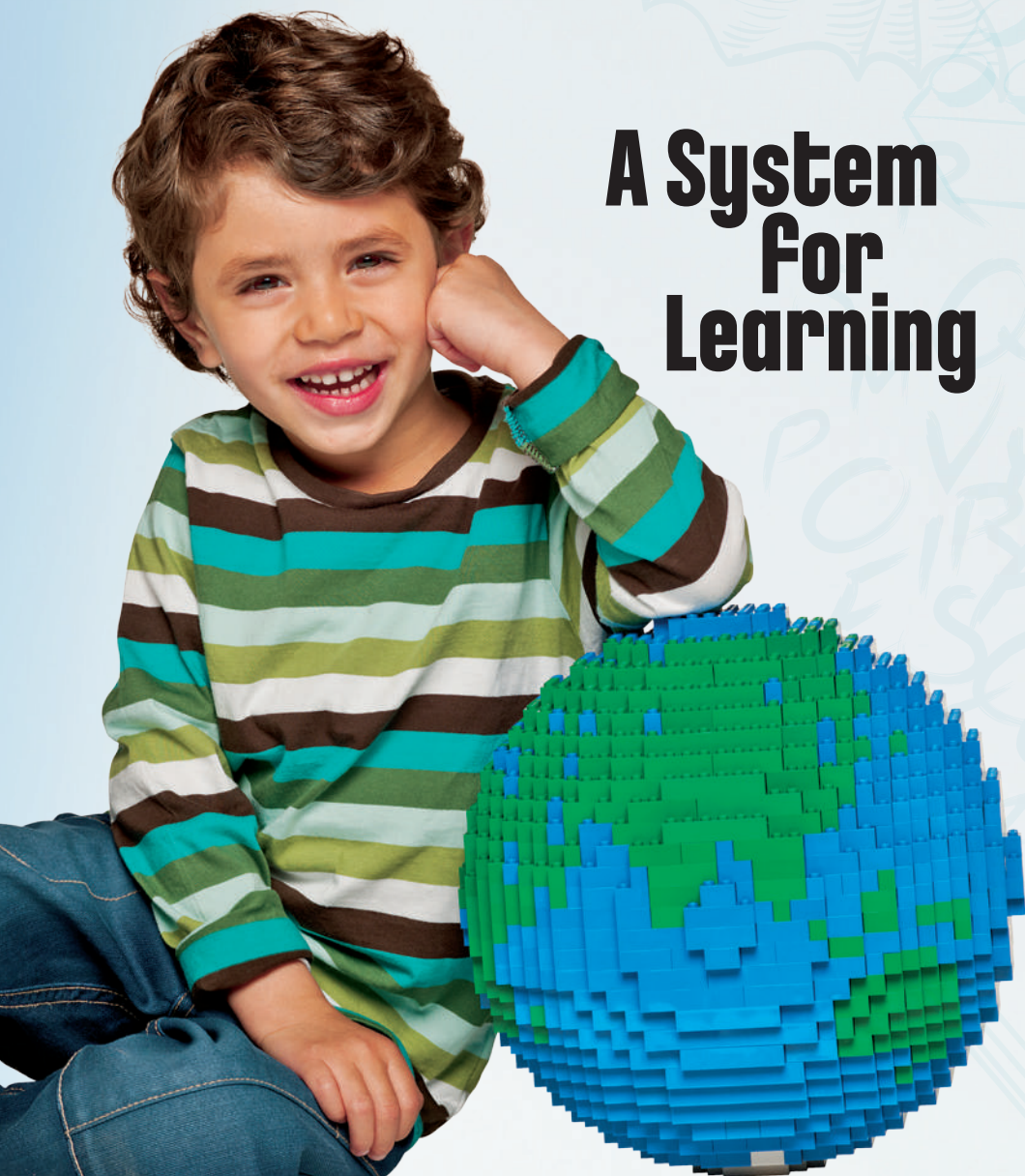


# A System For Learning



education



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## Our Manifesto

We believe children must be supported to be:

- **Systematically Creative Learners**
- **Active Learners**
- **Collaborative Learners**

**Children become Systematically Creative Learners through:**

- Learning by combining logic and reasoning with playfulness and imagination.
- Learning by mastering a tool and giving form to thoughts.
- Learning by combining, exploring and transforming ideas and objects.

**Children become Active Learners through:**

- Learning by constructing things in the real world, and in this way constructing knowledge in their minds.
- Making their mark and expressing their originality in the learning environment.
- Feeling ownership and taking charge, being proactive and internally driven.

**Children become Collaborative Learners through:**

- Learning from interpreted experiences and explanations of other people, including peers and experts.
- Learning through reflecting upon an experience, discussing why and how things worked in the accomplishment of a goal.
- Helping each other to learn, each according to their ability, through the shared language of LEGO® bricks.



# LEGO® Education

Learning is at the very core of the LEGO Group's most heartfelt values, and the company's education division has invested many years in cooperation and research with child development specialists and teaching professionals to build a rich understanding of what it takes to provide truly effective learning experiences.

While teaching to curriculum subjects and assessment through exam scores may continue to dominate political agendas, research into effective learning techniques and a growing understanding of the needs of 21st century learners show that individuals benefit more by applying knowledge as a means to expand their understanding than they do by simply acquiring knowledge in order to pass examinations.

The focus of education and the role of educators are changing. Twentyfirst century learning is about providing children with opportunities to experiment with their surroundings as a form of problem solving. It is about creativity and collaboration, motivation and self-direction. It is about improvisation and discovery, and interacting with meaningful tools that expand mental capacities.

New technology; computers, digital information and online communication, are helping to expand the way we acquire and use knowledge, and this too is paving the way for more dynamic and effective teaching and learning experiences.

LEGO® Education has been creating solutions for kindergartens and classrooms for 30 years. The skills and techniques that the LEGO System for Learning embodies meet many of the needs of 21st century learners.

LEGO Education solutions enable students to be active, creative and collaborative solution-seekers. In this way their instinct to learn is stimulated, and they are motivated to apply their learning in new contexts, which means that they embark on a self-directed learning process.

LEGO students use LEGO bricks and digital tools to solve problems creatively and to excel at working with others and thinking critically. By working in this way, they develop their understanding and ability to retain knowledge of key curriculum concepts, and therefore do well in school and on high-stakes tests.



# LEGO® System For Learning

Systems are essential for learning because they are used by the mind to generate meaning from the endless onslaught of stimuli from the outside world. They help us to make sense of things and to build knowledge and understanding.

Through systems we also channel creativity into ideas or artefacts in a way that can be understood and valued by ourselves and others.

They help us to express ourselves. Systems that allow us to build knowledge and understanding, as well as express it, are crucial for learning. We call this Systematic Creativity: the ability to think creatively and reason systematically. It is about making sense of, and leveraging, human experience. It is marked by a strong push to put imagination and creativity at the service of knowledge and reasoning.

The LEGO® System for learning is unique because it provides endless opportunities to make sense of things and express new ideas.

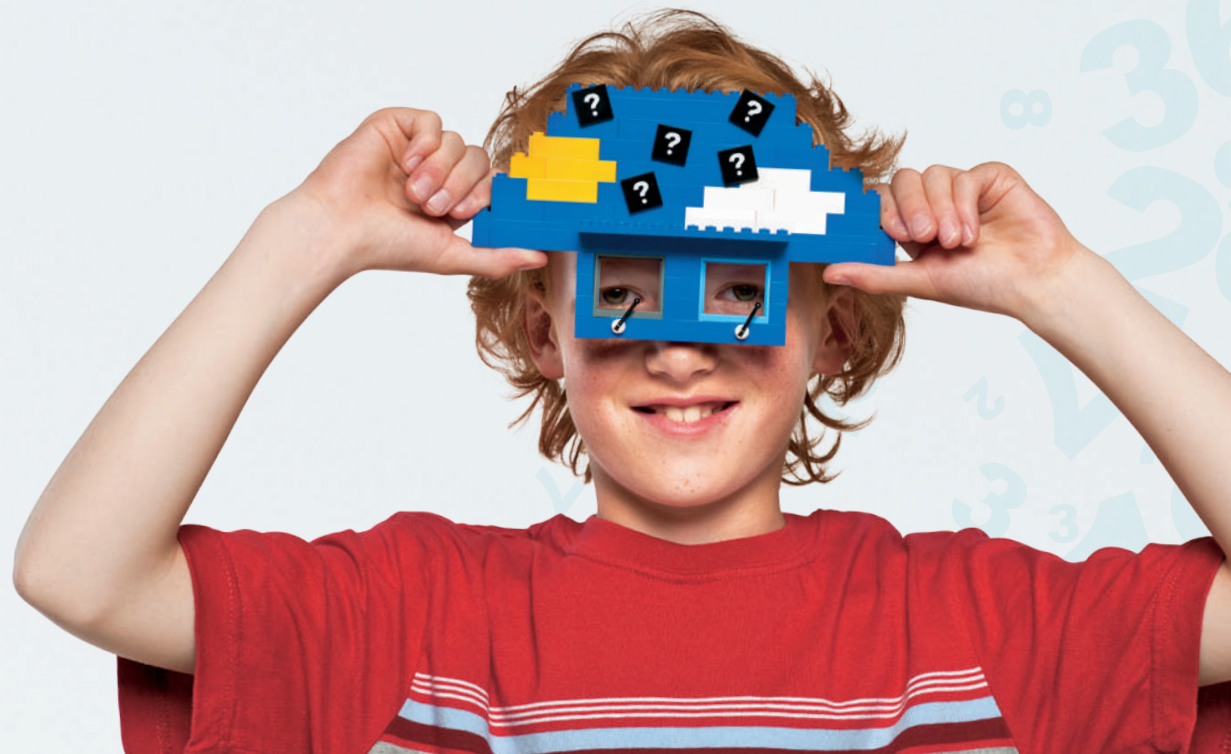
## Hands-on learning

The effectiveness of hands-on learning, for example through construction, has been well documented for many years. Today neuroscience is able to document even more precisely how physical and active involvement in experiences stimulates the brain and improves the quality of learning.

There is a growing recognition that people primarily think and learn through experiences they have had, rather than through abstract calculations and generalisations. We store our experiences in memory and use them to run simulations in our minds to prepare for problemsolving in new situations. These simulations help us form hypotheses about how to proceed in the new situation based on past experiences.

It is difficult to store and reflect upon abstract thoughts, as the brain does not have a memorable experience to retain and work with.

And yet a significant proportion of teaching efforts still rely on delivering knowledge in this disconnected way. While the LEGO System for Learning cannot solve all of the challenges that educators face, it is a fact that building representations of ideas, problems, and knowledge with LEGO bricks and digital tools provides students with an experience that is concrete and with learning that is memorable.







# The Digital and Creative Era

New technologies have brought easy access to knowledge and greater opportunities for collaboration and creativity. As James Paul Gee emphasises in *Learning Games*, technology eases information sharing, co-creation and the crossing of new and more distant borders, not just geographically, but also between physical and digital realms. Digital interfaces give us new ways to express ourselves, new ways to research ideas, new ways to experiment.

They allow us to take risks safely, to make and remake, to repurpose, recycle and trade in ways we could barely have imagined just a few decades ago.

Young people's combination and recombination of LEGO® bricks and models, both physically and digitally, nurtures non-linear forms of learning, where they move between rule acquisition and rule modification, between the familiar and the foreign. By working in this way, students gain opportunities to immediately reflect on the choices they make, to intuitively or collaboratively modify their ideas, and to collectively achieve better results with their classmates.

These developments and opportunities are changing the way teaching and childcare professionals view their roles. As one newly qualified teacher said: "I was looking at all these tools and thinking, 'How can I get good at using them in order to teach?' But then I realised that what I needed to do was to give them to the children and let them learn by using them."

# Delivering learning experiences through a Framework

LEGO® Education teaching resources embody a 'Four C' framework through which students are free to experiment and explore in order to gain new knowledge.

All LEGO tasks are designed to deliver a learning experience through this framework. The success of the Four C process is also dependent on the role of the facilitator in enabling students to achieve a state of Flow and to work collaboratively.

## Flow

To achieve a state of Flow, a balance must be struck between the challenge of the task and the skill of the performer. If the task is too easy, it leads to boredom; but if it is too difficult, it only creates anxiety, and Flow cannot occur. An educator's greatest responsibility is to facilitate the learning process in a way that allows children to stay within such a balance. In this way their creativity and engagement naturally flourish and Flow can be experienced. This is true of the entire Four C process.

By providing open-ended tasks and extension ideas, LEGO Education resources help students to achieve and maintain a state of Flow.

## Collaboration

Acknowledging collaboration is about recognising that while we learn on an individual basis, we need others in order to develop and complete our learning. Collaboration is about personal leadership and mastering the dynamics of teamwork. Learning to engage effectively in dialogue with peers, sharing ideas, and building on top of contributions by others while crediting the originator, are essential skills to master in all the phases of the Four Cs model.

Being collaborative involves building trust and empathy, and building strong bonds with others whilst remaining true to one's own identity. Collaboration entails sharing ideas and feelings through dialogue, and learning to negotiate differences.

## Connect

Learners are presented with a challenge or task that is open-ended and that places them in the position of solution-seekers. The active engagement of students always takes its starting point in questions asked by the learners themselves, thereby building on the students' own initiative and interests. In the Connect phase the facilitator encourages learners to ask questions and explore ideas around the task before they get started. Their curiosity is awakened, and the task is within their reach. It builds on existing knowledge and areas of interest.

## Construct

Every LEGO task involves a building activity. Active learning (or learning by doing) involves two types of construction: when children construct artefacts in the world, they simultaneously construct knowledge in their minds. This new knowledge then enables them to build even more sophisticated artefacts, a process which yields yet more knowledge, and so on, in a self-reinforcing cycle. To construct with others collaboratively extends this learning even further. Solutions that we create together are generally better than those we are able to create as individuals, due to the opportunities made available by the process.

## Contemplate

Students are given the opportunity to consider what they have learned and to talk about and share insights they have gained during the Construct phase. In the Contemplate phase everyone is encouraged to ask facilitating questions about the process and learning so far. Facilitating questions are designed to help learners gain awareness of the process they are in and explore new ways to go about finding solutions to the task that has been set.

## Continue

Every LEGO task ends with a new task that builds on what has just been learned. This phase is designed to keep the learner in 'a state of Flow'. The Flow state is an optimal state of intrinsic motivation, where a person is fully immersed in what he or she is doing.





## LEGO® Education in Practice

### For the Sciences and the Arts

LEGO® Education has developed a broad portfolio of teaching resources that can be applied to both the sciences and the arts.

Some resources tap directly into Science, Technology, Engineering and Mathematics (STEM) subjects, and allow students to engage with these subjects authentically. Practicing STEM in the classroom calls for problem- and project-based lessons as well as considerable social interaction – allowing students to refine one another's ideas, to articulate their own and to achieve new and valuable insights. Other resources are powerful tools that children use to create and tell stories as well as to express emotions and responses to their own experiences.





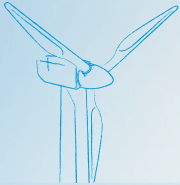
## How LEGO Education resources are used at schools



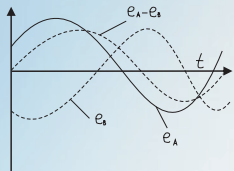
A group of 4-year-olds use LEGO® DUPLO® bricks to build the caterpillars Shorty and Stretch. They find things in the room that are “longer than”, “shorter than” and ‘exactly the same length as’ their caterpillar friends. Then they build their own caterpillars and use them to invent caterpillar stories.



A class of 10-year-olds uses the LEGO Education BuildToExpress method to talk about caring for the environment. The children build models that metaphorically represent their ideas and understanding. This is a skill they have been trained in and is a deliberate deviation from the more traditional use of LEGO sets to reconstruct real-world objects. The method improves their ability to reflect on their thoughts and participate in constructive dialogue.



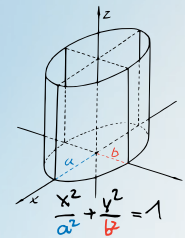
Primary and middle school physics students build LEGO models and use them to examine techniques such as capturing wind energy for transport or transforming energy by gearing down and concepts such as forces and wind resistance. They practice making accurate predictions and measurements, recording observations and findings.



Secondary mathematics students are asked to find a way to accurately control the speed at which a LEGO robot moves by logging the distance it travels over a period of time at varying speeds. The computer software includes a data logging component, so that when the robot moves, data is gathered and stored in a way that allows students to analyse and interpret it later. They are then able to calculate precisely how far, how fast and for how long a robot should travel to carry out a specific task.



A class of 8-year-olds engages in creating their own stories in groups, building a beginning, a middle and an end with the use of the LEGO® Education StoryStarter set. To inspire the story creation the teacher sets the scene by, for example, reading an engaging text from the teachers curriculum pack. The students build their stories thinking about the characters involved, the action taking place, and how the story can express their main idea and end in a way that serves their story right. They illustrate their story with photos of their building set-ups and add written text to it using the software StoryVizualiser. After a 2 x 45 minutes lesson, each group in this class has a well communicated story of their own creation to bring out of the classroom and an experience of themselves as good storytellers and storywriters. Each lesson has a clear learning objective linked to the national curriculum standards to build the students literacy skills in speaking, listening, reading and writing.



Each year, children around the world form teams (representing schools, clubs and families) to build and programme robots to complete a robotics challenge using LEGO® MINDSTORMS® sets. Teams compete in regional, national and international contests. The FIRST LEGO League challenge includes a research project on a given subject. Team performance is measured on the quality of the research, the robot design, the team's programming skills and the ability of the team to work together.

In all of these contexts the use of LEGO materials consistently helps to foster collaboration, imagination, resourcefulness, and equality. When everyone is building with LEGO bricks, they are on a level playing field, sharing their worldviews in the same international language.



# Conclusion

Twenty-first century learning is about providing children with opportunities to experiment with their surroundings as a form of problem solving; it is about improvisation and discovery, constructing dynamic models of real world processes and interacting with meaningful tools that expand mental capacities. It is about being active, creative and collaborative.

Educators no longer need to bear the burden of teaching predominantly through knowledge dissemination, but must instead become creators and leaders of effective learning experiences.



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