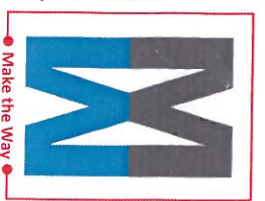


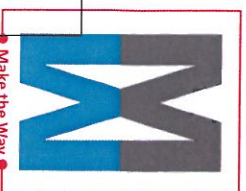
# Maker Cognitive Demand



<p><b>Higher-Level Demands</b></p>	<p><b>High Demand Making</b></p> <ul style="list-style-type: none"> <li>• Requires complex thinking in which the challenge does not suggest a series of steps required to be successful</li> <li>• Requires students to explore, understand and analyze the nature of the challenge and constraints, with minimal teacher direction</li> <li>• Demands monitoring and self-regulation towards meeting the challenge by testing and revising the product</li> <li>• Requires students to access relevant knowledge and experiences and make use of them while working through the challenge</li> <li>• Requires students to make decisions about the design and use of materials to complete the challenge</li> <li>• Requires considerable cognitive effort. This may involve some level of anxiety for the student due to the unpredictable nature of the solution process required</li> </ul> <p><b>Middle Demand Making</b></p> <ul style="list-style-type: none"> <li>• There are multiple designs that can meet the constraints of the challenge</li> <li>• Limited choices in the variety of materials available to meet the challenge</li> <li>• Requires some degree of cognitive effort. Students make decisions about how to determine if the product is meeting the constraints of the challenge.</li> </ul> <p><b>Product Making</b></p> <ul style="list-style-type: none"> <li>• The use of specific steps to design a product to meet the challenge is specifically called for or is evident based on prior instruction, experience or placement of the task</li> <li>• Little ambiguity (about steps and/or materials) about how the product can be created</li> <li>• There are limited opportunities for students to make their own design choices</li> <li>• Is focused on developing a product and not the process of designing based on constraints</li> <li>• The challenge does include the opportunity for developing draft, creating revisions, or engaging in rapid prototyping process</li> </ul> <p><b>Replication Making</b></p> <ul style="list-style-type: none"> <li>• Involves following a series of steps to create a product</li> <li>• Is not ambiguous (about steps and/or materials) about how the product can be created, is an exact replication</li> <li>• There are little, no, or trivial design constraints</li> <li>• The challenge does not require students to create drafts, revisions, or engage in rapid prototyping process</li> </ul>
<p><b>Lower-Level Demands</b></p>	<p><b>Product Making</b></p> <ul style="list-style-type: none"> <li>• The use of specific steps to design a product to meet the challenge is specifically called for or is evident based on prior instruction, experience or placement of the task</li> <li>• Little ambiguity (about steps and/or materials) about how the product can be created</li> <li>• There are limited opportunities for students to make their own design choices</li> <li>• Is focused on developing a product and not the process of designing based on constraints</li> <li>• The challenge does include the opportunity for developing draft, creating revisions, or engaging in rapid prototyping process</li> </ul> <p><b>Replication Making</b></p> <ul style="list-style-type: none"> <li>• Involves following a series of steps to create a product</li> <li>• Is not ambiguous (about steps and/or materials) about how the product can be created, is an exact replication</li> <li>• There are little, no, or trivial design constraints</li> <li>• The challenge does not require students to create drafts, revisions, or engage in rapid prototyping process</li> </ul>

Adapted from Stein, M.K., Smith, M.S., Henningsen, M.A., Silver, E.A. (2000). *Implementing standards-based mathematics instruction: A Casebook for professional development*. New York, NY: Teachers College Press.

**AGENCY, AUTHORITY and IDENTITY**



<p><b>Whole class</b></p> <p><i>To what extent are students the source of ideas and discussion of them? How are student contributions framed?</i></p>	<p><b>Small group</b></p> <p><i>To what extent do students value and support each other's ideas when working in a group?</i></p>	<p><b>Student presentations</b></p> <p><i>To what extent are students the source of presented ideas and respond to presented ideas?</i></p>	<p><b>Individual work</b></p> <p><i>To what extent are students the source of presented ideas; do students respond to presented ideas?</i></p>
<p>Student...</p> <ul style="list-style-type: none"> <li>• does not engage in opportunities to explain thinking</li> <li>• does not ask questions to make sense or modify classmates' ideas</li> </ul>	<p>Student...</p> <ul style="list-style-type: none"> <li>• does not engage in opportunities to explain any thinking</li> <li>• does not ask questions to make sense of groups' ideas</li> </ul> <p>Not everyone participates in group discussion</p>	<p>Presenters...</p> <ul style="list-style-type: none"> <li>• are constrained to respond to teacher questions</li> </ul>	<p>Student...</p> <ul style="list-style-type: none"> <li>• does not engage in the opportunity to develop ideas in order to make sense of the mathematics she is learning</li> </ul> <p>Student's ideas are not elicited or built upon</p>
<ul style="list-style-type: none"> <li>• explains some thinking, some of the time responding to teacher questions</li> <li>• solves problem not yet understanding why solution works</li> <li>• does not explore or build on ideas</li> <li>• makes claim</li> </ul>	<ul style="list-style-type: none"> <li>• explains some thinking, some of the time</li> <li>• does not explore or ask for other's ideas</li> <li>• does not build on other's ideas</li> </ul>	<ul style="list-style-type: none"> <li>• demonstrate individual proficiencies</li> <li>• ideas are not constrained by teacher questioning</li> </ul> <p>Discussions do not yet build on student's ideas</p>	<ul style="list-style-type: none"> <li>• develops own ideas to make sense of the mathematics is learning</li> </ul> <p>Accesses varied ways to engage in mathematics</p>
<ul style="list-style-type: none"> <li>• creates an explanation that classmates will understand using variety of strategies</li> <li>• pays attention to other's ideas and builds upon</li> <li>• makes connections; sees relationships</li> <li>• justifies and/or refutes claims</li> <li>• Evaluates ideas of peers and suggests modifications</li> <li>• Is held accountable to others</li> </ul>	<ul style="list-style-type: none"> <li>• creates an explanation that group will understand using variety of ways and defends reasoning</li> <li>• asks / responds to questions of group members</li> <li>• builds upon other's idea(s)</li> </ul> <p>The group uses student's ideas to make sense of the mathematics they are learning</p>	<ul style="list-style-type: none"> <li>• Clearly build on other student's math ideas and explanations.</li> <li>• Refer to other student's ideas</li> <li>• Make convincing arguments about the mathematics of the lesson based on student's ideas and explanations.</li> <li>• Evaluate ideas of peers and suggest modifications</li> </ul>	<ul style="list-style-type: none"> <li>• develops own ideas</li> <li>• ideas used for class discussion following individual work</li> <li>• poses questions of others' ideas</li> <li>• makes connections with other student ideas shared with class building to more complete idea</li> </ul>