Lesson Procedure (with details; to be used by instructors)

Materials: Friendly Alien Poster (letter size paper)
Friendly Alien Worksheet
Large Chart Papers
Markers (for the chart papers)
Alien arms cutout magnets (50 in each color)
Number combination cards (all 11 combinations)
Student Math Journals
Crayons or markers, red and blue, for each student

Activities; T's questions; anticipated S's possible responses	Teacher support	Evaluation
1. **Introduction to the lesson** (preferably in a large rug area with students sitting together, with a board nearby) Teachers introduce themselves to the students. Ask students about their summer vacation. Teacher 1 will start with her introduction and lead the discussion to the question:		
"I came to San Mateo with my two sons, and it is our summer vacation this year. We were very excited when we found out that there is a Space Camp nearby, and my sons wanted to attend the camp while I teach. I talked to them last night on the phone, and they said they loved the camp and also that they loved a friendly space alien picture on the wall that has 10 arms in blue and red. After I hung up the phone, I started wondering what the friendly space alien might look like. I drew a picture as I imagined the alien with 10 arms, but I don't know how many of the alien's arms are in red and how many are in blue. Today, I am hoping that you can help me figure out this problem."		
What are the different combinations of red and blue arms of the alien?		Are students interested in the problem?
2. Teacher-guided problem solving a. Post a letter-size alien picture on the board and ask a volunteer (or 2) to place a cutout magnet arms in red and blue. b. Count together to confirm there are 10 arms in all. c. Move the arms, align them, and confirm how many arms are in red and in blue d. Circle "R" and "B" to identify the numbers e. Fill in the blanks on the bottom of the sheet to indicate the numbers of red and blue arms with numerals	→ Alien Picture Red arms / Blue arms RRRRR RRRRR / BBBBB BBBBB	Do students understand the activity?

3. Individual Problem Solving

a. Show student worksheet with a smaller alien picture (1/2 page size) and recognize it is the same picture as the one on the board.
b. Instruct students that they are going to find as many different combinations as possible.
c. Divide students into pairs or small groups and give them worksheets (5 per group), and also tell them that they can have extra sheets as needed.

If some groups find many combinations, suggest them to spread their work on the floor or table and see the relationships – do they think they have all the combinations? How do they know? (this will allow fast students to expand their activity and make a foundation for their discussion, while slow students to take as much time as possible to work on the basic activity.)

Are students working as a group?

Are students engaged in the activity?

Anticipated students' approaches

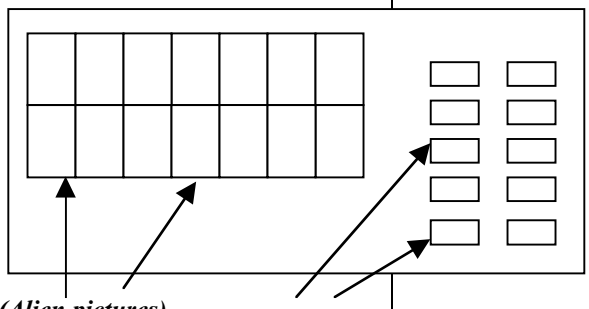
1. *Just color with visually different patterns, and then count the numbers of arms (may repeat the same number combinations).*
2. *Color with the increasing pattern with one color, color the remaining arms with another, and then count the numbers of arms.*
3. *Identify the number combinations first numerically, and then color the arms (fast students).*

Anticipated student question: *"Can we color all 10 arms in red?"*
Open the discussion to the group and see what students think. Teachers have students decide either coloring all 10 in one color is acceptable or not. If they decide to accept it, brief discussion of what "0" means should be included as a part of the whole class discussion at the end.

4. Sharing of ideas

a. Teacher 2 gets a large sheet of paper (prepared) with many alien pictures. Use cutout alien arms with magnets to be used on the board to show the combinations.
b. Ask a volunteer to show the combinations found. After the student puts up cutout arms, teacher 2 helps to move, align, and count them to identify the combinations [at this point, students are still concerned with the "colors" of the arms; therefore, the same combination in reverse order might come up (e.g., 3 & 7, and 7 & 3). Accept all the combinations at this point (up to 20 combinations)].
c. While identifying the combinations, teacher 2 also puts up combination number cards in order to make the pattern visible.

Teacher 1 walks around and checks students' work. When certain combination is missing on the chart, teacher 1 tries to find it in a student's work and encourage students to share



(Alien pictures)
(Number combination cards)

Example

5. Synthesizing the ideas

a. When there are enough combinations, ask students if they notice any pattern
b. When students make a comment, teachers confirm with the other students by pointing to the particular numbers and identifying the patterns.
c. Ask students to identify the patterns. Ask why they think there is a pattern.
d. Identify the combinations to break-apart 10 and the

Anticipated students' responses

1. *Numbers are reverse for some combinations*
2. *Each column has numbers 1 through 9 (10).*
3. *When number increases in one column, it decreases in the other.*
4. *When number increases in one column by one, it decreases in the other by one.*

patterns among them.		Do students notice the pattern?
6. Summing Up a. Make a list on the board with students' comments about relational patterns they noticed b. Ask students to get their journals out (or distribute sheets of paper) and record what they have learned today in the ways they may be able to record (use words, numbers, pictures, etc.)		Do students use different ways to express and record their learning?