Spot it - Chapel Hill Math Circle

Developed by Kim Johnson, Debra Wiegard, and Boyd Blackburn
(Games from Joshua Zucker, Summer Math Teacher Immersion workshop, June 2016)

1. Game 1: Match 1 (like War). With any number of players, shuffle the deck and start with one card (face up) on the table in front of each player. Place the rest of the deck face up in the middle of the table.

   Look for a symbol on the top card of the deck that matches a symbol on your card. They will be the same shape and color, but possibly different sizes. If you spot it, say the name of the symbol like "heart!" or "clock!" or "weird hand eyeball thing!" and then take the top card and place it on top of yours. Keep playing until you make it through the whole deck.

   Question: Is there always a match between your card and the center card? Or are you sometimes just stuck?

2. Game 2: Match 3 (like SET). Deal 9 cards face up in the middle of the table. Look for a set of exactly three cards that all have a symbol in common. If you spot it, say the name of the symbol, take the three cards, and then deal three more in their place.

   Question: Does there always have to be a symbol found on at least three cards? Or are you sometimes stuck?

3. Game 3: Spot it (like cooperative Tic-Tac-Toe). Work together.. The object of the game is to arrange a 3 by 3 grid of cards so that each row, column and diagonal are matches of 3, with some symbol shared by all of them.

   Question: Should it (could it?) be the same symbol for all 9 cards?

4. After playing these games, what do you notice? what do you wonder?
   a. How many cards are there?
   b. How many symbols are there?
   c. How many symbols on each card? Are they all the same?
   d. Are there any cards that are "missing"?
   e. How many cards have each symbol? Does each symbol occur the same number of times?
   f. Is there a reason for these numbers? Could you make a good deck with any number of symbols per card? With any numbers of cards?

5. Challenge: Make your own deck. Rules:
   a. Every card has to have the same number of symbols.
   b. Each pair of cards must have exactly one symbol which matches.
   c. Try a deck with three symbols per card.
   d. Try a deck with four symbols per cards. Can you describe a pattern that would allow you to predict what a deck with 7 (for example) symbols would look like?

If you'd like to investigate the game of Spot It! more fully, here are some resources that might be helpful.

- Donna Dietz has extensive resources including javascript games (which I haven't played, but look great!), a paper and a presentation. Her focus is on Spot It as a projective plane. She goes over how to arrange the entire deck so that the lines each have a symbol in common. Here are the links:
  - Javascript games: http://www.donnadietz.com/PG/
  - Paper (link to pdf): www.donnadietz.com/Dietz_SpotItArticle.pdf
  - Slides from talk (link to pdf): www.donnadietz.com/SpotItTalkMOMATH.pdf
- Tom Clark wrote piece in the Math Teacher's Circle Magazine about Spot It that talks about some of the ideas we discussed. The second paper (with Calvin Jongsma) talks about making decks with other numbers of symbols on each card.
  - http://www.mathteacherscircle.org/news/mtc-magazine/ws2017/spot-it/
  - www.mathteacherscircle.org/assets/legacy/resources/materials/Clark_SpotItPuzzle.pdf
- Another paper, good pictures and an explanation of the game, with questions about higher dimensions.
  - www.maa.org/sites/default/files/pdf/horizons/PolsterApril2015.pdf
- A very accessible analysis of how to make your own cards with various numbers of symbols per card:
  - http://www.pleacher.com/mp/mlessons/stat/spotit.html
- Wolfram Mathematics has pictures of projective planes. You have to install a piece of software to do the interactive part of the demonstration, but there is text and a few pictures.
  - http://demonstrations.wolfram.com/ProjectivePlanesOfLowOrder/
- Many people have written programs to make your own spot it cards. Here are a few:
  - This website has a python program, as well as already made lists of what pictures go on each card. He also has a spreadsheet that can be used to make your own cards with sight words.
    http://radiganengineering.com/2013/01/spot-it-howd-they-do-that/
  - This exchange contains a number of programs and insights, but since I don't do computer science, I can't evaluate the computer programs.
    http://stackoverflow.com/questions/6240113/what-are-the-mathematical-computational-principles-behind-this-game
  - This has a template with 13 symbols to make your own cards with pictures, but no computer programs.
    https://teachinggamesefl.com/2015/03/04/dobble-adapting-games/

This turns out to be just the beginning of the resources out there for this game. Have fun playing math!