Title	: New Planet
Type	: Activities
Country	: Turkey
Resource Langauge	: English
Technology	: TI-Inspire Technology
Topic	: STEM
Publishing Year	: 2019

Short Description: Main aim of this activity is letting participants to solve pre-determined tasks on a maze, using their coding, engineering and mathematical skills during the process.

Long Description: The aim of this activity is letting participants to solve pre-determined tasks on a maze, using their coding, engineering and mathematical skills during the process. There are four different starting points on the previously designed maze. Participants will be divided into groups. Then, each group will select a specific point on the mat and reach the end point. There are four different station points between the start and end points. Teams are expected to perform certain tasks at those stations. They will collect certain points when they perform the tasks. At the end of the event, the groups are expected to share the solution proposals and the problems they face.

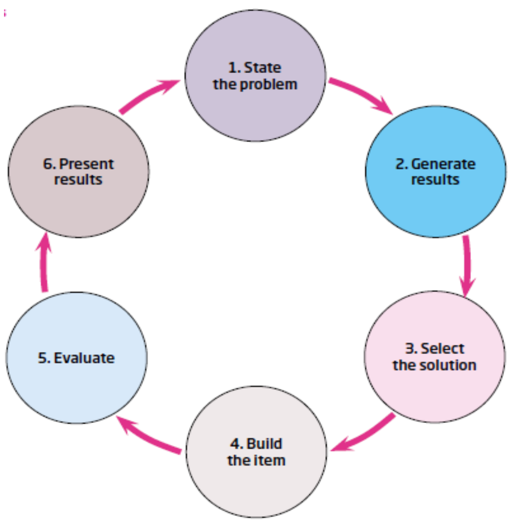
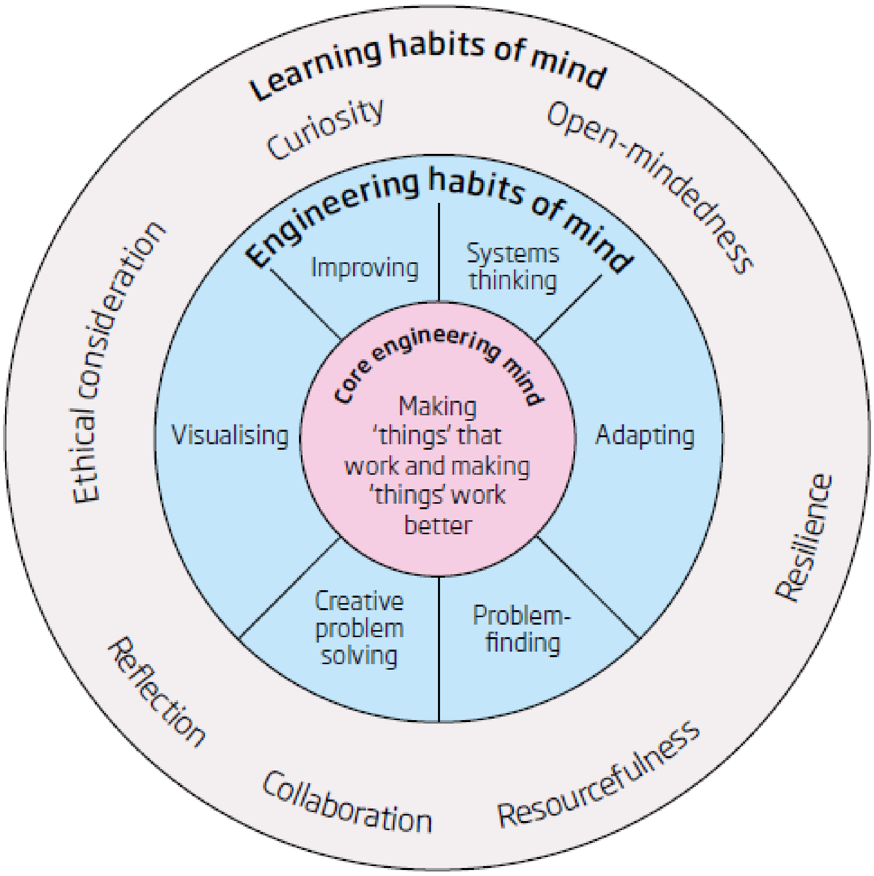


Figure 1 – The engineering design process (NASA)

Figure -2: Think Like an Engineer: Learning Habits of Mind



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Curiosity	Demonstrating a desire to learn, inquisitiveness and a passion for discovery
Open-mindedness	Being receptive to new ideas, prepared to consider the possibility that something is true and willing to change ideas in the light of evidence
Resilience	Being ready, willing and able to lock on to learning
Resourcefulness	Being ready, willing and able to learn in different ways
Collaboration	Work together as a team
Reflection	Something that is a sign or result of a particular situation
Ethical considerations	Drawing attention to the impacts of engineering on people and the environment, including possible unintended consequences of a technology, the potential disproportionate advantages or disadvantages for certain groups or individuals, and other issues
	CORE

Systems thinking	Seeing whole systems and parts and how they connect, pattern-sniffing, recognizing interdependencies.
Problem-finding	Clarifying needs, checking existing solutions, investigating contexts, verifying
Visualizing	Being able to move from abstract to concrete, manipulating materials, mental rehearsal of physical space and of practical design solutions
Improving	Restlessly trying to make things better by experimenting, designing, sketching, guessing, conjecturing, thought-experimenting, prototyping
Creative problem-solving	Applying techniques from different traditions, generating ideas and solutions with others, generous but rigorous critiquing, seeing engineering as a 'team sport'
Adaptability	Testing, analyzing, rejecting, rethinking, changing both in a physical sense and mentally

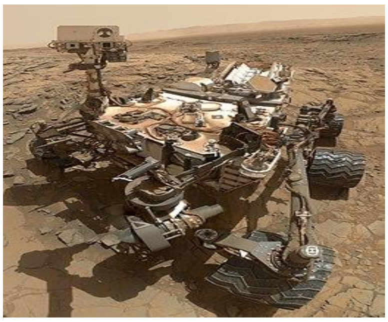
The event is designed for the 5E model.

1.Enter / Engage

People need to be aware of their current knowledge before they start learning new ideas. Participants are divided into groups. This stage is expected to take approximately 20-30 minutes.

How many Rover did NASA send to Mars?

Sojourner (1996)



Insight (2018)

Why do you think mankind sent rovers to Mars?

Curiosity is the most ambitious Mars mission in the NASA Mars Science Laboratory. Our robot investigates whether different living creatures live on the red planet and that the planet is suitable for human life, and Mars sends us information about the climate and its surface.

Curiosity is the size of a small car. To perform surface analysis; it has a robotic arm extending up to 2 meters in order to be able to draw any formation, stone, soil pictures and to conduct scientific experiments. Our robot, which is 2.7 meters wide and 2.1 meters high, weighs 900 kg and has wheels with a diameter of 50.8 cm. The explorer has been designed by engineers working at the NASA Jet Propulsion Laboratory to overcome obstacles up to 65 cm in height and travel up to 200 meters per day. Our robot obtains the necessary energy from the radioisotope thermoelectric generator which generates electricity from the natural decay of plutonium-238.

2. Explore

Participants work together, conduct experiments, work in an environment guided by the teacher, and produce thoughts to solve the problem or explain the event.

During this process, we will be able to gather various examples from Mars, such as Curiosity, using our Innovator rover to transport it to the base. Our activity mat is as seen in the figure 3. There are various starting points on the mat. Groups are free to start from the point which they want. The end point is the blue area in the middle. Group's rover needs to arrive at the starting point and collect the necessary data to come to the stations, and then come to the end point. There are four stations where groups can collect data on the mat. In this section, participants are expected to be divided into groups. Groups have to a name for themselves, each group is expected to be divided into specific tasks. These tasks include; leader, designer, programmer, strategist and motivator.

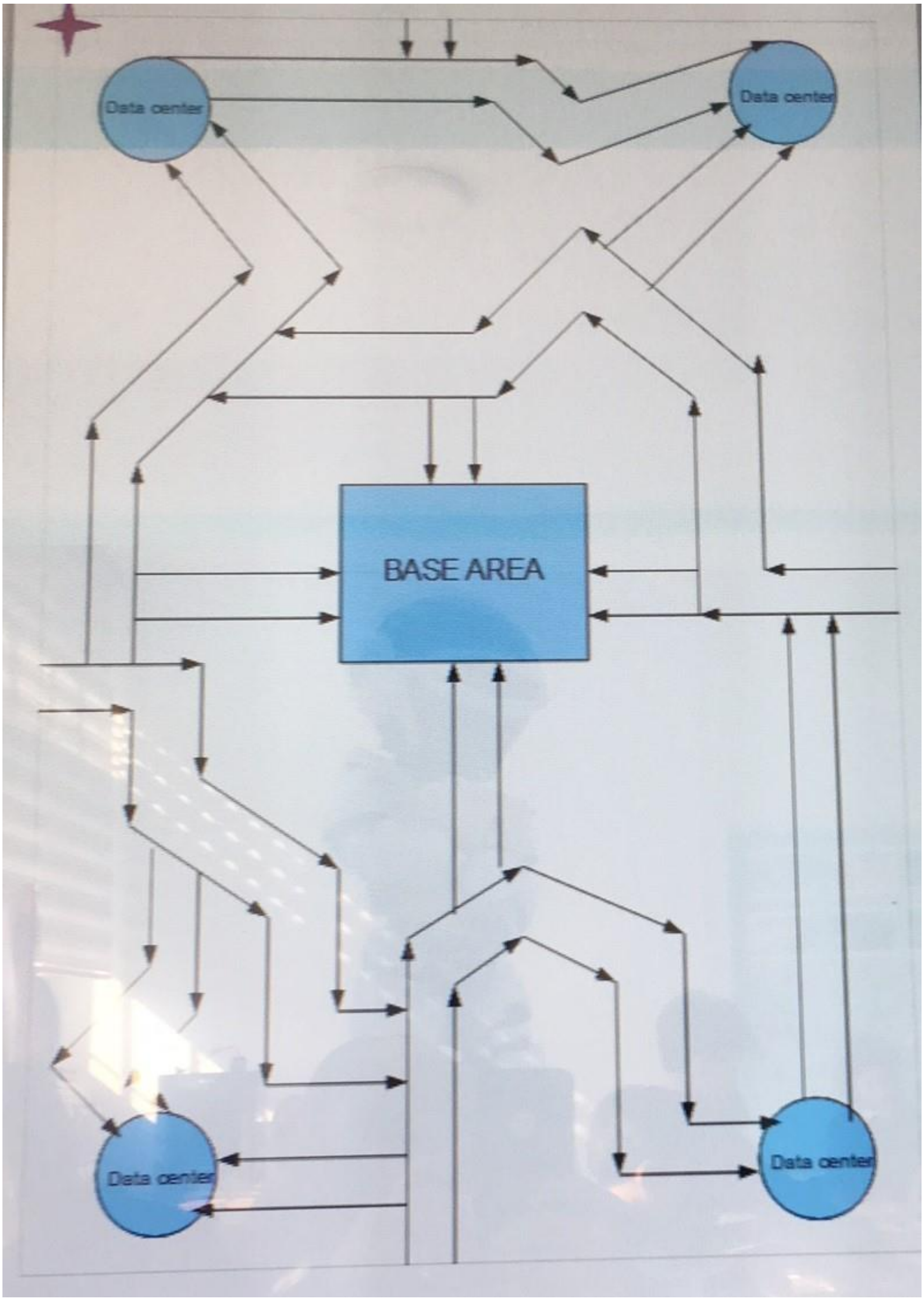


figure 3: New Planet Mat

1. Station: Dark Cave: 10 Point

2. Station: Non-measured area: 20 Point

3. Station: Luminous Door: 25 Point

4. Station: Cold Area: 10 Point

Now it's time to plan! Group has to divided distributing tasks leader, designer, programmer, Strategist and motivational roles to move on.

Leader: is responsible for managing the team and making the most logical decision.

Designer: To perform tasks on the mat, using the lego parts on the Innovator hub to make the most logical design.

Programmer: The designed or designed Innovator rover to reach the other point from a point on the specified route.

Strategist: The task is to determine the starting and ending points and to design the most rational autonomous rover within the given time.

Motivator: should help keep the group's motivation at the highest point.

At this stage, Group should choose a name, determine the roles mentioned above, form their strategies, finish their drawings.

At this stage, the activity plan (drawings if necessary) should be finished, and the Innovator hub should be designed by using Lego pieces. They then work on the strategy, try their possible solutions. This stage is expected to last about 40-50 minutes.

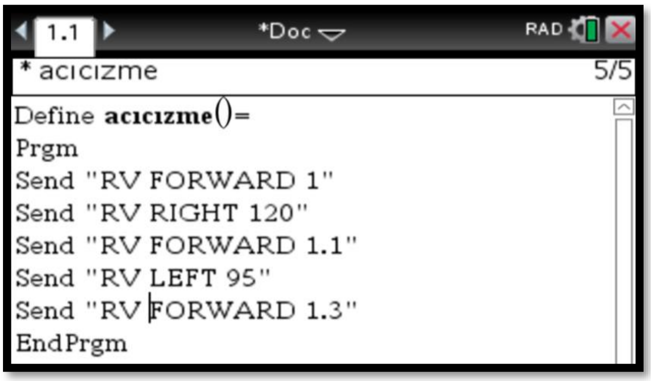
3. Explain stage

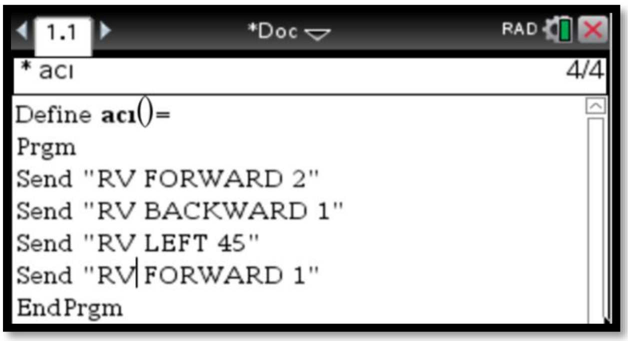
Participants often have difficulty in finding new ways of thinking without the help of the instructor. This is the most teacher-centered phase of the model, where the teacher helps the participants to replace their inadequate old ideas with new ones. At this stage, some basic information about the movement of Rover will be given.

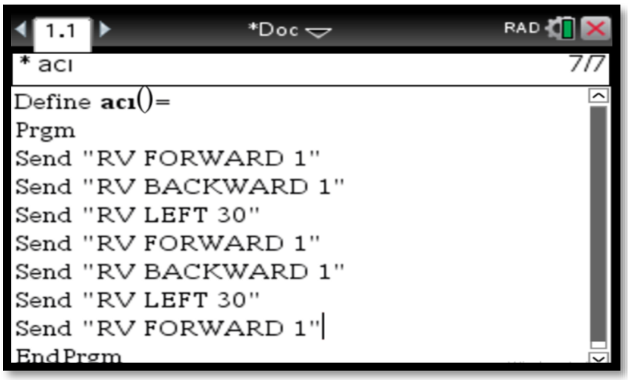
Let's write a simple program for your robot in your graphics calculator. In our program, we put a name for define the program we write. Then the expression "Prgm" will indicate that the program is starting. "CONNECT RV" is a command that shows the connection with our Rover. "RV FORWARD 1" shows that our robot goes 1 unit forward. "Endprgm" indicates that the program write command is finished.

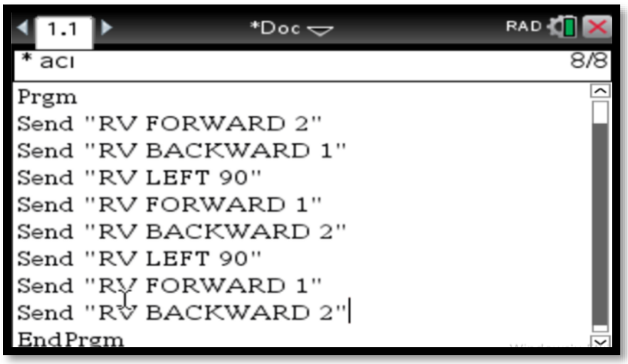
```
* düz
Define düz()=
Prgm
Send "CONNECT RV"
Send "RV FORWARD 1"
EndPrgm
```

The expression “Prgm” will indicate that the program is starting. “CONNECT” is a command that shows the connection to our RV Rover. Our “RV FORWARD 1” robot goes 1 unit forward, “RV BACKWARD 1” is going back one unit, “RV LEFT 120” turns left at 120 degrees. “Endprgm” indicates that the program write command is finished. Let's write our program









4. Elaborate

After the new information is obtained, it must be returned. At this stage, the activity plan (drawings if necessary) should be finished, and the Innovator Rover should be designed using lego pieces. Groups work on the strategy, try their possible solutions. This stage is expected to last about 40-50 minutes. At this stage, groups are expected to perform tasks on the mat. The groups have to move their rovers three times. In the three trials, the group with the highest score will gain activity. Each trial will take 3 minutes. This section is expected to last 40 minutes.

<table>
<tr><td>Groups</td><td colspan="2">Score</td><td>The Highest Score</td><td>Winner</td></tr>
<tr><td rowspan="3">A</td><td>1st Attempt</td><td></td><td rowspan="3"></td><td rowspan="6"></td></tr>
<tr><td>2st Attempt</td><td></td></tr>
<tr><td>3st Attempt</td><td></td></tr>
<tr><td rowspan="3">B</td><td>1st Attempt</td><td></td><td rowspan="3"></td></tr>
<tr><td>2st Attempt</td><td></td></tr>
<tr><td>3st Attempt</td><td></td></tr>
</table>

5. Evaluation

This is a phase in which students are expected to exhibit their understanding or change their way of thinking or behavior. Participants are expected to take the stage and evaluate the effectiveness strategies under the spell of group leaders. They are expected to assess what they do well and what they do bad. The activity will be terminated by filling out the self-evaluation and group evaluation forms. The presentations of the groups should not exceed 5 minutes. This section will last for 30 minutes. The important thing is not the outcome, the process. There are three evaluation criteria at this stage.

a) Please give information about the positive and negative aspects of your work by going to the group stage.

b) Complete the self-assessment form.

c) Use the group evaluation form.

SELF-EVALUATION FORM

This form is designed to help you for self-evaluation. Please answer the questions below carefully.

Name, Surname: Date:

1. What did I do in this study?

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2. What have I learned in this study?

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3. What are the parts I succeeded in this study?

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4. What are the most challenging parts in this study?

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5. What did I expect when I did my work?

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6. How could I have done this work again?

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GROUP EVALUATION

Group Name: ....

How did your group make the event?

Please read the following questions and the score you think your group deserves

	High	**Medium**	**Low**
1. How much was your plan for this event?	3	2	1
2. Have members of your group listened to each other's thoughts?	3	2	1
3. Has your group been shared fairly?	3	2	1
4. Did your goal use the tools with care?	3	2	1
5. Has your group recorded the information correctly?	3	2	1
6. How good was your group in solving problems without the help of the teacher?	3	2	1
7. What was the cleanliness and layout of your group?	3	2	1
8. How helpful and respectful were your members?	3	2	1
9. What was the success of your group in implementing the event plan?	3	2	1
10. How creative were your ideas?	3	2	1

After reviewing your answers to the questions above, answer the following questions.

11. What did your group achieve the best?

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12. What can you do to make your group more successful?

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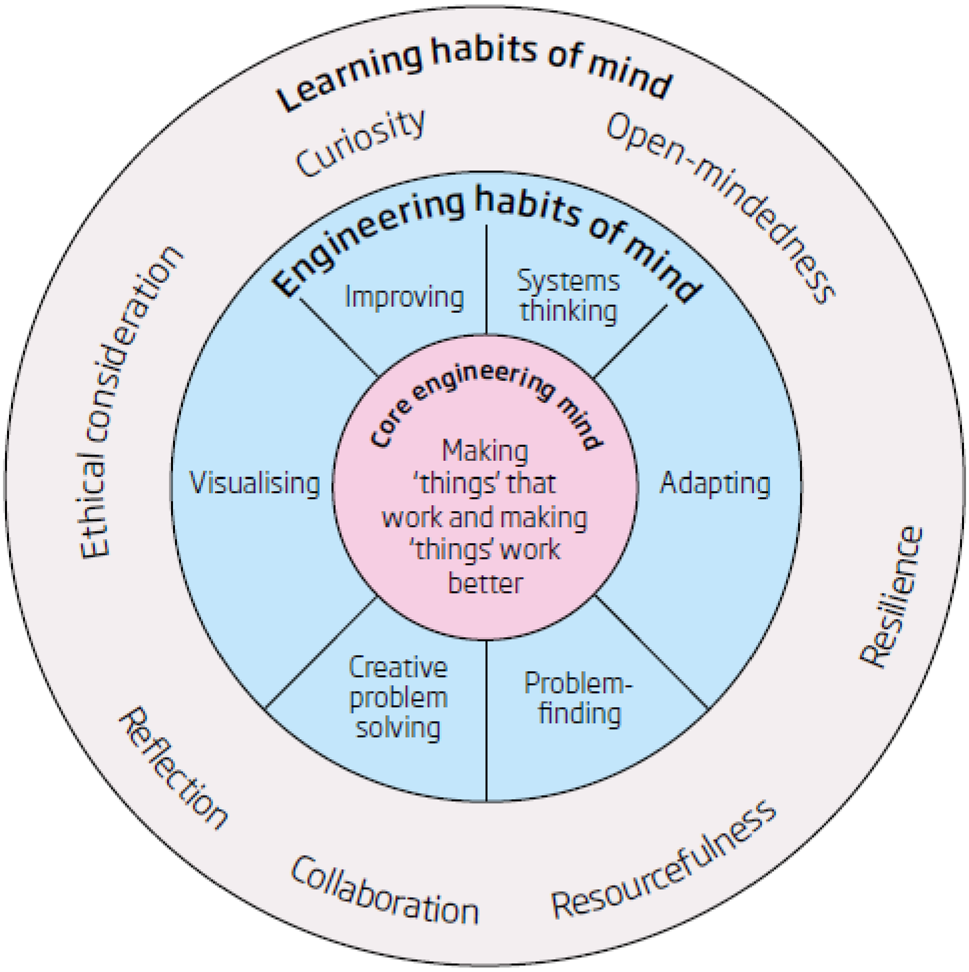
Final Words: Think Like An Engineer: Learning Habits Of Mind



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We design New Planet STEM Activity

Curiosity	Demonstrating a desire to learn, inquisitiveness and a passion for discovery	We have a new problem situation. We started with the Mars tool curiosity.
Open-mindedness	Being receptive to new ideas, prepared to consider the possibility that something is true and willing to change ideas in the light of evidence	Group of friends by distributing tasks leader, designer, programmer, Strategist and motivational roles to move on.
Resilience	Being ready, willing and able to lock on to learning	Participants are able to change their roles or plans.
Resourcefulness	Being ready, willing and able to learn in different ways	Participants brought a lot of pieces together and talked about a new model.
Collaboration	Work together as a team	Participants will work as a team
Reflection	Something that is a sign or result of a particular situation	Participants will reflect their ideas during the event
Ethical considerations	Drawing attention to the impacts of engineering on people and the environment, including possible unintended consequences of a technology, the potential disproportionate advantages or disadvantages for certain groups or individuals, and other issues	We will visit a specific area that called unmeasured area, but groups will respect to nature of new planet

Systems thinking	Seeing whole systems and parts and how they connect, pattern-sniffing, recognizing interdependencies, synthesizing	In addition to seeing all the pieces on the mat, group have created a specific thinking model by separating it piece by piece.
Problem-finding	Clarifying needs, checking existing solutions, investigating contexts, verifying	Group will identify the problem before you plan a strategic plan to take your rover from one point to another.
Visualising	Being able to move from abstract to concrete, manipulating materials, mental rehearsal of physical space and of practical design solutions	Groups will create practical solutions
Improving	Restlessly trying to make things better by experimenting, designing, sketching, guessing, conjecturing, thought-experimenting, prototyping	Groups will try to make things better
Creative problem-solving	Applying techniques from different traditions, generating ideas and solutions with others, generous but rigorous critiquing, seeing engineering as a 'team sport'	Groups can see the process of engineering as a 'team sport'
Adaptability	Testing, analyzing, rejecting, rethinking, changing both in a physical sense and mentally	Groups will test and analyze rover again and again

We Made Things that work and made things work better.

REFERENCES

Lucas, B., Claxton, G. & Hanson, J. (2014). *Thinking like an engineer: Implications for the education system*. London, United Kingdom: Royal Academy of Engineers. Retrieved from www.raeng.org.uk/thinkinglikeanengineer. Page. 2

NASA, The engineering design process
http://www.nasa.gov/audience/foreducators/plantgrowth/reference/Eng_Design_K4.html