





Rubrics: The Valentine Candy Challenge

Key APS Mathematics Performance Standards: Grades 6 & 7

-  **Collects** data using a variety of appropriate instruments (e.g., surveys, observations, & interviews).
-  **Organizes** data using appropriate graphical representations (e.g., frequency tables, stem-and-leaf plots).
-  **Draws** conclusions from data using measures of central tendency (e.g., mode, median, mean).
-  **Selects and develops** appropriate display(s) (e.g., T-charts, graphs) of data.

Level	Understanding	Strategies, Reasoning, & Procedures	Communication
Novice	<ul style="list-style-type: none"> ❖ The student understands that s/he needs to... <ul style="list-style-type: none"> • Identify the contents of the teacher's (answer) box. • Use the data from his/her box of hearts to help identify the contents of the teacher's box. ❖ The student does not understand that s/he needs to... <ul style="list-style-type: none"> • Obtain a larger sample size to determine the contents of the teacher's box • Collect data from the other students and represent the data in a chart. • Analyze and use the data to support his/her solution. • Write an observation about their solution. 	<ul style="list-style-type: none"> ❖ The student begins the task by analyzing the contents of their box of hearts, and bases his/her solution using one box of hearts. ❖ The student does not understand that to accurately determine the contents of the teacher's box of hearts s/he must obtain a larger sampling of the boxes. ❖ The student does not use any statistical reasoning to arrive at their solution. <p>Sample Strategy: Student identifies the contents of their box and based on that information guesses the contents of the teacher's box.</p> <p>Pink Red Orange Green Purple 3 7 9 4 8</p> <p>There are 31 hearts in my box, so the teacher will probably have around 31 hearts. The hearts will be pink, red, orange, green, & purple.</p>	<ul style="list-style-type: none"> ❖ There is little or no communication, the student did not label the work, and/or their thinking is difficult to follow. ❖ Summary: The student cannot write his/her final answer, and/or uses little or no math language and symbols to explain (in writing) how s/he determined the contents of the teacher's box of hearts. The student does not include an observation about their final solution. ❖ Representations: The student has no system (charts/t-tables/graphs) to track the contents of his/her box or the contents of the classes' boxes. The student cannot use the information in the chart to support their final solution.

Level	Understanding	Strategies, Reasoning, & Procedures	Communication																														
Apprentice	<p>❖ The student understands that s/he needs to...</p> <ul style="list-style-type: none"> Identify the contents of the teacher's (answer) box. Use the data from his/her box of hearts to help identify the contents of the teacher's box. <p>❖ The student <i>may not</i> understand that s/he needs to...</p> <ul style="list-style-type: none"> Obtain a larger sample size to determine the contents of the teacher's box Collect data from the other students and represent the data in a chart. Analyze and use the data to support his/her solution. Write an observation about their solution. 	<p>❖ The student begins the task by analyzing the contents of their box. The student realizes that they need to have a larger sample of boxes, but does not interpret the data from the larger sample size accurately.</p> <p>❖ The student has a beginning understanding of statistical analysis but needs more practice using and interpreting the data.</p> <p>Sample Strategy: The student collect data regarding the contents of their box and other boxes of hearts.</p> <table> <thead> <tr> <th>Pink</th> <th>Red</th> <th>Orange</th> <th>Green</th> <th>Purple</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>7</td> <td>9</td> <td>4</td> <td>8</td> <td>31</td> </tr> <tr> <td>5</td> <td>8</td> <td>7</td> <td>6</td> <td>11</td> <td>37</td> </tr> <tr> <td>6</td> <td>7</td> <td>5</td> <td>7</td> <td>9</td> <td>34</td> </tr> <tr> <td>5</td> <td>3</td> <td>10</td> <td>8</td> <td>7</td> <td>33</td> </tr> </tbody> </table> <p>The average box size is $31 + 37 + 34 + 33 = 135 \div 4 = 33.3$. The teacher's box will contain 33 hearts with a variety of colors pink, red, orange, green, & purple.</p>	Pink	Red	Orange	Green	Purple	Total	3	7	9	4	8	31	5	8	7	6	11	37	6	7	5	7	9	34	5	3	10	8	7	33	<p>❖ The student has communicated his/her understanding of the task by labeling their work, but the task is not clearly organized and the student's thinking is hard to follow.</p> <p>❖ Summary: The student states his/her final answer and uses some math language and symbols to explain (in writing) how s/he determined the contents of the teacher's box of hearts. The student does not include an observation about their final solution.</p> <p>❖ Representations: The student can identify the contents of their box of hearts, but has not established an accurate system (charts/t-tables/graphs) to track the contents of his/her box or the contents of the classes' boxes. The student cannot accurately use the information in the chart to support their final solution.</p>
Pink	Red	Orange	Green	Purple	Total																												
3	7	9	4	8	31																												
5	8	7	6	11	37																												
6	7	5	7	9	34																												
5	3	10	8	7	33																												

Level	Understanding	Strategies, Reasoning, & Procedures	Communication																																																																																												
Practitioner	<p style="text-align: center;">Proficiency</p> <p>❖ The student understands that s/he needs to...</p> <ul style="list-style-type: none"> • Identify the contents of the teacher's (answer) box. • Use the data from his/her box of hearts to help identify the contents of the teacher's box. • Obtain a larger sample size to determine the contents of the teacher's box • Collect data from the other students and represent the data in a chart. • Analyze and use the data to support his/her solution. • Write an observation about their solution. 	<p style="text-align: center;">Proficiency</p> <p>❖ The student analyzes the contents of their box of hearts and the boxes of the other student's boxes.</p> <p>❖ The student uses their knowledge of statistics to analyze the data collected and uses the information to accurately support their solution as to what the contents are in the teacher's box of hearts.</p> <p>❖ The student makes an observation about their solution.</p> <p>Sample Strategy: Student collects data from the class.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Pink</th> <th>Red</th> <th>Orange</th> <th>Green</th> <th>Purple</th> <th>Total</th> </tr> </thead> <tbody> <tr><td>6</td><td>7</td><td>9</td><td>4</td><td>8</td><td>34</td></tr> <tr><td>5</td><td>8</td><td>7</td><td>6</td><td>11</td><td>37</td></tr> <tr><td>6</td><td>7</td><td>5</td><td>7</td><td>9</td><td>34</td></tr> <tr><td>5</td><td>3</td><td>10</td><td>8</td><td>7</td><td>33</td></tr> <tr><td>7</td><td>9</td><td>6</td><td>10</td><td>4</td><td>36</td></tr> <tr><td>6</td><td>5</td><td>7</td><td>6</td><td>9</td><td>33</td></tr> <tr><td>5</td><td>8</td><td>9</td><td>7</td><td>7</td><td>36</td></tr> <tr><td>7</td><td>7</td><td>6</td><td>8</td><td>6</td><td>34</td></tr> <tr><td>9</td><td>5</td><td>8</td><td>7</td><td>6</td><td>35</td></tr> <tr><td>8</td><td>6</td><td>7</td><td>8</td><td>5</td><td>34</td></tr> <tr> <td>6.7</td> <td>6.5</td> <td>7.4</td> <td>7.3</td> <td>7.2</td> <td>34.6</td> <td>mean</td> </tr> <tr> <td>6</td> <td>6</td> <td>7</td> <td>7 & 8</td> <td>6 & 7</td> <td>34</td> <td>mode</td> </tr> </tbody> </table> <p>The teacher's box will contain:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Pink</th> <th>Red</th> <th>Orange</th> <th>Green</th> <th>Purple</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>6</td> <td>6</td> <td>7</td> <td>7</td> <td>7</td> <td>34</td> </tr> </tbody> </table> <p>I based my decision on the mode of the colors and when the mode was 2 numbers I chose the one that was closest to the average.</p> <p>I observed that for this sampling that the mean and the mode were very close and both would be good predictors of the heart colors for the teacher's box.</p>	Pink	Red	Orange	Green	Purple	Total	6	7	9	4	8	34	5	8	7	6	11	37	6	7	5	7	9	34	5	3	10	8	7	33	7	9	6	10	4	36	6	5	7	6	9	33	5	8	9	7	7	36	7	7	6	8	6	34	9	5	8	7	6	35	8	6	7	8	5	34	6.7	6.5	7.4	7.3	7.2	34.6	mean	6	6	7	7 & 8	6 & 7	34	mode	Pink	Red	Orange	Green	Purple	Total	6	6	7	7	7	34	<p style="text-align: center;">Proficiency</p> <p>❖ The student can represent his/her work in a clear, organized manner.</p> <p>❖ Summary: The student states his/her final answer and uses appropriate math language and symbols to explain (in writing) how s/he determined the contents of the teacher's box of hearts. The student does include an observation about their final solution.</p> <p>❖ Representations: The student can identify the contents of their box of hearts, and has established an accurate system (charts/t-tables/graphs) to track the contents of his/her box and the contents of the classes' boxes. The student can use the information in the chart to support their final solution.</p>
Pink	Red	Orange	Green	Purple	Total																																																																																										
6	7	9	4	8	34																																																																																										
5	8	7	6	11	37																																																																																										
6	7	5	7	9	34																																																																																										
5	3	10	8	7	33																																																																																										
7	9	6	10	4	36																																																																																										
6	5	7	6	9	33																																																																																										
5	8	9	7	7	36																																																																																										
7	7	6	8	6	34																																																																																										
9	5	8	7	6	35																																																																																										
8	6	7	8	5	34																																																																																										
6.7	6.5	7.4	7.3	7.2	34.6	mean																																																																																									
6	6	7	7 & 8	6 & 7	34	mode																																																																																									
Pink	Red	Orange	Green	Purple	Total																																																																																										
6	6	7	7	7	34																																																																																										

Level	Understanding	Strategies, Reasoning, & Procedures	Communication
Expert	<p>❖ The student understands that s/he needs to...</p> <ul style="list-style-type: none"> • Identify the contents of the teacher's (answer) box. • Use the data from his/her box of hearts to help identify the contents of the teacher's box. • Obtain a larger sample size to determine the contents of the teacher's box • Collect data from the other students and represent the data in a chart. • Analyze and use the data to support his/her solution. • Write an observation about their solution. <p>❖ Task Extension: The student includes a rule, equation, generalization, and/or observation (in writing) about their understanding of statistics and data analysis.</p>	<p>❖ The student analyzes the contents of their box of hearts and the boxes of the other student's boxes.</p> <p>❖ The student uses their knowledge of statistics to analyze the data collected and uses the information to accurately support their solution as to what the contents are in the teacher's box of hearts.</p> <p>❖ The student makes an observation about their solution.</p> <p>Sample Strategy: See the 'Practitioner' strategy</p> <p>Task Extension: The student extends the task by supporting their solution with additional statistical analyses.</p> <p>The range for the heart colors is 4 – 11 hearts in a box. The range for the total number of hearts in the box is 34 – 38, which is odd because the low end of the range is both the mean and the mode. The student uses additional charts to support their decision. See the 'Expert' benchmark paper to see the pie chart.</p>	<p>❖ The student can represent his/her work in a clear, organized manner.</p> <p>❖ Summary: The student states his/her final answer and uses appropriate math language and symbols to explain (in writing) how s/he determined the contents of the teacher's box of hearts. The student does include an observation about their final solution.</p> <p>❖ Representations: The student can identify the contents of their box of hearts, and has established an accurate system (charts/t-tables/graphs) to track the contents of his/her box and the contents of the classes' boxes. The student can use the information in the chart to support their final solution.</p> <p>❖ Task Extension: The student includes a rule, equation, generalization, and/or observation (in writing) about their understanding of statistics and data analysis.</p>