Performance Based Learning and Assessment Task

What's Your Party Like? An Exploration of Area

I.   **ASSESSSMENT TASK OVERVIEW & PURPOSE:**
In the What's Your Party Like? Activity, students will be exploring area by considering a patio or deck area that they want to have a party on this summer. Students will look at how the area of their patio breaks down. They will manipulate their patio, the objects on it, and the amount of people at the party to come up with an effective and efficient patio layout for their guests to enjoy.

II.   **UNIT AUTHOR:**
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III.   **COURSE:**
Geometry

IV.   **CONTENT STRAND:**
Geometry

V.   **OBJECTIVES:**
Students will be able to: 1)break down a two-dimensional figure into other two-dimensional figures, 2)find area of any given two-dimensional figure that we've previously discussed in class, 3)measure, make observations, analyze, and describe area of an entire figure and as smaller figures that come together to create the larger one, 4) develop meaningful representations, both as formulas and figures, of the area of their "patio"

VI.   **REFERENCE/RESOURCE MATERIALS:**
Students will use: Graph paper, Heavier, color paper, Rulers, Compasses, Scissors, Tape, Classroom set of calculators, What's Your Party Like? Activity Worksheet, Notebook paper, Assessment & Rubric Sheets

VII.   **PRIMARY ASSESSMENT STRATEGIES:**
Teacher Assessment and Rubric

VIII.   **EVALUATION CRITERIA:**
Students will be evaluated on their completion of the activity and their presentation to the class

IX.   **INSTRUCTIONAL TIME:**
Two 90-minute class sessions

Activity/Task 1 Title

Strand
Geometry

Mathematical Objective(s)
Students will be able to: 1)break down a two-dimensional figure into other two-dimensional figures, 2)find area of any given two-dimensional figure that we've previously discussed in class, 3)measure, make observations, analyze, and describe area of an entire figure and as smaller figures that come together to create the larger one, 4)develop meaningful representations, both as formulas and figures, of the area of their "patio"

Related SOL.
G. 14 (The student will use similar geometric objects in two- or three-dimensions to:
a) compare ratios between side lengths, perimeters, areas, and volumes; b) determine how changes in one or more dimensions of an object affect area and/or volume of the object, d) solve real-world problems about similar geometric objects)

NCTM Standards
- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
- Analyze properties and determine attributes of two- and three-dimensional objects.
- Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools
- Use visualization, spatial reasoning, and geometric modeling to solve problems.
- Use geometric ideas to solve problems in, and gain insights into, other disciplines and other areas of interest.
- Make decisions about units and scales that are appropriate for problem situations involving measurement.
- Understand and use formulas for the area and surface area.
- Use unit analysis to check measurement computations.
- Organize and consolidate their mathematical thinking through communication.
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.
- Analyze and evaluate the mathematical thinking and strategies of others.
- Use the language of mathematics to express mathematical ideas precisely.
- Organize their mathematical thinking through discussion with peers.

- Communicate their thinking clearly to teacher and peers.
- Analyze and evaluate the mathematical thinking and strategies of their partners.
- Use the language of mathematics to express mathematical ideas precisely.
- Create and use representations to record and communicate mathematical ideas.
- Select, apply, and translate among mathematical representations.
- Use representations to model and interpret physical and mathematical phenomena.

Materials/Resources
- Graph paper
- Heavier, color paper
- Rulers
- Compasses
- Scissors
- Tape
- Classroom set of calculators
- What's Your Party Like? Activity Worksheet
- Notebook paper
- Assessment & Rubric Sheets

Assumption of Prior Knowledge
- Students should have an understanding of area of 2-dimensional objects, how to find it, and be able to explain how it is found, specifically triangles and quadrilaterals. They will have already had lessons and instruction on these topics. This activity will be more of a review and extension of that knowledge.
- Students should be operating on Level 3 Abstraction or Level 4 Deduction with respect to area of circles and quadrilaterals. They should be on Level 3 or 4 with respect to the properties of circles and quadrilaterals, as well.
- Students will express formulas of area for different quadrilaterals and circles. Students will show how the area of one of the figures is broken apart into smaller areas of smaller figures. They will express effective ways to arrange these smaller areas for a better atmosphere at their party.
- Students may have trouble deciding what is most efficient and effective for their party. Truly, this idea is subjective and based on the perception of the student, making it difficult for them to come up with a "set" way.
- Students will have already learning about and explored circles, quadrilaterals, and the area of the two.
- Students can discuss the layout of their party, houses, yards, et cetera. Students can also come up with effective designs for companies, museums, laboratories, et cetera to layout

their buildings. Students can use this activity and area to think about the interior design of various places, art, and architecture.

Introduction: Setting Up the Mathematical Task

Write Agenda on board:

1. Questions?

2. Introduction to Activity (approximately 10 minutes)

3. Think/Pair/Share – review of area – brainstorming (approximately 25 minutes)

4. What's Your Party Like? (approximately 60 minutes)

5. Presentations (all of next class)

Discuss the agenda with the students. "In this activity, we will explore the area of quadrilaterals and circles in order to set up the layout of a patio party. Our goal is to look at area from a different perspective. We will take the area of a quadrilateral and break it down into smaller areas of circles and more quadrilaterals. By doing so, we will look at the spacing of our patio and how we can effectively set-up a party for guests to enjoy.

Think/Pair/Share:

To get students thinking about the activity and to briefly review area, students will take about 7 minutes to brainstorm everything they know about area. Next, with a partner (whoever sits beside them), they will share and compile what they know about area. Lastly, we come together and discuss what they've listed as an entire class. Either the teacher or a scribe will list what the students provide. This list will stay on the board for the activity for students to use as a reference.

The teacher can help prompt the students along the way by asking them and prompting them with the following (teachers are not limited to this list) :

o   What are formulas for area and explanations of these formulas?

o   What do the variables stand for?

o   Draw labeled diagrams of circles and quadrilaterals to better represent your area formulas.

o   What is area?? When is it used in real life?

o   How do you know this is the correct area?

o   How is area different from circumference or perimeter?

o   What are the characteristics of circles and quadrilaterals? How do we use them in area?

Student Exploration

Student/Teacher Actions

Handout one activity sheet per student and allow them to read it over. Read the sheet aloud and answer any questions students may have. Handout rulers, compasses, graph paper, scissors, and tape.Allow students to work individually on their patio party for the remainder of the class (approximately 50 minutes). Students will be designing their quadrilateral patio and arranging given objects on the patio. They will also decide how many people to invite. They will answer questions on the activity sheet about how changing their patio would affect the layout.

The teacher will walk around providing clarification and answering any questions the students may have. Since this is a review and extension activity, it is likely that students' misconceptions may appear more now when they're forced to use area in a different manner. The teacher will provide insight on how to break down the overall area, things to think about as far as party atmosphere, et cetera.

Lastly, students will publicize their mathematical thinking and understanding of area in relation to their patio party by presenting their patio layout to the class. They will create a visual presentation to show the class as they discuss how they've set-up their patio and why that layout works best for their party.

By doing this task and presenting their patio, students deepen their knowledge of how area is found and how the formulas are derived. They also review what they know about quadrilaterals and circles.

To incorporate technology, students could use GeoGebra or Geometer's Sketchpad to recreate their patio's layout. This could be done either as a class, in groups, or individually, depending on time restraints and the needs of the students. For students that are interested, programs rendering 3-D objects could be used to create their layout.

For more details on what the students are doing, what they should be thinking about, and how the activity is done, see the attached What's Your Party Like? worksheet.

Monitoring Student Responses

Students are expected to communicate their thinking and new knowledge to both the teacher and their peers by writing down their findings, creating their patio, creating a visual presentation of their findings, presenting and explaining their findings to the class. They will answer questions from both the teacher and students during their presentations.

The teacher will introduce the activity and how it applies to area. They will reiterate how area is used in real life and that this is just one example! Additionally, teacher will ask students and

discuss how the overall area of a quadrilateral breaks down. Why does it work this way? How does it apply to the formula you know?

For students that are ready to move forward, the teacher will have additional questions about the area of other two-dimensional objects. What about triangles? Would you want a triangular or even a circular patio? Why or why not? Come up with an alternative patio that you find just as effective for your party. Students that are ready to move on could also pair up with students that are having difficulties to provide hints and insight, without giving away too much information or pushing their ideas on the other student.

As an additional extension, students could research "dead load" versus "live load" and explore the weight of the patio with the objects and guests included. Does their patio outweigh county capacity limits? How will they modify in order to meet them?

After all students have presented their patio layouts, the class will discuss some of the following ideas:

- Which patios did you like the most? Why? Are they effective for a party?
- How did you all define effective or efficient? Is that relative to the students?
- What if you only want a small party versus a large party? Do you see how everyone's patios may be different based on their own likings?
- What are some ways you could improve your patio now that you've seen others? Do you still feel as though your patio is considered effective?
- How would you help others improve their patios? Be constructive.
- How could you change your patio to accommodate to different people's preferences?
- How did the patio break down into smaller sections?
- Why were the areas of different sections important for your overall area of the entire patio?
- What did you like about this activity? What did you enjoy? What didn't you enjoy? How would you improve this activity?

This discussion allows students to reflect upon their initial ideas of area and their patio versus their ideas after they've seen everyone present. It also allows them to realize that they may not have understood or realized everything that could be brought up during this activity.

Lastly, as a class, we could pick one patio and derive the formula for i's area using the smaller areas we used in its set-up. As an extension, if time permits, a small to- scale patio could be built using small wooden craft items, Popsicle sticks, Legos, et cetera.

Assessment List and Benchmarks
Assessment List, Rubric, and Benchmarks are attached.

Assessments for each task and activity are provided within the Introduction, Activity, and Summary of the described task. Additional guidance in the activity is shown in the What's Your Party Like? Activity Worksheet

For students with poor motor skills, teachers and assistants may need to help with cutting, taping their layouts of their patios. English Language Learners may need someone to read to them and help translate any instructions, questions, or ideas they may have

What's Your Party Like?

An Exploration of Area

In this activity, you will use your knowledge of quadrilaterals, triangles, and area to create a layout for a patio that you plan to have a party on. You will need to use graphing paper, a ruler, scissors, and colored paper to help create your patio layout. Your work must be neat, easy to read, and very precise. You may answer any questions on this sheet. You will need to present your answers, your patio, and your reasoning in your presentation.

Follow the instructions below to:

1. Build your patio.
2. Establish a layout for the patio.
3. Think about how many guests you'd like to invite to your party.
4. Prepare a presentation of your patio party.

Building Your Patio

1. On your graph paper, use your ruler to draw a large quadrilateral to represent the perimeter of your patio. You will be working within your perimeter to set-up the layout of the patio for the party. Be realistic about the shape of your patio. Most patios are rectangles but you are not limited to a rectangular patio! What shape patio did you choose?

2. Measure and label each side of the patio with the appropriate measurements. Do not add units to the measurements. Simply allow one grid box to be one unit.
3. What is the perimeter of your patio? Express your answer in units.
   (*ex: Patio Perimeter = 150 units*)

4. What is the area of your patio? Show the formula you used and each step you took to find the area.

5. How many square feet of wood would you need to lay the flooring of your patio? Assume that 2 grid boxes are equivalent to one foot.

6. Now cut out your patio from the colored paper. This paper will be cut up to show the different items on your patio later. For now, just cut out the entire patio shape.

Setting Up Your Patio's Layout

7. The following items are items you *must* include on your patio, alongside their grid box dimensions. These dimensions are the minimum space required around the object to allow for a comfortable amount of room. You may choose how many of these items you want to include on your patio. You also choose where you place them and their orientation. Fill in the "Area of One Item", "Number Used on Patio", and "Total Area of All Items" columns once you've decided on you patio layout. Be sure to pay attention to the total number of grid boxes that circular items will inhabit. For example, a circular item of diameter 3 takes up an entire 3 x 3 rectangular space on the floor plan.

Item	Dimensions (grid boxes)	Area of One Item (units²)	# Used on Patio	Total Area of All Items (units²)
Chair	3 x 3			
Large Table	4 x 6			
End Table (E.T.)	2 x 1			
Grill	5 x 3			
Buffet Table	5 x 10			
Plant	2 x 1			
Tiki Torch (T.T.)	Diameter = 2			
Guest	Diameter = 2			

8. Now, come up with 2-3 patio items on your own. They may be rectangular or circular. What are their dimensions and area? Incorporate these items into your plan, if you'd like.
9. Sketch a layout of your proposed patio plan. You may need to create multiple sketches to decide which one you like best. Only the final sketch will be turned in with your presentation but make note of how many sketches you do and how you change them. You will discuss these things in your presentation.
10. As you are creating sketches, make sure you account for space for your guests to stand and walk. Make sure not to include too many items or else you won't have enough room to have people join you at your party!
11. Using the patio cutout from the colored paper, begin cutting out the items you've placed on your patio. You should have enough colored paper. If you don't that means you left no space on your patio, which means you cannot have a party!
12. Tape these items over their place on your patio you've drawn on your graph paper. Label each of the items so that it is clear what you've placed where.
13. Why did you create the layout the way you did? Be prepared to explain.

Inviting Guests

14. Using your comfort level of socialization and the amount of space you have, how many guests will you invite? Include yourself in this total and place it in the chart provided in #7.
15. What is your reasoning for your guest total? Be prepared to talk about this in the presentation.

Presentation

16. Prepare a presentation where you will discuss your answers to this sheet. Be able to elaborate on any of your answers. Make sure the verbal part has a logical flow to it. Following this activity worksheet may help.
17. Make sure your patio layout is very neat and legible. This will be your visual for your presentation.
18. Be prepared to answer these questions and defend your answer:
    a. How did you divide up your area into smaller areas?
    b. Did you have space leftover? How did you know from cutting the colored paper?
    c. What's another way you would know how much area you had used, how much was left over, and how many guests would fit? (Hint, use the table from #7 and think about totals.)
    d. What would happen if we cut your quadrilateral patio in half across the diagonal? What shape would it be? What would happen to the area? Could you include as many items or guests? Why?

What's Your Party Like?

An Exploration of Area

Building Your Patio

1. On your graph paper, use your ruler to draw a large quadrilateral to represent the perimeter of your patio. You will be working within your perimeter to set-up the layout of the patio for the party. Be realistic about the shape of your patio. Most patios are rectangles but you are not limited to a rectangular patio! What shape patio did you choose?
    I chose a rectangular patio because it would make the most sense to be placed up against a house and in a yard.

2. Measure and label each side of the patio with the appropriate measurements. Do not add units to the measurements. Simply allow one grid box to be one unit.
    See visual.

3. What is the perimeter of your patio? Express your answer in units.
    (*ex: Patio Perimeter = 150 units*)
    Patio Perimeter = 21 + 21+ 29 +29 = 100 unites

4. What is the area of your patio? Show the formula you used and each step you took to find the area.
    Area = lw, l = 29 units , w = 21 units
    Area = 29(21) = 609 units^2

5. How many square feet of wood would you need to lay the flooring of your patio? Assume that 2 grid boxes are equivalent to one foot.
    152.25 square feet of wood (divide 609 by 4 since 2 x 2 is representative of 1ft. x 1ft.)

6. Now cut out your patio from the colored paper. This paper will be cut up to show the different items on your patio later. For now, just cut out the entire patio shape.
    Visual shows shaded pink. I did not tape paper on so that you could see the layout better.

Setting Up Your Patio's Layout

7. The following items are items you *must* include on your patio, alongside their grid box dimensions. These dimensions are the minimum space required around the object to allow for a comfortable amount of room. You may choose how many of these items you want to include on your patio. You also choose where you place them and their orientation. Fill in the "Area of One Item", "Number Used on Patio", and "Total Area of All Items" columns once you've decided on you patio layout.

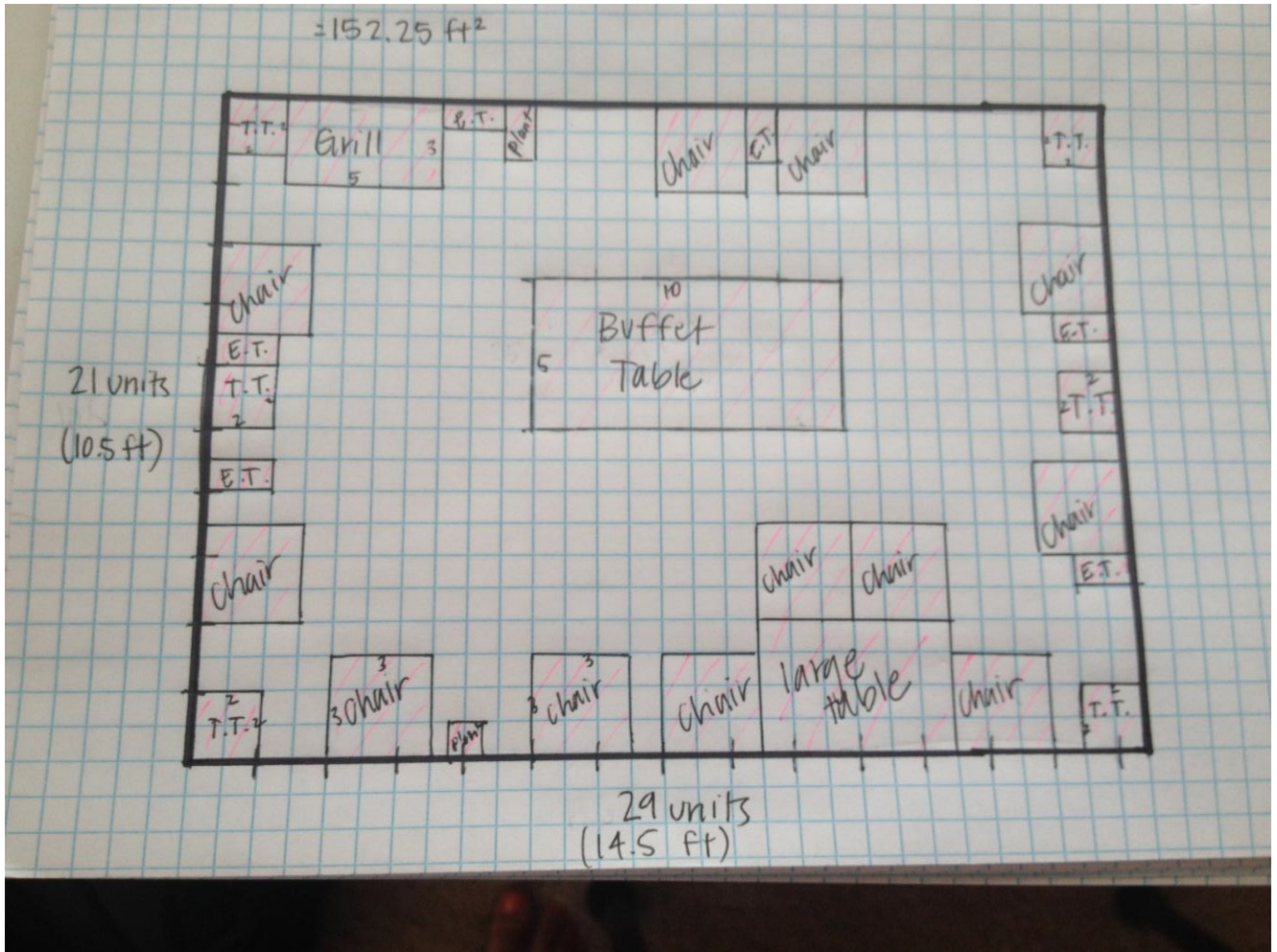| Item	Dimensions (grid boxes)	Area of One Item (units^2)	# Used on Patio	Total Area of All Items (units^2)
Chair	3 x 3	9	12	108
Large Table	4 x 6	24	1	24
End Table (E.T.)	2 x 1	2	6	12
Grill	5 x 3	15	1	15
Buffet Table	5 x 10	50	1	50
Plant	2 x 1	2	2	4
Tiki Torch (T.T.)	Diameter = 2	4	6	24
Guest	Diameter = 2	4	12	48

8. Now come up with 2-3 patio items on your own. They may be rectangular or circular. What are their dimensions and area? Incorporate these items into your plan, if you'd like.
   Small, round table, diameter = 3, area of rectangular space = 9
   Hot tub, 8 x 8 rectangle, area = 64
9. Sketch a layout of your proposed patio plan. You may need to create multiple sketches to decide which one you like best. Only the final sketch will be turned in with your presentation but make note of how many sketches you do and how you change them. You will discuss these things in your presentation.
   See visual.

10. As you are creating sketches, make sure you account for space for your guests to stand and walk. Make sure not to include too many items or else you won't have enough room to have people join you at your party!
11. Using the patio cutout from the colored paper, begin cutting out the items you've placed on your patio. You should have enough colored paper. If you don't that means you left no space on your patio, which means you cannot have a party!
12. Tape these items over their place on your patio you've drawn on your graph paper. Label each of the items so that it is clear what you've placed where.
    Visual shows shaded pink. I did not tape paper on so that you could see the layout better.
13. Why did you create the layout the way you did? Be prepared to explain.
    I created an open layout with one large buffet table and one grill in order to keep the party small. I would rather guests focus on socializing that being overwhelmed with food and extra furniture. I only had one large table to force gets to move around the patio and use up the entire space. To accommodate for table space, I added end tables beside every chair. I did not include may plants since the patio is already outside and there is plenty of nature around us!

Inviting Guests

14. Using your comfort level of socialization and the amount of space you have, how many guests will you invite? Include yourself in this total and place it in the chart provided in #7.
15. What is your reasoning for your guest total? Be prepared to talk about this in the presentation.
    I invited 12 guests, including myself, because I prefer smaller gatherings. I do not like to be overwhelmed by too many people and have to worry about my property being broken. I also only included one chair per guest. By keeping the party small, people feel they have plenty of space to walk around and get to know everyone.

Presentation

16. Prepare a presentation where you will discuss your answers to this sheet. Be able to elaborate on any of your answers. Make sure the verbal part has a logical flow to it. Following this activity worksheet may help.
17. Make sure your patio layout is very neat and legible. This will be your visual for your presentation.
18. Be prepared to answer these questions and defend your answer:
    a. How did you divide up your area into smaller areas?
    For simplicity, I divided up the entire rectangular patio area into smaller rectangles and squares. It was very easy to see how the patio could be divided into smaller rectangles in order to see the entire area of the space.
    b. Did you have space leftover? How did you know from cutting the colored paper?
    After guests and items, I had 324 units² leftover in area for people to walk around and mingle. I do not like feeling cramped and wanted to make sure people had plenty of space. I had colored paper leftover, thus, I had not used my entire patio area.
    c. What's another way you would know how much area you had used, how much was left over, and how many guests would fit? (Hint, use the table from #7 and think about totals.)
    Another way to tell if I had area leftover, which I did, was to total up the total area column of the table and subtract it from my total area of the patio, regardless of items placed on it.
    d. What would happen if we cut your quadrilateral patio in half across the diagonal? What shape would it be? What would happen to the area? Could you include as many items or guests? Why?
    If the patio were cut in half across the diagonal, I would be left with a triangular shaped patio, specifically a right triangle. This would cut the area in half as well. I would most likely include have as many guests, chairs, and end tables. I would have to decrease my furniture and guests since the total area decreases by half, which is a lot of space!

≈152.25 ft²

T.T. 2 | Grill 5 | 3 | E.T. | Plant | Chair | E.T. | Chair | T.T. 2

21 units
(10.5 ft)

Chair | E.T. | T.T. 2 | E.T. | Chair

Buffet Table | 10 | 5

Chair | E.T. | 2 E.T. T.T | Chair | E.T.

chair | chair | large table | Chair

T.T. 2 | 3 Chair 3 | Plant | 3 chair | Chair | Chair | T.T. 5

29 units
(14.5 ft)

Visual

What's Your Party Like? Activity Assessment List

#	Element	Point Value	Earned Assessment	
			Self	**Teacher**
1	Student completed activity worksheet.	2		
2	Student sketched patio layout plan.	2		
3	Student included labels required.	2		
4	Student measured perimeter and area correctly.	2		
5	Student attached colored paper as items on patio layout.	2		
6	Student invited and allowed space for guests.	2		
7	Student answered follow-up questions for each instruction on worksheet.	2		
8	Student provided patio layout with attached items.	2		
9	Student's visuals (patio) are neat.	2		
10	Student's worksheet and visual are well organized.	2		
11	Student explains their patio break down, including the area break down.	2		
12	Student defends their reasoning for patio layout.	2		
13	Student defends their reasoning for amount of guests invited.	2		
14	Student's verbal aspect of presentation is well organized.	2		
15	Student's verbal presentation is easy to hear and understand.	2		

What's Your Party Like? Activity Rubric

#	Element	0	1	2
1	Student completed activity worksheet.	Incomplete	Partially complete	Complete
2	Student sketched patio layout plan.	No sketch	Partial sketch	Full sketch
3	Student included labels required.	No labels	Some labels	All labels
4	Student measured perimeter and area correctly.	Measurements not provided.	Some, but not all, measurements provided.	All measurements provided.
5	Student attached colored paper as items on patio layout.	No colored paper attached.	Some items shown with colored paper.	All items shown with colored paper.
6	Student invited and allowed space for guests.	No guests invited and/or no space provided.	Invited guests but did not allow space OR allowed space but did not invite guests.	Invited reasonable number of guests and allowed adequate space.
7	Student answered follow-up questions for each instruction on worksheet.	No follow-up questions answered.	Follow-up question answered but are not correct or do not make sense.	Follow-up questions answered logically.
8	Student provided patio layout with attached items.	No layout or items attached.	Incomplete layout provided.	Completed layout with attached items.
9	Student's visual (patio) is neat.	Lacks neatness.	Needs improvement.	Neat and legible.
10	Student's worksheet and visual are well organized.	No evidence of organization	Mostly organized	Organized and easy to follow
11	Student explains their patio break down, including the area break down.	Cannot explain break down	Partially explains break down	Correctly and completely explains break down.
12	Student defends their reasoning for patio layout.	Does not defend	Partially defends and explains	Fully defends and explains reasoning
13	Student defends their reasoning for amount of guests invited.	Does not defend	Partially defends and explains	Fully defends and explains reasoning
14	Student's verbal aspect of presentation is well organized.	No evidence of organization	Mostly organized	Organized and easy to follow
15	Student's verbal presentation is easy to hear and understand.	Cannot hear or understand	Can usually hear and understand	Can always hear and understand