

Terminology and concepts addressed through P2E Curriculum

(As presented in Bagiati. A. (2012) Early Engineering - A Developmentally Appropriate Curriculum for Young Children.)

Lesson plan title	New engineering-related concepts and terminology	Revisited engineering concepts and terminology	Rationale to be addressed
"I have a great idea!"	Engineers, desire, discussion, usage		Engineering usually is initiated by someone's desire to create and construct something new or to alter something that already exists in order to achieve a new goal. Engineers discuss the new idea about how things can be used .
"Making a decision!"	Decision-making, brainstorming, constraints, criteria	Engineers, discussion, usage	Engineers usually brainstorm and then revisit their initial ideas to see if any new idea has appeared before coming to a final decision . After brainstorming and coming up with a set of new ideas or possible solutions, engineers have to also consider the constraints .
"Let's look at building elements!"	Building, observing, elements	Engineers, discussion, usage, decision making, criteria	While constructing a building there are plenty of building elements that an engineer can think about designing and implementing.
"Let's look what it is made of!"	Materials	Building, observing, elements, decision making, criteria	While constructing a building , depending on the climate, cost, usability, and numerous other factors, an engineer can select to use different materials on the building
"Let's make a model"	Design, model	Building, elements, materials	After brainstorming and doing some first drafts on paper, engineers start to try to come up with 3D models of the construction , which can be made out of many different materials : paper models, cardboard models, and models with mixed materials.

Table Cont.

"Let's improve our models"	Improve	Discussion, design, model, material, usage	Today you will revisit the 3D models you created, discuss them, and attempt to improve them.
"Let's show our ideas"	Design representations, drawing, sketch, floor plan	Engineers, design, models	Engineers are using different representations in order to communicate their ideas with clients/other engineers/constructors, etc. Today you will introduce children to these types of representations.
"Let's show our ideas differently"	Maquettes, consult	Design representations, drawing, sketch, floor plan, model, improve	Today children will revisit and discuss these representations and work on their maquettes .
"Let's sketch it"	Sketch, present	Buildings, observing, drawing, discussion	There is a lot of discussion regarding how much inspiration and creativity freehand sketching is stimulating. For this reason, we want to take the children on a field trip in order to observe and free sketch their environment.
"Let's observe our building"	Electricity, water, buttons, switches, pipes, function	Building, sketch, present, observing, discussion, usage	Discuss the sketches . Let the children present them. Then start observing and identifying engineering features in the school building, and start making connections between action and effect (e.g. pressing buttons).
"Let's investigate some more"	Handles, investigate	Building, discussion, electricity, water, buttons, switches, pipes, function, observing	Keep observing the building . Add one more element for investigation and discussion (i.e., handles).

Table Cont.

<p>“Let’s see what is around us”</p>	<p>Tables, graphs</p>	<p>Buttons, switches, pipes, handles</p>	<p>After gathering information, engineers use various visual representation tools in order to make the results of the data gathered more obvious. Today the children will do tables and graphs.</p>
<p>“Let’s get prepared for our constructions”</p>	<p>Information gathering</p>	<p>Criteria list, materials</p>	<p>After having come up with some initial ideas, engineers are creating criteria/requirements lists in order to start planning the actual construction. This is also a good time to consult other engineers in order to discuss problems that may appear in the design, or just to get more ideas.</p>
<p>“Let’s sketch some more”</p>		<p>Sketch, observe, present</p>	<p>The children will go on another field trip in order to observe and free sketch their environment</p>
<p>“Let’s observe our surroundings”</p>	<p>Get inspired</p>	<p>Observe, discuss</p>	<p>In today’s class, we want the children to observe engineering features in their surroundings that may be used as inspiration to their project.</p>

Table Cont.

<p>“Let’s see where the light is”</p>	<p>Electricity, circuit, lamp</p>	<p>Sketches, drawings, switch, maquettes, model, improve, test</p>	<p>When coming closer to an end product, engineers start to bring more details in their maquettes and models. Revisit previous representation types (e.g., drawings, sketches, maquettes), and try to add more features to them. Today children will create simple electric circuits and will be prompted to use them within their previous work.</p>
<p>“Let’s search a little more”</p>		<p>Information gathering, communication, consulting, presenting</p>	<p>When coming closer to an end product, engineers do more detailed information gathering about particular elements of the design. Information gathering can include looking at books, online searching, and discussing the issue with other experts in the field. When new ideas are on the table, engineers have to explain the new details to other members of their team. Some days ago, parents were asked to conduct research regarding the project with their children at home or in the surrounding area, and send the information with their children to class. Today the children will present their findings.</p>

Table Cont.

<p>“Let’s pay a visit”</p>		<p>Consulting, information gathering, observe, communication, exchange of ideas</p>	<p>Today the children will go on a field trip to visit a facility related to their project and gather more information about it by talking to the people who work there.</p>
<p>“Let’s ask an engineer”</p>		<p>Model, consulting, improving, comparing, testing, construction, electric circuits, buildings</p>	<p>While developing a final model, engineers try, test, and compare different solutions for various elements in their construction. Along with their personal testing, consulting also takes place. It is not necessary that only one solution is the optimum every time. Today parents or friends that are engineers will visit the class to show the children different ways to assemble and test electric circuits and to discuss the children’s building ideas.</p>
<p>“Let’s see what we can build with”</p>		<p>Model, consulting, information gathering, communication, exchange of ideas, materials, presentation</p>	<p>Elements have to be selected to be used for the final model construction to resemble reality and represent the design features as beneficial as possible. Today the children will present in class building materials they brought from home, and they will discuss how they could use them to build their final constructions. Parents and friends that are engineers have also been invited to be in class and participate in the discussion and the building process.</p>

Table Cont.

"Let's see how we can improve it"	Decorate	Test, improve, model	Upon completion of construction of the model , engineers revisit it to test and improve it even further, and then start to add decorative elements to provide more context.
"Let's build our village"	Synthesize, finalize,	Model, decorate	Upon completion of construction of the final model , engineers revisit it to test and improve the final deliverable and add decorative elements to provide more context.
"Let's show it to our friends"	Explain, invite	Model, engineers, present	Upon completion of construction of the final model , engineers present them to colleagues or customers. Today the children will present their work to children from other classrooms, and they will create invitations to invite their parents to come and see their work.
"Let's show it to our parents"		Model, maquette engineers, present	Today the children will present their work to their parents.

Items addressed per lesson plan

<ol style="list-style-type: none"> 1. Concepts and Terminology To Teach 2. Class Goal(s)/Objectives 3. Required Materials 4. Setting 5. Step-By-Step Procedures 	<ol style="list-style-type: none"> 6. Plan For Independent Practice 7. Closure - Reflect Anticipatory Set 8. Assessment Based On Objectives 9. Possible Connections To Other Subjects 10. Image(s) to be Placed on the Cardboard
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Besides the Large-Group (LG) and Small-Group(SG) time, parents are encouraged to help their children further expand on activities related to the P2E Curriculum at home, by gathering information about their project together. In an

auxiliary role, and depending on classroom space and resources, an engineering theme is occasionally available for role playing, and engineering-related tools are made available for children's free play time. Parents who are engineers and other engineers are invited to actively participate in the curriculum, either by attending LG or SG time during the classes, or by inviting and accompanying the children on a field trip in an engineering-related working environment.