

STEM Qboidz Starter Set

E05.1 TEACHER'S GUIDE

The **STEM Qboidz™ starter set** is the ideal set for preschool children to start building with **ENGINO®**. The QBOIDZ™ system combines the award-winning snap-fit connectivity of **ENGINO®** system with the effortless building feature of stackable blocks! The set encourages preschool children to develop their cognitive, social and motor skills through fun and creative play. This set includes enough parts to build models out of a library of 20 different ideas. The system is designed to allow for four different levels of building complexity, allowing younger children to still be creative while also challenging them as they grow older!

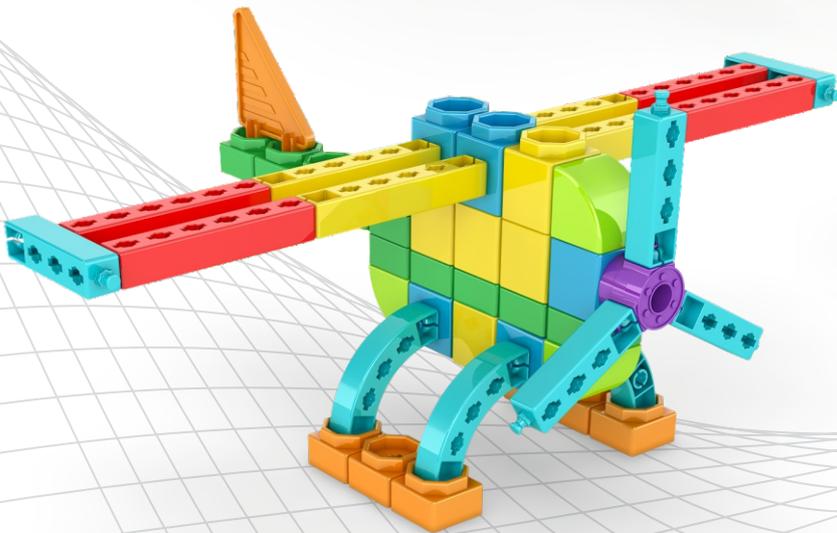
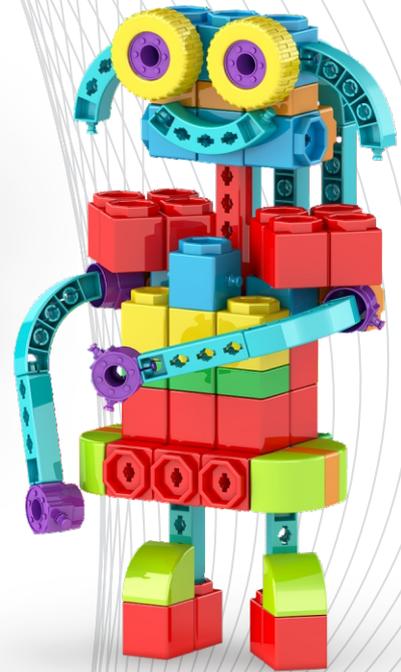


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Engino® Philosophy

The Teacher Guide for STEM Qboidz™ has been developed in order to be utilized as a tool by teachers who wish to introduce innovative teaching methods for their classroom. In Engino, we believe that learning has to be a playful and pleasant experience during which kids are actively engaged. STEM Qboidz is an educational set which is based on the latest pedagogical principles of STEM, aiming to provide students with the necessary skills and knowledge to deal with the technological advancements of the future. Recognising that children at early ages are motivated when they are involved into hands-on activities, we have created a building system that gradually allows emotional and cognitive development from the practical to the abstract level. This is achieved through activities structured in a way where simple challenges and models can scale up gradually.

Theoretical Background

The STEM Qboidz educational set is based on contemporary pedagogical methods of learning and the revised six stages of cognitive development provided by Benjamin Bloom (1956). Bloom's Taxonomy is represented by a pyramid as it is shown in figure 1 below. According to Bloom, the learning procedure begins from remembering and grows to understanding, applying, analyzing, evaluating and finally creating knowledge.

The Engino STEM Qboidz system helps students succeed at all levels of cognitive development. As children grow, the complexity of the activities grows respectively.

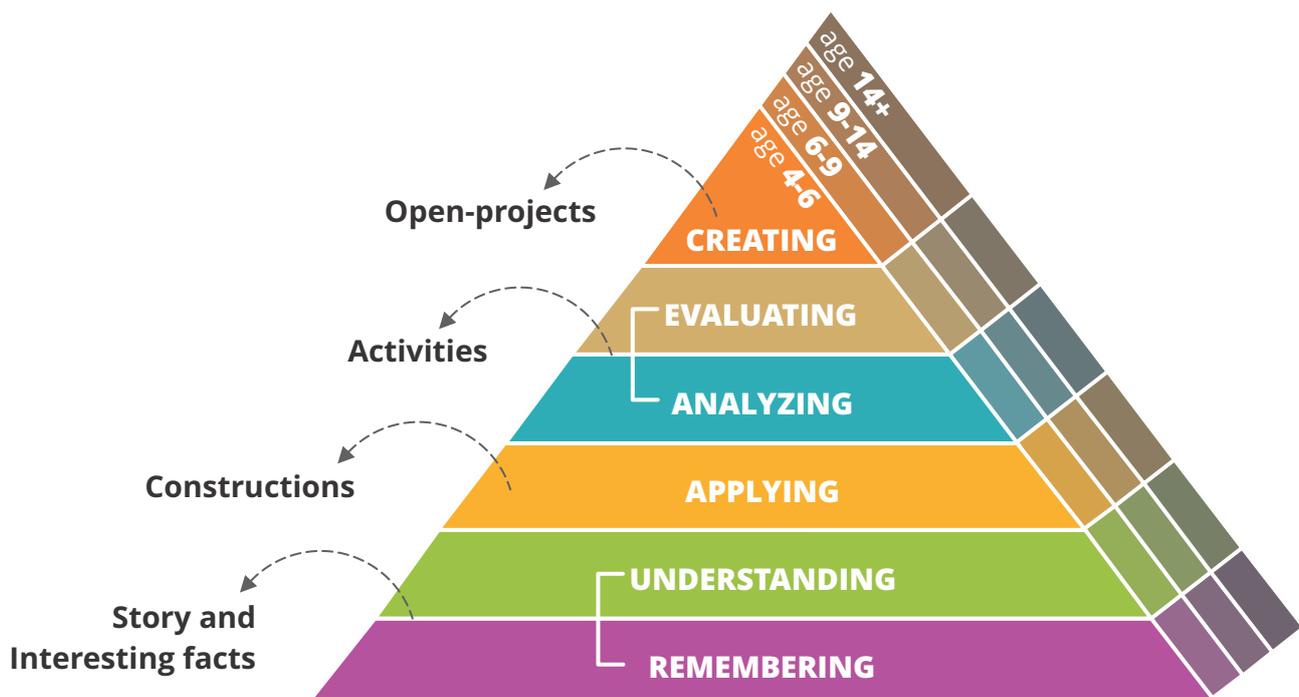


Figure 1: Projection of Bloom's Taxonomy into Engino's Pedagogical Approach

Bloom's taxonomy is achieved through Engino's learning methodology. The methodology is represented by well-structured lesson plans that include stories, interesting facts, building models, activities and open-projects. The storytelling and the interesting facts the teacher provides in the classroom lead to remembering and understanding the newly acquired knowledge. Moreover, the building procedure using the innovative system of Engino® leads to the application of the knowledge. A deeper level of learning is accomplished at the analysis and evaluation stage with the experiment and activities. Finally, children can reach the higher level of the learning pyramid, where creation and synthesis of knowledge is accomplished by carrying out open projects.

Engino® Pedagogical Methodology

At Engino® we have developed a new, Multi-level teaching methodology, taking into account the tremendous benefits of using a construction system as your main teaching tool. This method is presented in the below circular diagram (figure 2) as a series of encompassed layers which are explained in the next page.

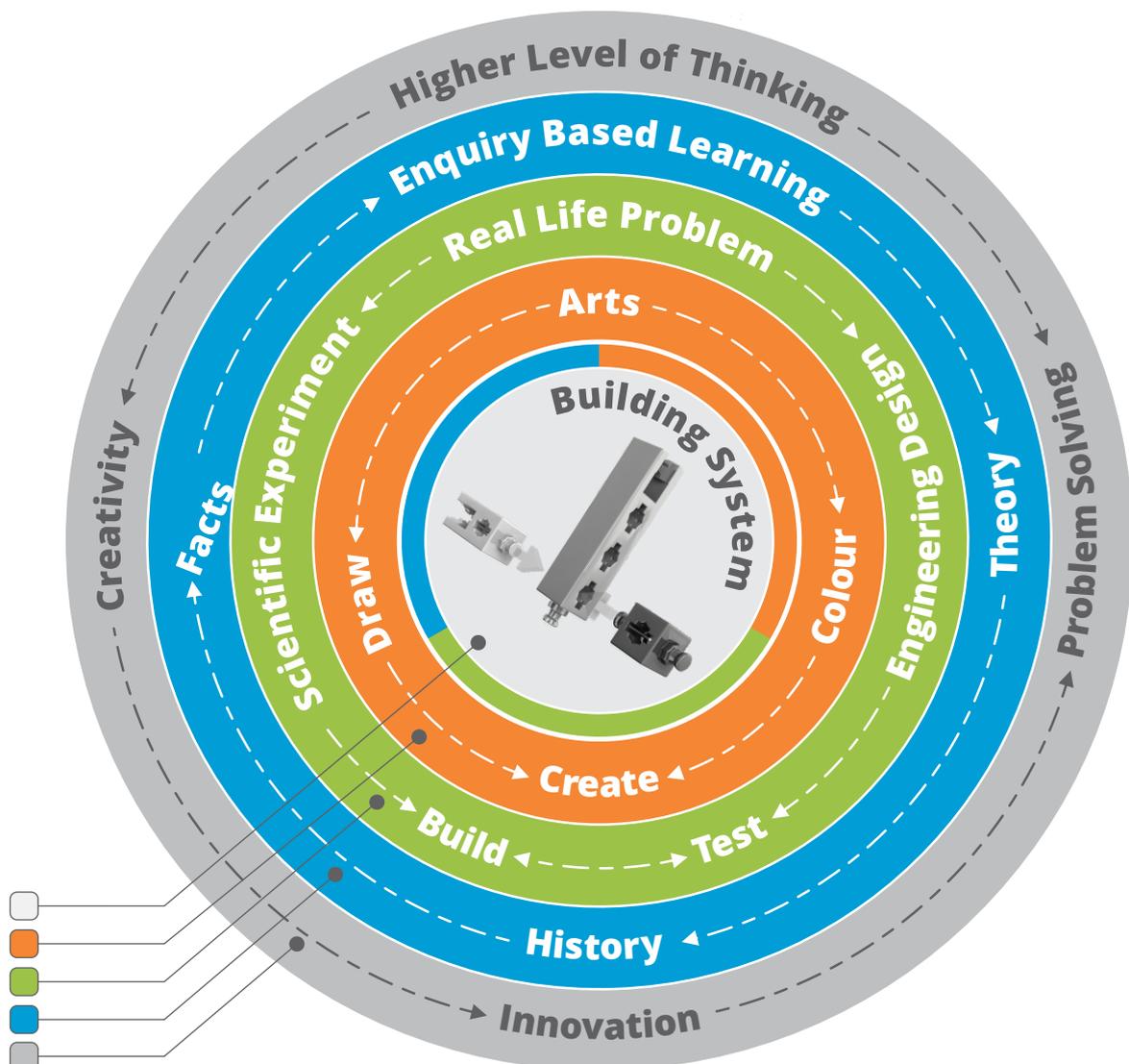


Figure 2: Engino® Multi-level teaching methodology

Building System: At the center of all layers there is the “heart” of the methodology, the Engino® building system! The unique ability of the system to easily build and modify technical models can lead to enhanced dexterity skills and perception of 3D space.

Arts: The next layer represents the latest trend in education science that incorporates “Arts” within the STEM curriculum. Even though Art is an inherent part of the engineering design process, “A” puts emphasis on one of the highest brain functions, that of inspirational creativity. “Inspiration” has been the driving force behind all humanity’s masterworks, either inventions, architecture, music, painting or literature. Besides the traditional ways to include “Art” to communicate and refine ideas, the Engino® system has organically embedded such functions during the “making” stage, where students can add surfaces of their own artwork on the assembled models!

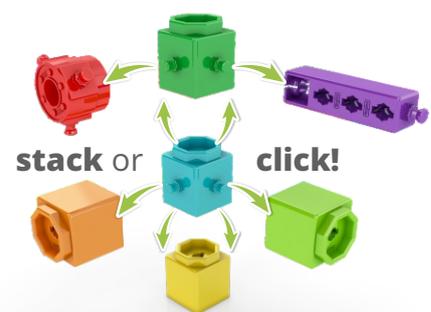
Real Life Problem: The next layer engages students more deeply in STEM learning as they now need to solve a real-life problem. Problems are approached either as Engineering design challenges or as Scientific experiments. During these processes, students build a model, modify it to meet the challenge requirements, test it and observe the results and draw their conclusions. This is an iterative process that leads to a higher level of learning and the acquisition of “engineering design skills”.

Enquiry Based Learning: Deep learning comes as a natural evolution of the previous layer. Once students complete their challenge or experiment, they are more eager to learn more about the underlying Technology (or Science and Maths) that dictates their solution simply because they can now understand it. Engino® supportive material contains a wealth of theory and facts about each subject, but students can also seek their own answers, a process that will help teachers implement “inquiry based learning”.

Higher Level of Thinking: The final layer: Ultimately, by guiding your students through this interactive, multi-level approach, they can attain higher levels of thinking, acquire inventive skills and become problem solvers of enhanced creativity and imagination!

Engino® Qboidz System

The STEM Qboidz™ set combines the award-winning snap-fit connectivity of Engino® system with the effortless building feature of stackable blocks! The Qboidz building system was originally designed and developed so that young children can make constructions of different levels of difficulty. Qboidz parts are easy to use, big enough for safe play that enhance creativity by connecting bricks with rods at any direction.



The different levels of building along with the features of the Engino® building system are shown below (figure 3). Children of small ages start from level 1 with simple constructions and as they grow up they reach level 4 with more complex ones.

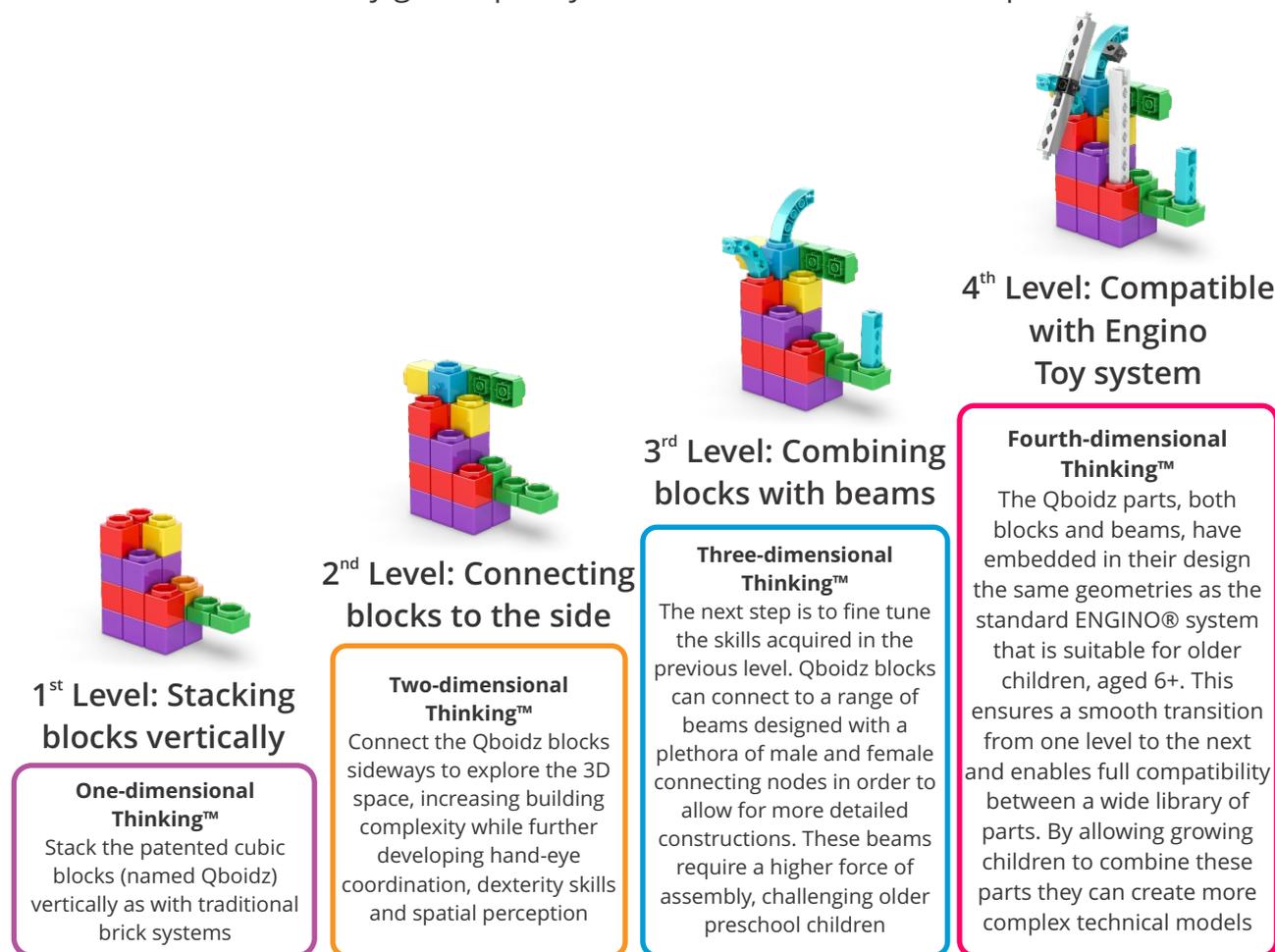


Figure 3: The levels of Engino® Building System

Engino® system is a simple scientific construction toy that leads to the development of higher level skills and especially higher level of thinking. The system develops a variety of skills where the most of them are developed over each level but in different grade. However, each level of the system focuses on different skills as it is shown in figure 4 below.

1 st Level	2 nd Level	3 rd Level	4 th Level
Motor skills	Emotional skills (i.e. confidence)	Cognitive skills	Creativity skills
Emotional skills (i.e. patience)	Social skills	Curiosity skills	Exploration skills
Language skills	Thinking skills (i.e. focus)	Co-operation skills	Imagination skills
Hand-eye coordination skills	Communication skills	Spatial skills	Logical and Thinking skills

Figure 4: The skills developed in each building level

Engino® STEM Qboidz Set

The STEM Qboidz educational set is specifically designed for Preschool children of ages 3-6 and can be used in groups of 2-3 children. The set encourages preschool children to develop their cognitive, social and fine motor skills through fun and creative play. In addition, children are motivated to explore Science, Technology, Engineering and Mathematics through the models they build and which are used as manipulatives for further understanding and experimentation.

STEM Qboidz set is delivered in a plastic tub of 197 plastic parts and is being accompanied by a comprehensive teaching resources, building instructions for 20 models and a lot of activities.



Engino® STEM Qboidz Curriculum

The Curriculum allows teachers to prepare and implement easily ideal lesson plans into their classroom while it includes a variety of topics such as:

Animals



Vehicles



Airplanes



Technology



Sea Exploration



Each topic includes:

- Interesting facts about each model
- Related images
- Digital and printable building instructions for each model
- Worksheets with activities
- Worksheets with extra activities
- Open projects

The Engino STEM Qboidz allows teachers to focus on the development of the information literacy, soft and cognitive skills and character traits, like curiosity. Each task of the above is explained in detail in the following pages.

Storytelling

Telling a story about the topic taught is a good way to start the lesson. The stories work as useful engagement tools and as medians that transfer important didactical messages to children. For example, an animal story may be used to emphasize the meaning of diversity and how important it is for people to accept others in their lives. Other principles, such as self-esteem and respecting others can also be cultivated. It is really significant for these ages to develop basic principles through stories, constructions and activities.

Both the introductory story and the afterwards discussion should be presented in an exciting way in order to spark children's interest and make them eager to participate in the activities that ensue. Additional material with images is provided, so that it can be used while reading the story and the interesting facts of each topic. The images can be found in the Curriculum, can be printed, laminated and shown during the lesson.

Building Instructions

The building instructions for the models can be downloaded and printed. While, it is recommended to be laminated for long lasting use. Each group can build a model using a set of printed instructions. It is highly recommended that a brief explanation on how to use the building instruction is given during the first lessons. The children should:

- collaborate and work in groups of 2-3,
- recognize and find the Qboidz parts and
- follow the lines to connect the parts together.

Another way of building the models is by using the digital building instructions found in the Curriculum. The 3D building instructions can also be found in the "Engino KidCad (3D Viewer)" application, which is available in Google Play Store and App Store. A computer or a smart device is needed for each group and kids can follow the step by step instructions to build their model.

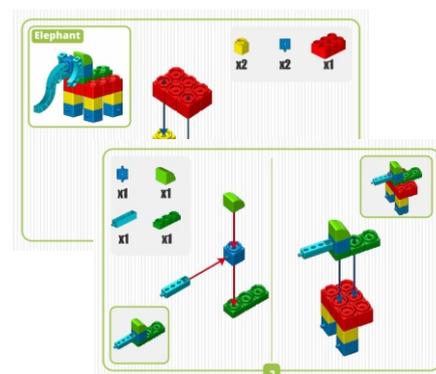
Story



Images



Printed Instructions



3D Instructions

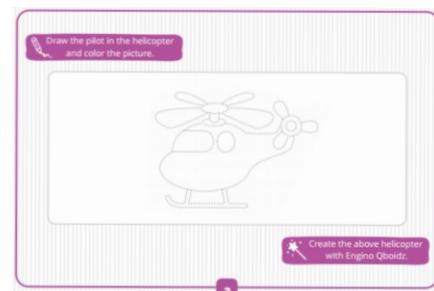
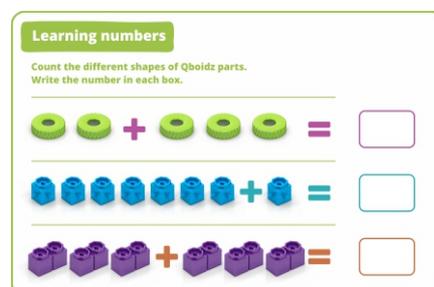
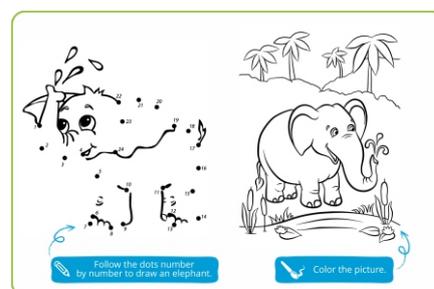


Through the building procedure, children's motor and dexterity skills, as well as their 3-dimensional perception is developed. Moreover, collaboration and communication skills are cultivated while working in groups. In addition, the use of the digital building instructions creates excitement, enhances focus, develops digital skills and instills creativity. All the above constitute the 21st century learners' characteristics.

Activities - Extra Activities

There is a variety of activities for every topic which are based on the given models. However, they can be extended to other fields of STEAM such as learning numbers and colors. For each model / lesson up to four activities are provided, enough for children of this age. One set of printed worksheets should be given to each child. When the building procedure is completed, they can proceed to the activities of the worksheet.

There is an opportunity of printing and giving to the children worksheets with extra activities to an additional lesson after a topic is completed. The extra activities allow children to make choices, express their creativity and support their independence. They follow the same standards as the activities given for each model / lesson. However, the activities are more general on the topic and on the fields of STEAM instead of emphasizing on a specific model.



The activities and extra activities include a variety of exercises such as: spot the differences, color (as they wish or by number), join the dots (plain or by number sequence or by letter sequence), count objects, escape the maze, build a model, circle the images according to a group, match the number to a quantity, match the word to the color, draw a model or a picture, replicate a model or a picture, join the shadow to the picture, spell learning activity, find, cut and stick an image, do simple addition and subtraction, draw the missing parts, complete the number sequence and create a new model.

The diversity and variety of activities in each lesson provide learning through playing in a fun way. Therefore, children develop their creativity, imagination, collaboration together with their cognitive social and motor skills. The different types of activities and the projection of skills that are developed are shown in the tables (figures 5 and 6) in the next pages.

Skills Activities	Creativity & Imagination	Communica- tion	Problem solving	Collaboration	Fine motor skills	Information literacy	Logical thinking
Spotting the differences	✓		✓		✓	✓	✓
Coloring (as wished or by number)	✓				✓		✓
Joining dots (plain / by number / by letter)	✓		✓		✓	✓	✓
Counting objects			✓		✓	✓	✓
Escaping the maze			✓		✓	✓	✓
Building a model	✓	✓	✓	✓	✓	✓	✓
Circling the images according to a group			✓		✓	✓	✓
Matching the number to the quantity			✓		✓	✓	✓
Matching the word to the color			✓		✓	✓	✓

Figure 5: The skills developed by the activities

Skills Activities	Creativity & Imagination	Communica- tion	Problem solving	Collaboration	Fine motor skills	Information literacy	Logical thinking
Drawing a model or a picture	✓		✓		✓		✓
Replicating a model or a picture	✓		✓		✓	✓	✓
Joining the shadow to the picture	✓		✓		✓	✓	✓
Doing a spelling activity			✓		✓	✓	✓
Finding, cutting and sticking an image	✓	✓	✓	✓	✓	✓	
Doing simple addition and subtraction			✓		✓	✓	✓
Drawing the missing parts	✓		✓		✓	✓	✓
Completing the number sequence			✓		✓	✓	✓
Creating a new model	✓	✓	✓	✓	✓	✓	✓

Figure 6: The skills developed by the activities

Open projects

An open project is an activity based on the knowledge and skills acquired during the lessons. It mainly works as an assessment tool which gives a good hint of what kids have understood and learned. While it also intends to higher level of thinking.

In order to organize an open project based lesson, firstly the open project topic related with the material taught in the classroom must be decided. Open-project topics that refer to an everyday life problems are more interesting and increase students' engagement. The specifications and requirements for the solution to the problem is better to be discussed with the whole class. Children should use their imagination, find related images (they can be provided with some), design the solution on a paper and construct their solution using the Engino® Qboidz™ parts and any other available materials.

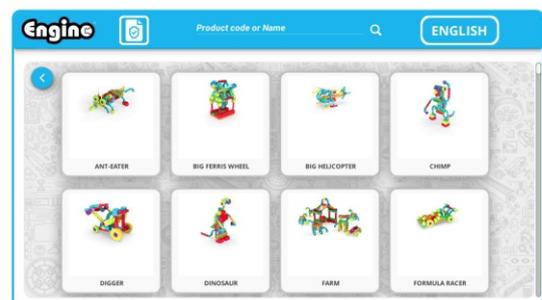
Children can be encouraged to work in groups in order to share and improve ideas and collaborate to create a fascinating construction. However, they can also work individually. Each child can compose his/her ideas and create a model according to his/her imagination, abilities and skills. Once they finish they should present their creations. The use of the resourceful library of the Qboidz parts alongside other materials can result to numerous impressive creations.

Models Library

This section includes:

- Printable building instructions and
- Step by step 3D building instructions.

Apart from the models that are used in the activities, there are more models available in the section "Models library". There are 20 different models, in total, from a variety of themes. This offers the opportunity to the teachers to create more lessons plans and activities by following the structure of the suggested ones.



The value of STEM Qboidz

Engino STEM Qboidz set provides a lot of benefits to the teachers since they can work with ready-made material, or even create more lesson plans by using models from the models library. Open project ideas can also be developed. There is the opportunity to use structured lesson plans for five different topics (animals, vehicles, airplanes, technology and sea exploration) and the flexibility to use the material further with projects. For instance, when children complete their construction, they can be asked to modify their model. They can improve, enrich and extend a construction by attaching or removing Qboidz parts and by adding other materials according to their imagination and creativity skills.