Example Evaluating Alternatives Rubric

EXAMPLE: Team Superengineers is comprised of four students. They are designing a scooter for children. The team followed the engineering analysis process below to evaluate their best design alternatives.

**Step 1: List Criteria**

a) Team Superengineers came up with the following four design criteria:

- safety
- appearance
- ease of use
- cost to produce

**Step 2: Assign Priority Values to Criteria**

a) The team completed the interaction matrix (page 2) by listing the criteria both in rows down the left and columns across the top.

b) The team chose a facilitator to poll the entire team for their opinion of the relative importance of one criterion over another. The results were:

- All team members ranked safety over appearance, ease of use, and cost of production.
- One team member ranked appearance over ease of use.
- Two team members ranked appearance over cost of production.
- Three team members ranked ease of use over cost of production.

c) Next, the team added the numbers across the rows for each criterion and wrote these numbers in the “ROW TOTAL” cell.

d) Then they added the “ROW TOTAL” numbers down the column to find the “COLUMN TOTAL.”

**Step 3: Normalize the Priority Values**

a) Lastly, the team divided each “ROW TOTAL” by the “COLUMN TOTAL” to find the “NORMALIZED VALUES.”

b) Notice how the sum of the “NORMALIZED VALUES” (0.5 + 0.125 + 0.125 + 0.25) equals 1.
Design Step 4: Select a Promising Solution Using Engineering Analysis Activity – Example Evaluating Alternatives Rubric

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Step 4: Compare Alternative Designs

a) The team ordered the normalized criteria values from largest to smallest and wrote these values in the decision matrix (page 4).

b) Now for the fun part; the team evaluated their design alternatives. So far, the team has three alternatives for their scooter design:

<table>
<thead>
<tr>
<th>Play-It-Safe Scooter</th>
<th>Stylish Scooter</th>
<th>Teeny-Tiny Scooter</th>
</tr>
</thead>
<tbody>
<tr>
<td>This scooter has an extra set of brakes, wider tires for extra balance, and detachable scooter training wheels.</td>
<td>This scooter glows in the dark and has blinking lights powered by the motion of the wheels!</td>
<td>This scooter is constructed of thin metal materials and can fold up to fit inside a small backpack.</td>
</tr>
</tbody>
</table>

c) Using a 0–5 scale (0 meaning that the design concept does not meet the criterion at all), they ranked each alternative design concept according to how well they felt the concept could satisfy each of the design criteria they identified.

d) Write these ranked values in the gray cells below each design alternative.

e) Multiply each ranked value by the normalized criterion value and write this number to the right of the ranked value for each design alternative.

f) Sum these multiplied values and write them in the corresponding “TOTAL” cell.

Step 5: Analyze Results

a) The design alternative with the highest value (as shown in the “TOTALS” row) is the alternative that best meets the selected criteria. Design alternatives with significantly lower values can be discarded. The design alternative with the highest score may be selected, or you can select the alternative that received the highest score for the majority of the categories.
### Decision Matrix

<table>
<thead>
<tr>
<th>Criteria (ranked by normalized criteria value)</th>
<th>Normal Priority Value</th>
<th>Design Alternative #1</th>
<th>Design Alternative #2</th>
<th>Design Alternative #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>0.5</td>
<td>5</td>
<td>2.5</td>
<td>2</td>
</tr>
<tr>
<td>Ease of Use</td>
<td>0.25</td>
<td>4</td>
<td>1</td>
<td>3.75</td>
</tr>
<tr>
<td>Appearance</td>
<td>0.125</td>
<td>2</td>
<td>0.25</td>
<td>5</td>
</tr>
<tr>
<td>Cost of Production</td>
<td>0.125</td>
<td>2</td>
<td>0.25</td>
<td>2</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>4</strong></td>
<td><strong>2.625</strong></td>
<td><strong>3.875</strong></td>
<td></td>
</tr>
</tbody>
</table>

b) The design alternative with the highest value (as shown in the “TOTALS” row) turned out to be the “Play-It-Safe” Scooter. Team Superengineers decided to proceed with this idea!