A PEEK INTO
CREYA LEARNING STUDIO
An Integrative STEM LAB & DESIGN STUDIO

Robotics | Digital Media | Engineering Design | Internet of Things (IOT) | Coding

Experiential, Interdisciplinary & Connected to Real World
Dear Educator,

Since 2011, Creya Learning has been working with schools across India to transform the way children learn and empower them with the skills and competencies necessary for success in the 21st Century.

Our constant work and efforts with children, teachers and coordinators in different schools - CBSE, ICSE, state syllabi-oriented schools or schools teaching the IB and IGCSE curricula - has been immensely satisfying. The results are there for everyone to see! We see students approaching problems in novel ways, designing out-of-the-box solutions that are out of the box, asking questions that make teachers think, and interacting constructively with their peers and mentors in the Creya Learning Studio. This making-designing-thinking-tinkering approach is at the core of Creya's philosophy. Two decades of research backs our insight that students must “Do-Feel-Know” to learn and construct their own knowledge of the concepts being taught to them.

Enabled with Creya’s solution, schools become centres of Experiential Education - that promoting project-based learning, experimentation and interactive learning. Students gradually move to application and demonstration of knowledge and thus gain mastery of the crucial 21st Century Skills. Creya aims to create reflective and articulate learners during the final transformative phase of learning; learners who can construct their own understanding of concepts and are able to communicate it to the world.

While Creya Learning Studio Experiences diverse range of projects that include the latest like Internet of Things (IoT) and Tynker for App Building, we have illustrated for specific cases of projects involving Digital Media, Bricks, Engineering Design and Robotics. They depict how learning the Creya way is different from learning in a regular class, activity classes or labs.

Through these case studies, readers also get a glimpse of the cutting-edge equipment and technologies young learners are exposed to in the Studio - tablets, engineering constructibles, digital media (audio and video), bricks, etc.

In these short ‘slice of life in a studio’ illustrations, we present to you how students typically approach solving a real world challenge. We hope this gives readers a brief understanding of the transformative learning opportunities available to students in a truly engaging and experiential learning environment.

Happy Reading!

Team Creya
In the Studio, students work on projects, **challenges** and a **capstone** with each activity taking them progressively through Kolb’s **experiential learning** cycle. Projects are guided activities to familiarize them with manipulative usage. The opportunity to manipulate the built model and the journal reflection activity helps in their abstract concepts becoming clearer and concrete. The **Challenge** and **Capstone** activities are open-ended with no step-by-step instructions. Instead, they have a problem statement asking students to design and build solutions for a real world problem.

Each group of students starts the design cycle by **ideating** to solve the problem at hand. They work in groups, brainstorming ideas and collaborating on ways to solve the problem. Such exercises bring to the fore skills such as **communication** and **creativity**. Students learn to negotiate the dynamics of their immediate group and the larger class to achieve their aim.

Based on the design, each team collectively agrees on the optimal one, and they progress to the **prototype** stage, at the end of which, they may revisit the design, if they learn something new during prototype creation, or if they come across a difficult constraint. Journal questions help them through the reflection phase that completes the design cycle.
Digital Media
[ Introduction to Tablet & PicsArt ]

During grades 3 and 4, students are kinesthetic/enthusiastic learners. The Creya curriculum is designed to fully utilize their innate curiosity and thirst to learn about the world around them.

Students were trained on the usage of Tablet camera on the first day, so they would be able to complete projects and challenges without impediments during the following days. Students were also trained on the use and function of the photo editing software called PicsArt.

Whilst all learning is interdisciplinary, Creya’s grade 3-4 curriculum is aligned to the NCF objectives in English Language Arts, Mathematics, Environmental Studies and ICT. In addition, first graders are assessed on the following learning outcomes during the Creya experience:

**ANALYTICAL THINKING**
- Analyzing information: data, ideas or concepts
- Applying formulas, procedures, principles or themes

**DIGITAL LITERACY - PHOTOGRAPHY**
- Image quality/clarity

**CREATIVE THINKING**
- Ideation/ Brainstorming
- Originality

**COLLABORATION**
- Contribution to team
- Working with others
[ The Approach ]

Students are visual learners who respond positively to multimedia. By introducing Tablets and PicsArt, students learn to creatively take photographs.

Visual arts has become a big part in today’s education. Through the Creya learning studio, students from grades 3 and 4, not only develop thinking skills like creative thinking, analytical thinking, persistence, but also become well versed with digital skills such as the nuances of clicking good pictures, photo editing, audio recording, and making presentations. Digital media devices such as the audio recorder help students focus on diction, vocabulary, voice modulation, etc.

Analytical thinking is assessed depending on whether students have understood the task at hand, if they are reading and looking at the picture given and assessing what exactly is to be done, and if they are making real life connections with minimum faults or prompting.

They were taught how to use the capture button, zoom and display function on the tablet camera. After that the children were also taught how to use PicsArt – Photo Editing Software. The idea was to allow the students to explore the camera in general and get familiarized with the device they would be using frequently to complete their upcoming projects.
[Project – Color Me Happy]

Colors make photos more real and life-like. Different colors make us feel differently. Students were given the following project statement.

Color red is linked to anger. Below are a few examples of some feelings. Try and associate them with a color that you think suits the feeling best: happiness, sadness, fear, calm, cold, hot, strong, and weak.

The range of expressions that the two groups came up with, is characteristically unique and diverse. While the first picture shows a broken pencil that is depicting a sad expression, the second picture shows a lonely red chair depicting an angry expression.
Observing other groups coming up with repetitive pictures within the confines of a class, Harshita’s group used their own team member to express “emotions”.
The log books contain reflective questions which make sure the students understand why they have taken certain actions during the projects and challenges. This is where we make sure the students are learning. The journals help students consciously evaluate their learning.

Here are a few samples of students’ reflections on the activity conducted:

Write down the list of colors that you chose and the objects or people that you photographed for each color associated with each picture.

Do you think the photos would make you feel the same way if they were in their natural or true color? If not, explain why.

Explain the reason for choosing the color for any one picture you clicked.

If you took a photograph of yourself, what color would you use and why?
[ Project – Old Timey Photos]

The students used PicsArt software to create photographs that look like old time photographs. With this activity, the children learnt about characteristics of old photographs, black and white photography and sepia tone in photography.

Project statement: Have your team mate take a photo of your letter and upload it into the computer. After everybody’s turn, your coach will display the photographs to the class.

Santosh, Mohit, Lakshit and Akshay of Group 2 understood the difference between the photos that are taken today and the old photos. They were able to understand that different characteristics of photos like color, posture of the people posing in the picture, clothes/attires were different in old time photos.
Aryan’s team decided to click their photos with a plain background. According to them it is important to know that most of the photos clicked during old times had plain background. This shows the high level of creative thinking by students.

Here are a few glimpses of students’ reflection through journals:

As a photographer, what did you do to make your subject in the photograph look and feel old?

As a photographer I coloured it black and white and sepia and we asked our teammates sit tightly straight and their hands on their laps.

What differences do you see between your original photo and the old timey photo?

The difference between the original photo and old timey photo was original photo was coloured and old timey photo was sepia and black and white.
[ Evaluation and Reflection ]

Students’ responses to reflective questions after the activity flesh out their experiences and give us insights into what they learned.

A seemingly simple exercise is so well structured and conducted to imparts crucial learning in English language arts, digital media literacy, ICT literacy, non-verbal communication, visual communication, collaboration and more, all within one Creya session!
[ Summary ]

The students of class 3 collectively took inspiration from each other during the challenge.

The students showed a high amount of collaboration in the class. At the same time, they also struggled in analyzing information and displaying confidence during the first two days. They opened up their minds the days progressed, and started working on the projects with lot more effort and focus.

It was interesting to observe how the students approached the projects and the challenge – They initially were shy and required a little prompting but over the days they became more confident and were at ease in the sessions. The students worked effortlessly in their groups and many of them managed to come up with some good ideas and finish the projects and challenge given to them. This showed their Problem Solving and Creative Thinking skills. As the days progressed, the students showed improvement in Analytical Thinking, Persistence, Focus and Ease of Adaptation. Their journals speak volumes about their learning.

This is when students started understanding the need to visualize and create finished models and not mere bare-bone working structures.

The students had an opportunity to apply the concepts of digital media and also:

- Used Design Thinking - a structured way to solve problems
- Created Design Sketches and Briefs
- Reflected on the work they had done
- Articulated - in writing - their successes and failures
- Improved their social and cultural skills while working in groups.

Multiple skills gained while "doing and learning" - all in a single Creya session!
Bricks
Grades 1-3 are the most important years in the learning process of children. They are getting acquainted with new concepts and making sense of the world and they are at their receptive best. In the Creya Studio, the various models and theories the students learn in the classroom are reinforced. A wide range of learning outcomes like collaboration, analytical thinking, creative thinking find their roots in the studio as the students go through the various projects and challenges.

The students of grades 1 to 3 were trained on the use of Bricks and made to go through a guided project to get them comfortable. The project builds and subsequent journaling also helped them visualize how the concepts related to Natural and Man-Made Objects (Grade 1) and The Science of Building (Grade 2 and 3) translate to concrete working models and real world applications.

Following this, students were required to use and apply all the concepts and knowledge gained through guided projects to design solutions for a challenge. The challenge for Grade 1 was to click photos of two natural and two man-made objects they find in the school premises and build any one of them using bricks.

The challenge for Grade 2 was to build the longest and the strongest bridge. The students had to complete the challenge using the knowledge they gained across the projects.

Students were trained on using the Bricks, so they would be able to build projects and challenges without impediments during the following days. Students participated actively and enthusiastically in the boot camp.
[Project 1 – Reduce, Reuse and Recycle]

Students learned the concepts of waste management and learnt about the 3Rs – Reduce, Reuse, Recycle. In the first project, they understood the concept of reuse by constructing different letters using the same set of bricks.

It must be noted that, after just 80 minutes of exposure to the Bricks bootcamp, not only did the entire class finished making alphabets by reusing the bricks, but also extended their understanding of reusing the blocks to make new alphabets. Every student was able to finish the journal questions that followed the project.

These groups exhibited impressive analytical thinking and collaboration. Good team effort allowed them to finish their projects and journaling on time.

The students were at ease while working with Bricks. They took keen interest while building the alphabets. They made changes in the builds by themselves to better understand the concept of reusing by making alphabets different from given in the project sheet.
Through these reflective journal questions, the students learnt to make a connection between what they have in the classroom and what they see in real life.

1. What are the 3 R’s?
   Re d u c e (use less stuff)
   Re u s e (use stuff again)
   Re c y c l e (make new stuff from old stuff)

2. For each item, write an example of a product that you have seen at home.
   Plastic: Plastic packet
   Paper: Paper bags
   Metal: Metal goods

4. Suggest a few ideas on how to use an empty shoebox that you don’t want to throw away.
   1. We can paint it and keep some of our things in it.
   2. We can paint it, put some sand and make it a beach.
   I used to make a car from an empty shoe box.
Project 2 – The Milk Carton

Imagine a day when the Earth is covered with heaps of waste! When we throw away the products that are made of plastic and other material that do not mix in the soil, they keep piling up and cause harmful effects. How do we stop that day from coming? There are three important ways to handle waste. They are the 3 R’s: reduce, reuse and recycle.

Students learnt the concept of recycle by recycling the material used to make a milk carton to make a pencil stand. These groups displayed good skills of problem solving and analytical thinking. They were quick to grasp all the concepts and even use them in the challenge.
Not only were the students using written English and math to attempt the journal questions, but also displayed their civic sense and applied their value education.

4. Write two ways to save water at home.

Repair the leaking taps, do not let water while brushing.

2. Raju throws away 2 empty milk pockets a day. If he did not send them for recycling, how many milk pockets will be in the trash after:
   a) 1 week? Fourteen - 14, (7 x 2 = 14)
   b) 1 month? sixty - 60 (30 + 30 = 60)

1. Pick one item from the list below and draw a picture of the recycled item you can make out of it.
   Newspaper, cereal box, notebook, shoebox.

3. Write two things that you should not waste at home.

1. Pick one item from the list below and draw a picture of the recycled item you can make out of it.
   Newspaper, cereal box, notebook, shoebox.
We see bridges being used daily to get vehicles from one place to another. All of them are of different sizes: some very small, and some extremely long. The one thing common among all bridges is their capacity to carry huge weights. If a bridge falls down, it will cause a lot of destruction to roads, cars, infrastructure. Hence, a bridge should always be strong enough to be able to carry a lot of weight. The students had to build the longest and strongest bridge. They had to make sure that it could carry a lot of weight.

Each group succeeded in solving the challenge. The students had grasped enough knowledge from the preceding days to be able to visualize the solution before building it, and could even estimate the number parts that would be required to attempt the solution.

Each student had to take quick decisions, delegate tasks and manage time to solve the challenge. They had to negotiate with and convince their team-mates about the ideas they wanted to implement.
The students did a very good job with the challenge. They built bridges with the pillars close to each other for support. They made the base bigger and wider for extra support.

Gopika showed good analytical thinking and communication skills. She read all the instructions carefully and applied all the concepts she knew to build something new during the challenge. She also was one of the first to answer all the questions asked to the class.
[Evaluation and Reflection]

Students’ responses to reflective questions after the activity flesh out their experiences and what they learned. The students not only built the projects, but also understood the importance behind building them. They made a real life connection between the classroom and the outside world through the reflective questions given in the journals.

Write down a list of all the colors of the bricks in your kit.

Red, yellow, blue, white, orange

Fill the table below based on the data from your classmates on what color bricks they like.

<table>
<thead>
<tr>
<th>Brick Color (from Classmates)</th>
<th>Tally Mark</th>
<th>Number (Frequency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>+ + + + + +</td>
<td>16</td>
</tr>
<tr>
<td>Orange</td>
<td>+ + + + +</td>
<td>2</td>
</tr>
<tr>
<td>Blue</td>
<td>+ + + +</td>
<td>10</td>
</tr>
<tr>
<td>Yellow</td>
<td>+ + +</td>
<td>4</td>
</tr>
</tbody>
</table>

Note the word Frequency in the 3rd column. Frequency of something is the number of times it occurs or happens.

Fill the table below based on the data you collected about the colors of your bricks.

<table>
<thead>
<tr>
<th>Brick Color (from Bricks)</th>
<th>Tally Mark</th>
<th>Number (Frequency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>+ + + + +</td>
<td>11</td>
</tr>
<tr>
<td>Blue</td>
<td>+ + + +</td>
<td>11</td>
</tr>
<tr>
<td>Orange</td>
<td>+ + + + +</td>
<td>5</td>
</tr>
<tr>
<td>Yellow</td>
<td>+ + +</td>
<td>6</td>
</tr>
<tr>
<td>Green</td>
<td>+ + + +</td>
<td>3</td>
</tr>
</tbody>
</table>
2. Write down a list of the number of bricks used, their sizes and colors in the space provided. Their are six colours bricks list of green, yellow, black, orange, blue, and red. List many sizes and colors used in the space provided.

3. Draw a sketch of the pictograph that you have made. Use the correct colors.

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**Data Collection**

Draw a table below based on the data you collected about the number of studs in your bricks.

<table>
<thead>
<tr>
<th>Number of Studs</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Bricks</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Which brick was the highest in number in terms of:

- color:
- number of studs:

Take tally marks in the given boxes for the number of items and write the frequency.

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**Pictographs**

- What is the key to this pictograph?

- On which day did the shop sell the most number of apples? How many apples were sold that day?

- On which day did the shop sell the least number of apples? How many apples were sold that day?

- If the key is changed to 4 apples, how many apples were sold on Thursday?
[ Summary ]

We have observed that students were able to work comfortably with the Creya XEL program. It was wonderful to see the students highly engaged. Students had opportunities to display Thinking Skills (Creative, Problem Solving and Analytical skills) in guided activities (projects). As they worked with the projects, students were able to relate holistically to the concepts and techniques of digital media, support structures in basic architectural elements, etc.

While working on challenges, students realized the importance of planning and designing before prototyping. While there were many design sketches by students showing the immense possibilities of creative and unconstrained thinking, students figured out the limitations around which real world solutions have to work on. They discovered this when they started prototyping and converting their design to a build. Getting to know this iterative process of design- prototype - evaluate - redesign is an important aspect of learning from mistakes, an opportunity usually not available in a regular classroom.

Students were able to work in groups after overcoming initial hiccups of group dynamics allowing for participation and sharing of ideas. However it is possible that with continuous opportunities to work in groups across different projects and roles, these students can move from just being passive ‘team players’ to being active ‘collaborators’ resulting in far reaching results.

Students also filled the journals with sketches and responses to questions as they worked on ideating and building. It demonstrated how children, given an opportunity to document their self-learning, would do it as long as it is engaging and enjoyable.
Robotics
[ The Case of the Exploring Robot ]

Students of Grade 6 are entrusted with more academic work. In the Creya Learning Studio, they become Associative Learners. Work in the studio brings about a range of learning outcomes including analytical thinking, creative thinking, problem solving and collaboration as these students experience the various projects, challenges and capstones.

Students are assessed for the following Analytical Thinking outcomes:

- Analyzing information: data, ideas or concepts
- Applying formulae, procedures, principles or themes
- Presenting multiple solutions, positions or perspectives
- Synthesizing ideas into a coherent whole.

Learning in the Creya Studio always starts with a Foundation Unit, a unit that introduces students to, or refreshes their understanding of, the various Creya constructibles as well as the philosophy of constructivism.

Other units of learning may be rearranged to suit individual teaching styles and student needs.

[ The Approach ]

Students of Grade 6, while learning about Sensors in Robotics, work with integrating motors and sensors in their robotic models. They program the robots using Cortex, with basic programming concepts such as loops, sensor motor interaction and conditional statements.

In the studio we visited, students were building models of robots. The primary task was to program the robot to draw a circle with a diameter of 60 cm. This required students to modify the design to make the robot hold a pencil/marker at a length that yields the required diameter, and a height that allows the pencil/marker to draw the circle. Then, they had to program the robot to make a pivot turn so that it could draw the circle.

In the pages that follow, we present a series of activities centered around these concepts.
In the building phase, students understand the components of a robot such as motors, brain, sensors, cables, etc. They learn about the movement of wheels and the role polarity of current plays in changing the direction of motion of wheels. They go on to build (with the help of instructions) a complete robot with a mechanical body, an actuator in the form of two motors, a programmable brain and sensors. They then experiment with the motor and sensory control of the robot.

**PROJECT 1: BUILD EXPLORER THE ROBOT**

**Materials**

- 2 Mini Motor 6-9v
- 1 Hinged Block Claw
- 3 Link 30
- 1 Motor Reducing Gearbox
- 2 Clip Axle with Gear Wheel T28
- 1 Axle Coupling
- 4 Building Block 15
- 6 Spring Cam
- 1 Battery
- 1 Power Wire
- 2 Motor Cable
- 1 Flat Plug Green
- 1 Flat Plug Red
- 5 Building Block 30
- 2 Flat Hub Collet
- 2 Clip Axle 45
- 1 Base Plate 120x60
- 2 Hub Nut

In this project, you will build a robot that has a mechanical body, an actuator as well as a programmable brain.

1. Attach two Mini Motors with a Link 30 as shown in the picture. Orient the motors such that their grooves are facing upward.

2. Slide a Building Block 30 horizontally over the Link 30 as shown.

3. Insert a Hinged Block Claw into the groove on the lower side of the Building Block 30.

4. Push a Clip Axle with Gear Wheel T28 into the hole on the side of each of 2 Motor Reducing Gearboxes (the side that contains the gears). Ensure that the teeth of the gear on the Clip Axle mesh with the gears of the Gearbox.

5. Attach the assemblies from Step 7 to the grooves on the far side the Building Block 7.5s.

6. Adjust the assemblies such that the Building Block 15 with Bore align with the Axle Couplings (from Step 3) and the Link 30’s are facing downwards.

7. Create two tire assemblies by using a Flat Hub Collet, a Tire 45, a Hub Nut and a Clip Axle 45. Do not tighten the Hub Nut over the Collet.

8. Slide the Clip Axle 45 from the tire assemblies into each Building Block 15 with Bore, attaching it to the Axle Couplings.

9. Once the tire assemblies are in place, tighten the Hub Nuts over the Collets.

10. Insert a Building Block 30 vertically into each of the Building Block 30s (from Step 8) as shown in the picture. Note the orientation of the grooves.

11. Insert one Building Block 5 with 2 Pins on top of each of the building block 30s. Note: if you are using the larger sized batteries, you made need to use Building Block 30s instead.

12. Attach the near side of a Base Plate 120x60 onto the pins of the Building Block 5 with 2 Pins.
Priyadarshini, Karan and Sreeman not only finished the model of a robot in record time, but also identified problems with their model – instability and loose wheels - and added two extra wheels and a gear wheel to stabilize the model.

Extensive journaling in the studio allows children to reflect on what worked and what did not in the session. Samples:

**Control Rover the Robot**

1. What types of turns are used in Steps 5 and 6?
   - **Step 5:** The pivot turn is used in Step 5. The motors rotate in opposite direction.
   - **Step 6:** The curve turn is used in Step 6. One of the motors rotates in a circle.

2. Describe in your own words how the command SETPOWER (n) works.

   By using the SETPOWER command, we can provide the speed of the rover. The reason why we have attached two axles to two wheels is to use the SETPOWER command to provide individual speeds to each motor. This helps us to save power because here one of the motors can use low battery power because of close speed.
Cherrapunji in Meghalaya is the one of the wettest places in the world due to heavy rainfall. So, the hottest commodity in Cherrapunji bazaars is the umbrella! Ibansara Syngai is an umbrella factory owner in the town who recently modernized her factory floor. She has hired your engineering firm to design and build a robot that will automate the cloth cutting needed for the umbrellas. The exact size needed for the umbrella cloth is a circular cloth of with 60 CM diameter. The robot should be able to draw the circle in a continuous movement. If you’re successful, Ms. Syngai will purchase several of these robots which would net your company a nice profit.

Students, after articulating the challenge statement among groups, started with the design of the models. Although, it did not require them to change the body of the robot, they had to significantly alter the design of the existing robot models to make sure that there is a provision for holding a pencil/marker firmly. Moreover, the bigger challenge was to ensure that they place the pencil/marker at a length from the center of the robot, and at a height from the ground so that it draws a circle of an exact diameter of 60cm. Students used the concept of ratios and proportions to attach the correct number of building block 30s to yield required dimensions.

After multiple iterations made to their models, students figured out the design. The next step was to program the brains to make the robots move in a circular path to draw a circle. One of the ways was to make the robot move along a perceived circumference of the required circle. However, as this was a harder path, students cracked an easier route to solve the problem. They programmed the robots to make a pivot turn so that the robot can draw the same circle with minimum usage of time and energy. The results were exciting, both to students, and to us.
Here are some sample design briefs of how students planned to complete the challenge:

This group went a step further and added two pencils - one at each end of the robot, placed at a certain distance. This further reduced the time taken by the robot to draw the circle as it did not have to turn 360 degrees to draw the circle.

As we can see, this group’s design uses a calculated number of building block 30s to create a holder for the pencil. The arm was 30 cm in length, starting from the center of the robot model. The radius of the circle will be 30 cm, which means that the diameter becomes 60 cm.
And here are some designs translated to reality:

[ Evaluation and Reflection ]

Samples of responses to reflective questions after executing the challenge:
Your task in this capstone challenge is to design a robot security device. This robot would need to be able to move around the perimeter of a building to check for any intrusions that might be there to cause trouble. Your team decides to construct a model building (out of engineering parts) for the test. The robotic security guard must be programmed to stop at each corner of the building and give a visual cue before proceeding on its guarding routine around the building you have built. If your robotic guard is successful, you can think of marketing it to all the upcoming construction firms.

Students were visibly excited at the prospect of using sensors with their robots. Their task was to design a house of particular dimensions and then program their security guard robots to go around the house and blink the LED sensors at each corner of the house. What was remarkable was the class unanimously decided to create one model of a house where each group contributed to building a part of the house. They did this to reduce the use of resources and to share their responsibilities. This way, they also created a common problem for the entire class, which they would approach in unique ways.

Each group then began their calculations to solve the capstone challenge. A few groups were able to visualize how their robot should move around the house and avoid banging into walls on its path. They solved this problem by making the robot move 2 cm extra at every corner so there would be space for the robot to make a 90 degree turn.

Next, students proceeded to programming the model. They used new commands such as LED sensors, wait commands. Most groups were able to solve the capstone challenge by the end of the session.

Sample Design Brief of the Capstone:
Some kids are born collaborators. Prajwal Sundar in this studio was one. After successfully completing his challenge, he went around the Studio and helped other groups sort out the kinks in their designs and make them work. A true 21st Century trait!
Reflection Journals post-Capstone fleshed out where children faced problems and what they learnt:

4. What challenges did you face during the capstone? How did you overcome them?

The most difficult challenge was in this challenge project was deciding how can we give the robot commands about how to make it move around the building.
Engineering
[ The Curious Case of the Paper Crinkler : Engineering Design ]

This story is from a Creya class of Grade 8 students working on an Engineering project. By Grade 8, students in a Creya class are Autonomous Learners, capable of constructing their own learning and able to articulate their understanding to the world. As the 8th graders get exposed to various projects, challenges and capstones in the Creya class, they are assessed for a set of 14 different learning outcomes ranging from thinking skills to leadership skills using an observation-based rubric framework.

In this unit, children work on projects to build models with guided instructions that help them explore concepts like gear trains and power ratios. The Challenge Project in this unit is asks students to address a business need of a paper lantern manufacturer. Groups of children get to design solutions expressing their problem solving and creative thinking skills building on what they have learnt in projects.
The Approach

For Grade 8, Unit 3 is “Gear Ratios”. In this unit, students are introduced to the concept and application of Gears. They explore concepts such as Gear Pairs, Gear Trains, Gear Reduction, Power and Speed Ratios in Gear Pairs and Trains.

In the Studio we visited, students had built and experimented with models that exhibit power and speed ratios. They would now use these concepts to attempt the first challenge in which they would design and build prototypes. These models would use the principles of gears to solve real world problems.

Project

The students work on two projects (drawing upon detailed instructions in the course material) that explore concepts like gear ratios, gear reduction, power and so forth. They build working models of a gear train and a wheel axle with bevel gear in the projects as shown below.
A sample of the project curriculum shown above illustrates how children work through instruction led guided activities and answer journal questions. Manipulating the built model and journaling helps build the connections to Math and Science behind the models in an engaging way. With this concrete knowledge of Gear Trains and Power ratios, children are now ready to apply this for solving a real-world problem statement - The Chinese Lantern Challenge.
“You have been approached by a famous lantern manufacturer. The client would like your group to design and build a machine that will crinkle paper. He plans to use the crinkled paper as the shade material over a lantern fixture. You explain that this should be easily accomplished by creating a machine that will crinkle the paper as it is rolled through a gear train. The client is excited about being able to see his idea become reality with your help.”

The Coach had prepared for the Challenge session by looking up the Coach resources provided by Creya – a video about paper crinkler machines and a video on how to make the Paper Crinkler machine prototype using Creya constructibles.

To provoke thought on the real world usage of the model they would build, she showed the children an image of a Chinese lantern made of crinkled paper. A short discussion followed on other possible uses of crinkled paper.
Different groups of students in the same Grade 8 came up with different approaches to solving the challenge. The first group designed a straight fast paper crinkler. The second group designed a crinkling machine that essentially achieved thicker crease with lesser number of parts. The design of the third group led to a crisscross pattern crinkle.

This diversity of thought is encouraged and expected in the Creya Learning Studio. Problem statements and challenges in the Studio (mirroring the real world) do not have one “set” answer. Multiple solutions and various approaches to each solution may be devised for any given problem.

Students created detailed design briefs after brainstorming and researching. In the briefs, students showed the design sketches of how they would like their models/builds to be at the end. They also listed the part requirements.

Students have come up with design sketches that show a sense of possibility, an application of the concepts and builds used in the project stage and a detailing of the list of parts that will go into making the prototype a working model. The sketches also demonstrate the diversity of thought process possible only in a studio kind of environment.
After design, the teams built their models using the Constructibles in the Studio. The Materials Manager of each group went to the Constructibles cart and picked up the required parts based on the parts requirement list of his/her group.

Building working models is a team effort, requiring different skills from each team member. It calls for intense collaboration and communication within the group. Similar to their varied designs, each group’s model was different. Some students built just the core mechanism. Some included input and output trays in their machine.

Students learnt one of the core principles of working in real life – that there is no single “correct” solution to a problem, and that multiple unique solutions are possible.
This team built a slightly complex mechanism with a series of multiple gears connected to progressively crinkle the paper even if it is of higher thickness.

This team’s model had high functionality but what set their model apart was the innovative design which consisted of an enclosed model showcasing sophisticated understanding of safety and aesthetics.

This team’s design and model not only had the functionality of crinkling the paper but also had built an enclosure that took safety and aesthetics aspect into consideration.
[ Evaluation and Reflection ]

Reflections on the process and the project were journaled, allowing students to articulate what worked, what did not, and why. This is an important element to learning in the Creya Studio, as it helps develop metacognitive skills essential to the development of autonomous learners.

Students also understood how this learning can help improve the design for better next time around and also about the iterative process of designing and applying learning. Students end up being better engaged as they see a sense of purpose to them learning the concepts in various subjects.

**Challenge 1**

1. Were you able to build a gear train to ‘crinkle’ paper? If yes, write what you did to meet this challenge. If no, describe the biggest problem you had.
   
   Yes, we were able to build. We were confused with the no. of gears at the beginning. After constructing half the model, we realized that we needed only 6 two gears. We also had problem with inserting the gear paper inside the last gear.

2. What adjustment was required in the gears so that the paper could travel through them?
   
   Spacing. Enough spacing between the gears was required.

3. How could you accommodate the gears in the model?
   
   The gears were accommodated in the model as per the given instructions.

1. Describe one advantage of using a Wheel Axle with Bevel Gear.
   
   The advantage is that a force applied in one direction can distributed to many directions.

3. Examine a Wheel Axle with Bevel Gear. Describe at least two features that differentiate it from a Spur Gear.
   
   A spur gear cannot transmit force in 90°, whereas Bevel gear can. Bevel gear has better grip and whereas, spur gear has relatively less grip.
Another milestone by students of Creya Partner schools in the Inaugural Edition of the Young Innovators Program 2017 conducted by the IIT Kharagpur. With over 1000+ schools from across India that competed over 4 rounds with judges from IIT as well as external experts, it tested the students abilities to work on real-world problems and find solutions. The problems they worked on included shoes for arthritis to oil slick detectors and eco-friendly air-coolers.

1/3 rd of the schools that made it to every next round of the 4 rounds were Creya Partner school teams and the 1st and 2nd prize winning projects were also Creya Partner Schools.
IGNITED MINDS CHALLENGE 2017

CHALLENGESCHOOL: ROYAL PALACE JANK AND

Pinnacle of Achievement

Challenge: The operational cost of various tools and machines required for leveling, plowing, sowing, and adding fertilizers and pesticides is very high.

Intelligent Seed Sowing Robot

Solution

Jury Speaks

What is unique

Understanding of Dynamics of the Agriculture Flavors of the build

High marks for design and empathy

Supported by

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[Image and text content]
[Pinnacle of Achievement]
Of the many exciting things that students of the Creya program get to experience, this one stands out in terms of its alignment with our vision: A town hall meeting with the UNESCO Director General Ms Irina Bokova on the topic of 21st Century Skills. Creya was one of the supporting partners for UNESCO-MGIEP ‘by invite only’ event and was glad that students from Creya schools could not only make it to the event but also made the most impact.
The Journey with Creya is all about equipping the next generation of learners with skills essential for success in college, career and life in the 21st century.

From Chandigarh to Chennai and Guwahati to Gandhinagar, Creya Learning Studios are impacting 50,000+ students in elite private schools and Government Schools to work on inter-disciplinary projects, build skills and inspiring them to innovate.
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Inspiring to Innovate