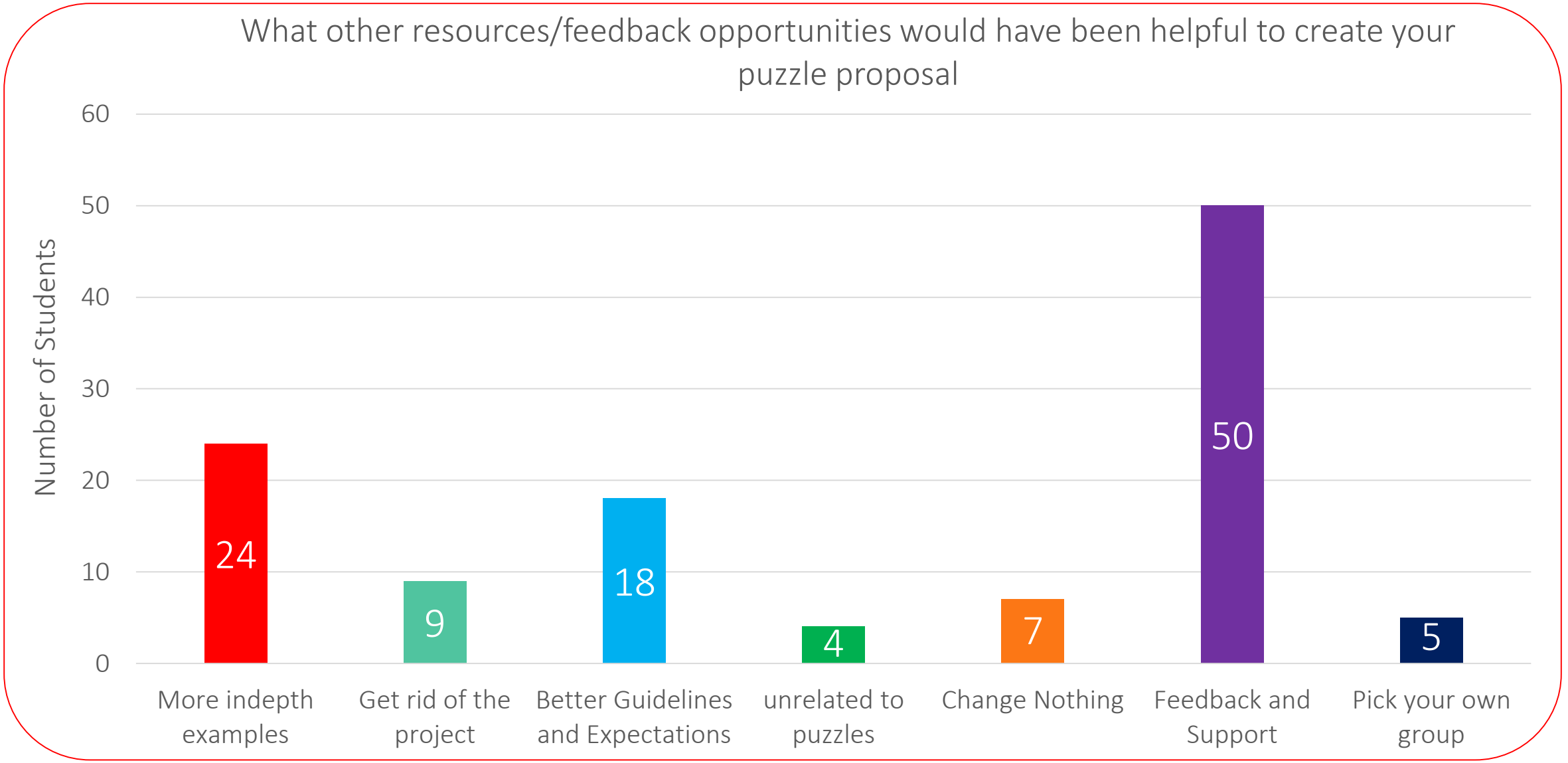
Activity 3: Puzzle Creation Walk Through

6. **Under what conditions could your puzzle break?**

7. **What hints could you provide your students in case the puzzle breaks, so they can reset and solve the puzzle?**

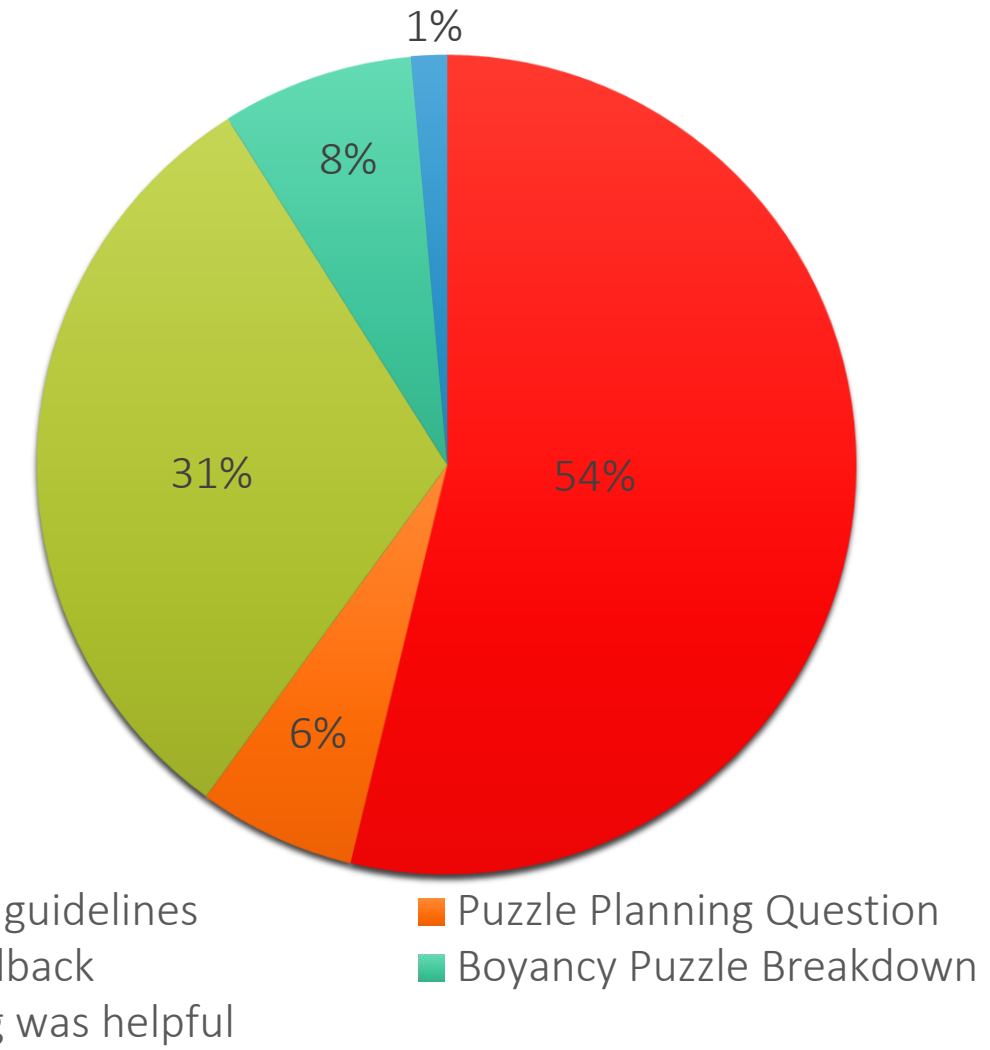
	Unknown Solution 20	Unknown Solution 31	Unknown Solution 25	Unknown Solution 34
Indicator Thymolphthalein	Clear	Clear	Clear	Blue
Indicator Bromothymol Blue	Yellow	Yellow	Green	Blue
Indicator Bromophenol Blue	Yellow	Green	Blue	Blue

Battle Box Survey

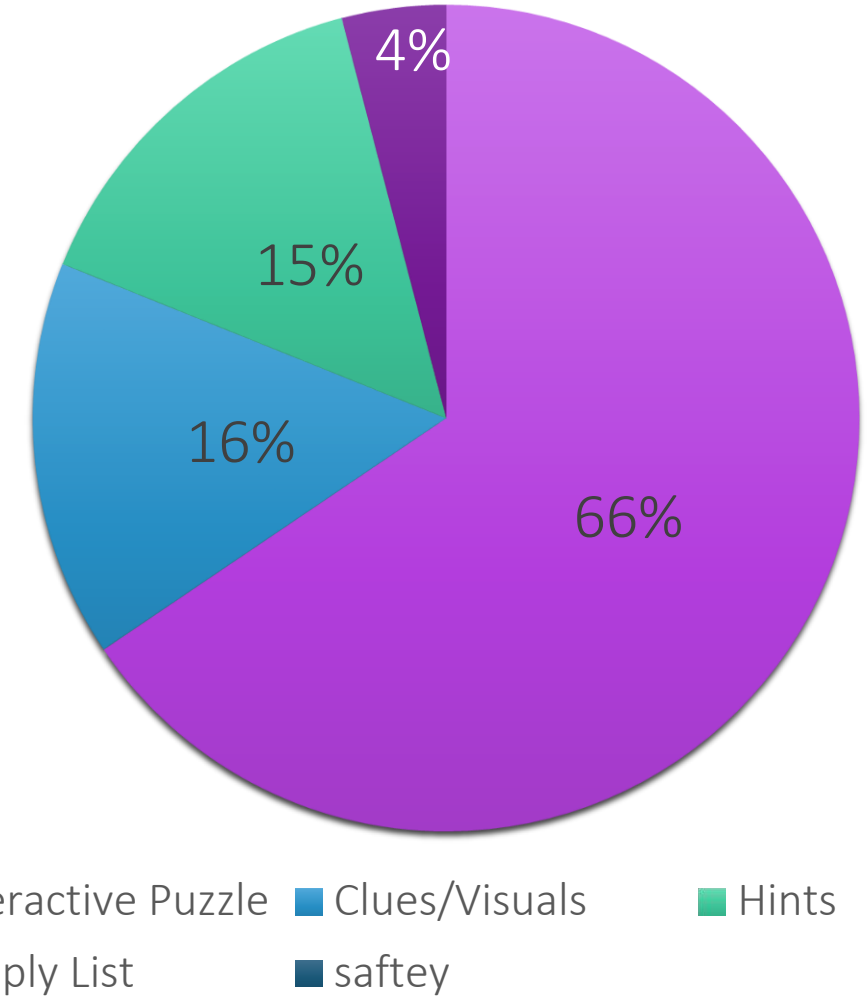


Feedback on Battle Box Support

Rank the following resources from most helpful to least helpful?



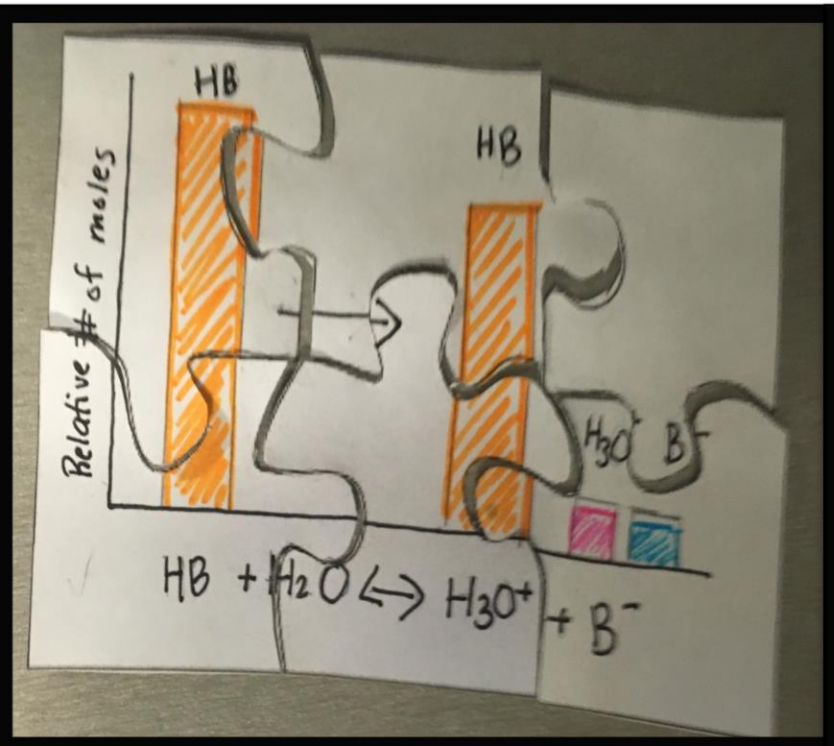
What was the most difficult part of puzzle design for the proposal?

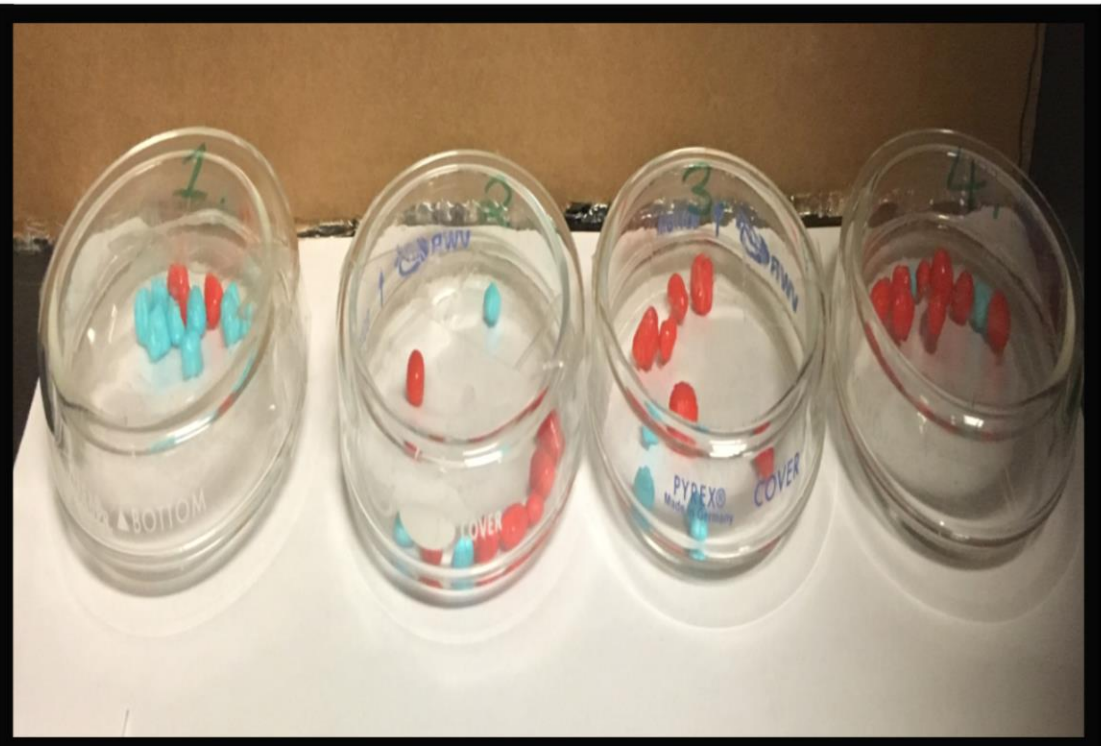


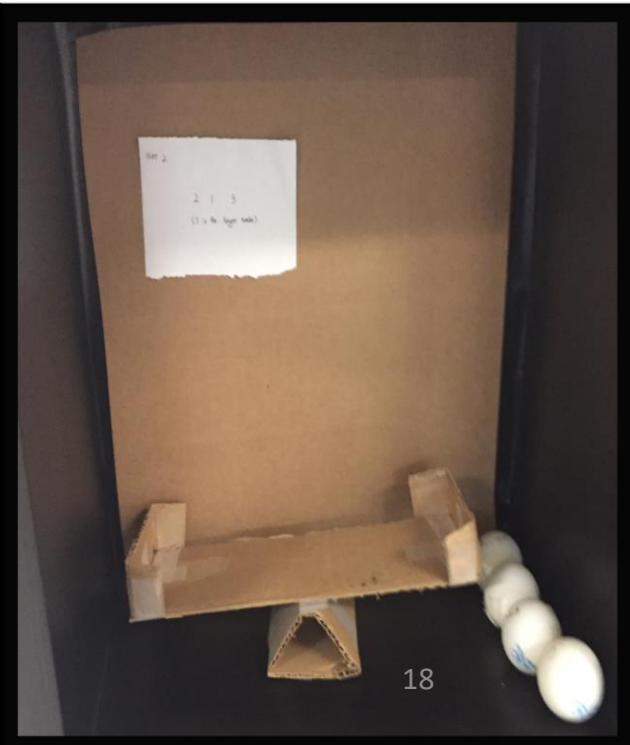
More Student support is required to transform the CHEM 209 Learning Objective into a Hands on Puzzle

Activity 3: Puzzle Creation Discussion

Over the next ten minutes please feel free to complete the following the second worksheet and check out more of the student puzzles

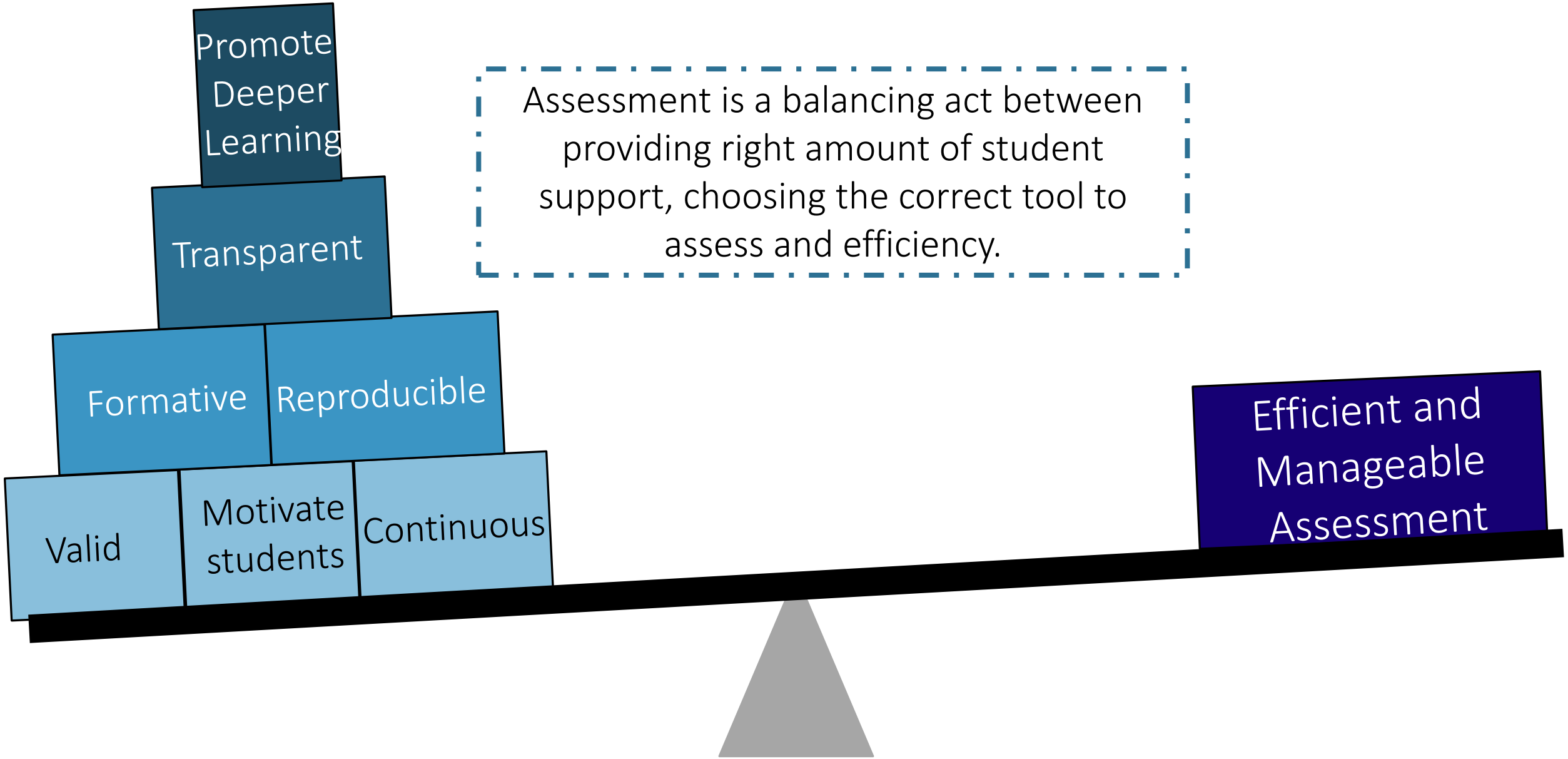






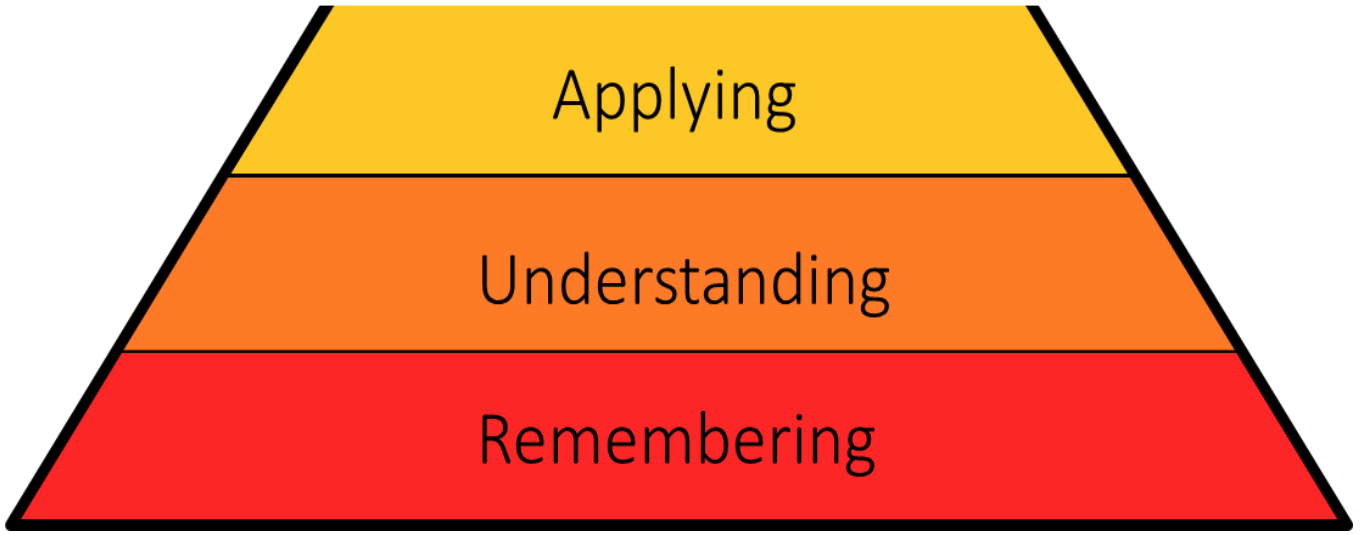
What Makes a Good Assessment?

Assessment is a balancing act between providing right amount of student support, choosing the correct tool to assess and efficiency.



5. Brown, S.; Race, P.; Smith, B. 500 Tips on Assessment, 2nd ed.; Taylor and Francis Group: New York, 2004.

Measuring Deep Learning Using Bloom's Taxonomy

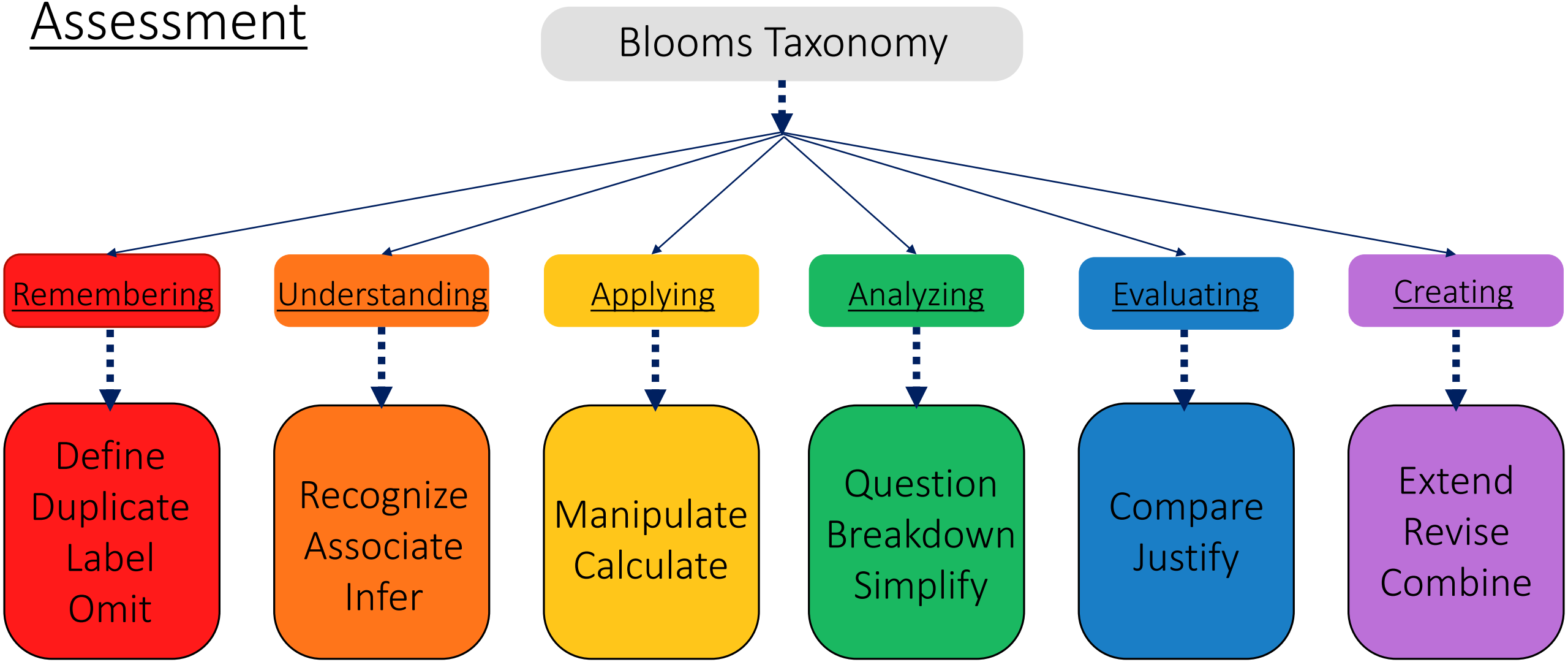


Deep Learning is associated with the top categories of Bloom's Taxonomy. These categories are the creating, evaluating and analyzing.

The more surface level to learning is associated with the idea of remembering

9. Krathwohl, D.R. A Revision of Bloom's Taxonomy: An Overview. *Theory into Practice*. **2002**, *41*, 212-218.
10. Newton, G.; Martin, E. Blooming, SOLO Taxonomy, and Phenomenography as Assessment Strategies in Undergraduate Science Education. *Research and Teaching*. **2013**, *43*, 78-90.

Assessment



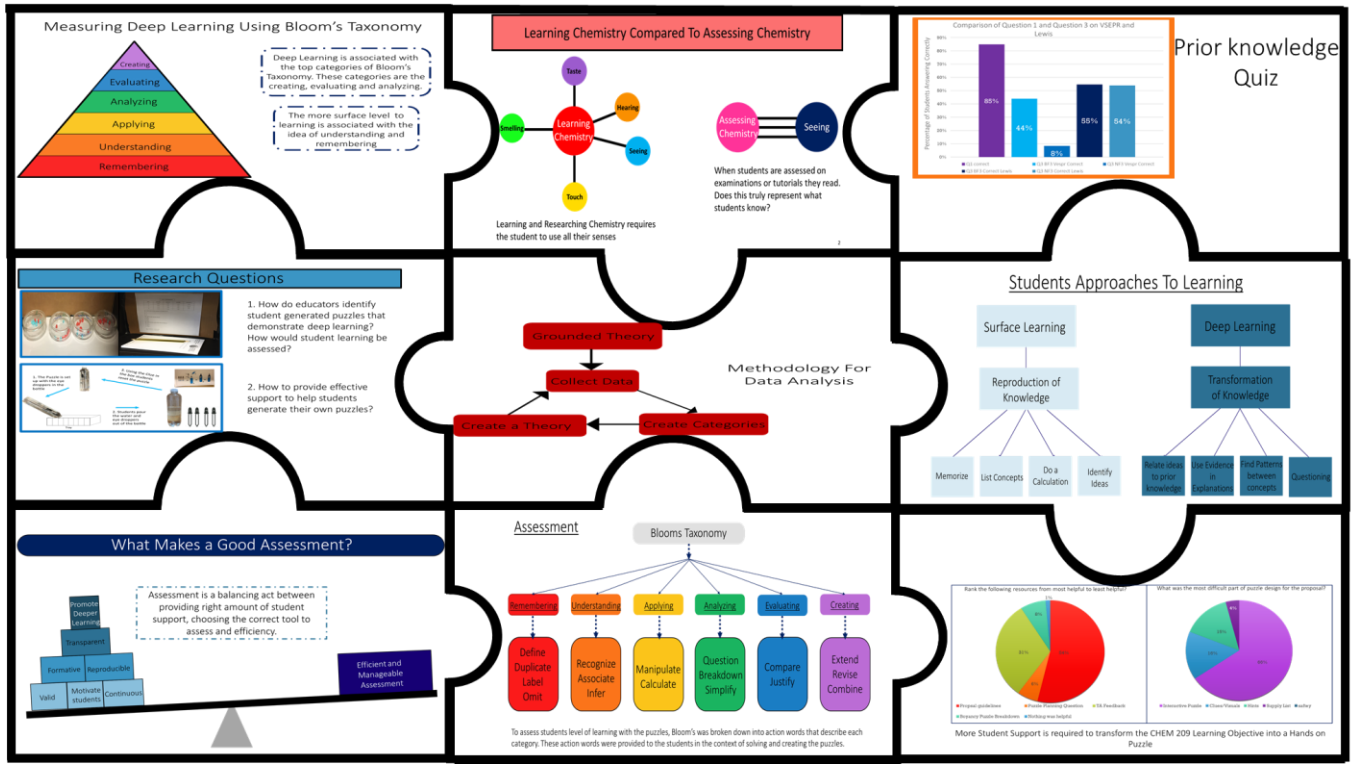
To assess students level of learning with the puzzles, Bloom's was broken down into action words that describe each category. These action words were provided to the students in the context of solving and creating the puzzles.

11. Newton, G.; Martin, E. Blooming, SOLO Taxonomy, and Phenomenography as Assessment Strategies in Undergraduate Science Education. *Research and Teaching*. **2013**, *43*, 78-90.
12. Wood, E.J. Problem-Based Learning: Exploiting Knowledge of how People Learn to Promote Effective Learning. **2004**, *3*, 1-12.

Figure above modified from another figure https://lynnleasephd.com/2016/06/20/blooms-taxonomy/

Conclusions

- More support is still required to help students generate their puzzles
- The Battle Boxes maybe able to promote deep learning in students
- Further modifications to the assessment of the student generated needs to be conducted.



Discussion: What are your thoughts on using Puzzles for Assessment?

Acknowledgements

The ChemEscape Team: Marissa Clapson, Judy Tran, Brian Gilbert, Stephen White and Dr. Vivian Mozol.

Thank You to Patrick for supplying and helping design the puzzles in the battle boxes.

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