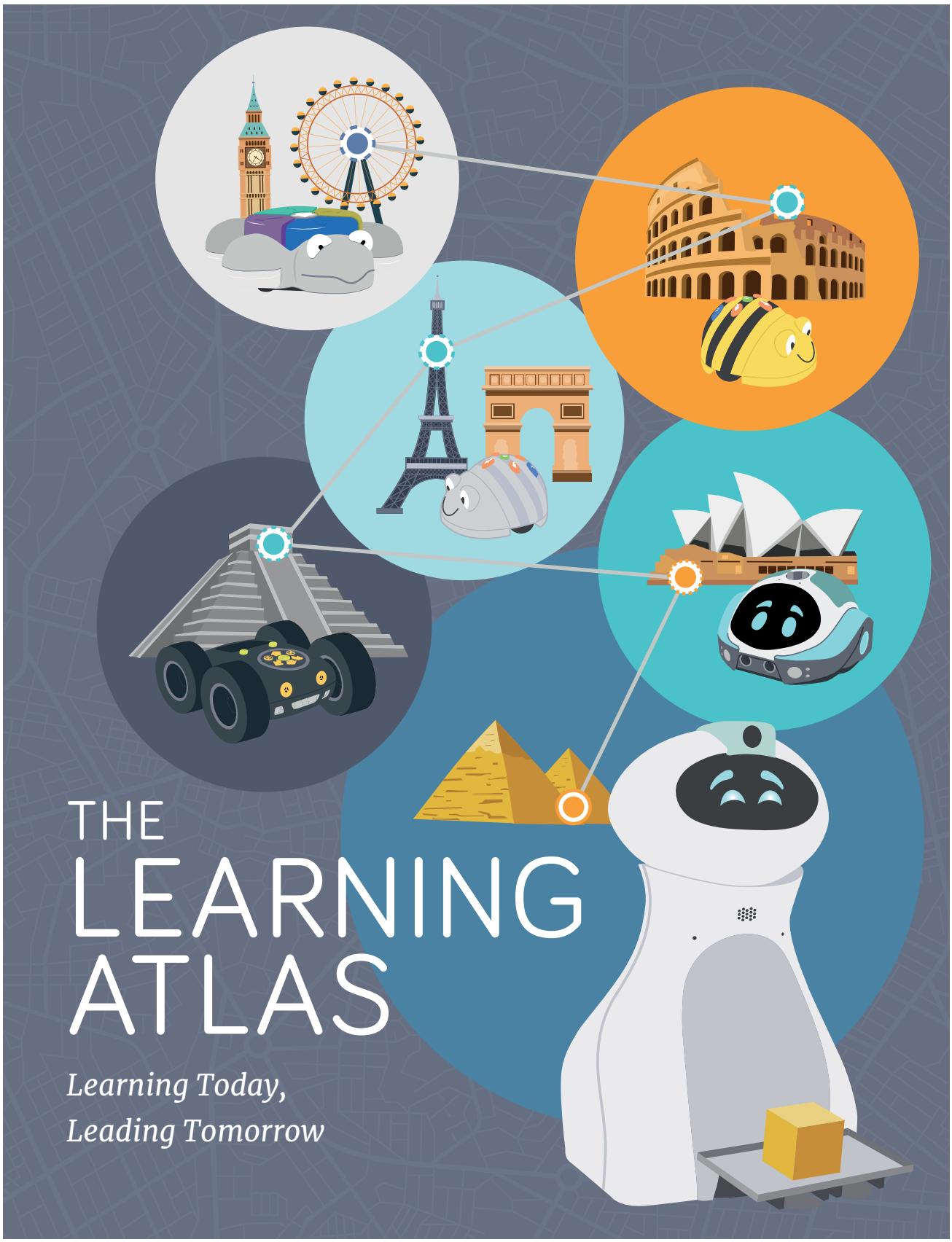
GLOBAL • EDUCATORS • LEARNING • INSPIRING



THE LEARNING ATLAS

Learning Today, Leading Tomorrow

THIRD EDITION

BROUGHT TO YOU BY tts

A Welcome Note from TTS

Welcome to the latest edition of The Learning Atlas: –
Learning Today, Leading Tomorrow!

For those of you who enjoy facts and figures, I would like to start with the following –

"According to Dell, 85% of us who are in work will be doing jobs in 2030 that don't exist yet."

And further….

"According to the World Economic Forum, more than half of the jobs that we do in 2030 will require an understanding of digital technology."

What the future holds, we are not quite certain of today, however, what we are certain of is the fact that the world around us will continue to change, transform and the skills required will continue to rapidly evolve. So how do we prepare?

With a global outlook and articles written by experts and innovative pedagogues from all around the world, we bring you a current and engaging outlook on what the future holds for the children of today and the practices required to lay the foundations for success right from the beginning. We discuss the the importance of STEAM, EdTech and robotics, and how teachers globally are having to adapt to the ever-evolving classroom environments.

If you haven't yet met our bots, I'd like to introduce you to the TTS Programming Journey, which solidifies TTS as a true market leader in robotics. This is the only robotics range to develop computational thinking and programming skills from Early Years to age 12 and beyond; a range that has been thoughtfully crafted to integrate different subjects, making them valuable cross-curricular teaching tools, offering endless possibilities to modern-day teachers.

As you delve into this insightful and comprehensive edition, we encourage you to consider your own approaches and practices, questioning the changes necessary to be made to keep up with the accelerated pace at which technology is developing today. *Learning Today, Leading Tomorrow!*

Rebecca Harrington
Editor-in-Chief

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CONTENTS

21ST CENTURY LEARNING SKILLS

Introduction to the Programming Journey
Gemma Koch Page 8-9

Programming Journey
Page 10-11

Glow and Go
Page 12-13

Bee-Bot
Page 14-15

Blue-Bot
Page 16-17

Rugged Robot
Page 18-19

Loti-Bot
Page 20-21

Oti-Bot
Page 22-23

ICT Skills Matrix
Page 24

Compare our bots
Page 25

Active Learning by Digital Doing
Balazs Czekman Pages 28-29

PROGRAMMING FOR EARLY YEARS

Introducing the Glow and Go Bot
Catherine L Clark Page 32-33

Paola Lopez – Senior Program Director at Kinderoo Children's Academy in Florida reviews the TTS Glow and Go Bot
Paola Lopez Page 34-35

LANGUAGE & COMMUNICATION

The new landscapes of educational technology and its integration in digital environments
Dr. Prof. Cristina Rodrigues Page 38-41

Simple educational robots can contribute significantly to children's development
Dr. Janika Leoste, Dr. Tiiu Tammemäe, Dr. Tiia Õun, Dr. Elena Peribáñez and Estefanía Martín-Carrión Page 42-43

STEAM IN THE WORLD

STEAM: Discovering the world through experience
Dr. Prof. Cristina Rodrigues Page 46-47

Explorer KIDS: Computational thinking and programming for everyone
Marjorie Klich Nunes Page 50-51

Blue-Bot on board the EDUbus
EduTeam Page 52-53

OUTDOOR PROGRAMMING ROBOTS

Rugged Robot controls crib sheet
Page 56

Cross-curricular links
Page 57

Rugged Robot challenge sheet
Page 58-59

From stepping stones to alternative algorithms: The Mars Expedition
Page 60-63

Rugged Robot Takes out the Trash!
Kjell Gunnar Ytre-Eide Page 64-65

ADVANCED PROGRAMMING

Loti-Bot the Block-based Programmable Robot
Page 68-69

Loti-Bot: Finding ways to add challenge to learning
Richard Duncan Page 70-71

Embracing Robotics Loti Bot in Action
Page 72-73

SOCIAL ROBOTICS - THE FUTURE

Meet Oti-Bot
Page 76-77

Getting to know Oti-Bot
Page 78

Skills and learning with Oti-Bot
Page 79

ROBOTICS FOR INCLUSIVE EDUCATION

Debug'd Coding: Making Coding Experiences Inclusive and Accessible for ALL Children
Christy McDonald, Leanne Husk and Susie Blackstien-Adler Page 82-83

Robots in school and the possible positive impact they can have on children with special needs
Kathe Bjerggaard Johansen Page 84-86

Inclusive Oti-Bot
Page 88-89

These articles are a collection of learning experiences from around the world

Sit down, relax and prepare to be inspired!

21ST CENTURY LEARNING SKILLS

Introduction

to the Programming Journey

Gemma Koch

Head of Innovation, EdTech & Curriculum

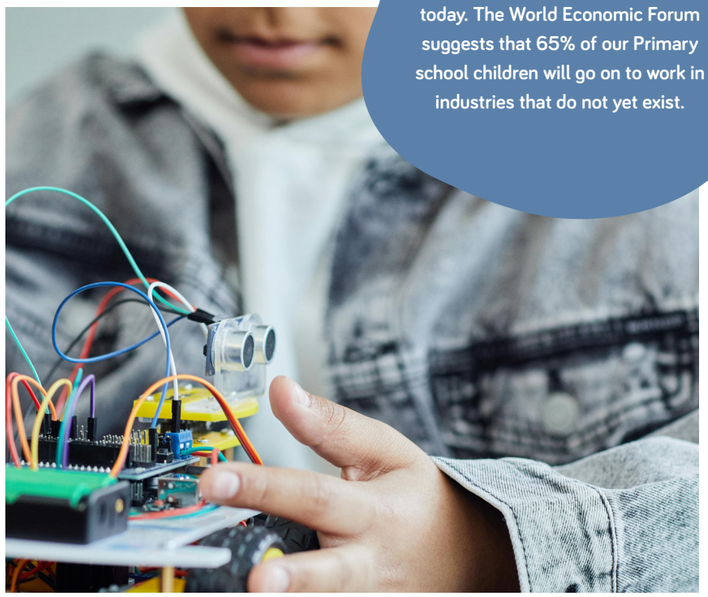
The world is changing at a rapid rate. New frontiers are being broken in the fields of nanotechnology, artificial intelligence, and the connected world. Advances in Science and Medicine, pushed forward by the need for survival in the pandemic, have shone a light on STEM careers and their value in society.

How then as educators are we to satisfy the needs of our curriculum, whilst balancing our limited school budgets and preparing our learners for a yet unknown future of work? All whilst meeting the pastoral and emotional needs of children who have spent a significant proportion of their childhood in a global pandemic? Never has it been more challenging to be a classroom teacher or school leader. Never have a generation of children seen such rapid advancements in technology throughout their childhood.

With all this in mind, we must draw from what we already know as educators. Nurturing our students to become curious and resilient learners, to foster their creativity and communication skills will serve them in the future, whatever they go on to do with their lives.

We must also accept that sensible adjustments need to be made to the technology students interact with at school. This needs to be an approach that successfully builds on prior learning, supports the use of technology outside of school and allows for a differentiated approach to teaching students of mixed abilities. In the very best practice, technology will be leveraged to support students with learning differences.

The industries our grandparents worked in are not the industries of today. The World Economic Forum suggests that 65% of our Primary school children will go on to work in industries that do not yet exist.



SO WHY USE ROBOTIC DEVICES IN OUR CLASSROOMS?

Whilst there are unknowns about our future, one thing can be certain. In some way, shape or form our children will interact daily with robotic devices in the future. From cleaning public spaces to dispensing medicines, serving food in restaurants, or assisting the elderly and infirm. This normalcy is our children's future.

At school, we have used robotic devices to deliver computing and programming lessons. Whilst this is a perfectly wonderful way to embed robotics into your curriculum, they offer so much more.

Working with Robotics builds confidence in students, friendly non-judgmental characters that can withstand the rigour of the classroom, and the ability for students to experiment and refine their skills at their own pace without the worry of breaking something or doing something "wrong".

Working with Robotics allows students to understand mathematical concepts, experiment with cause and effect, use technical language, communicate with peers, problem-solve, and express their creativity through technology.

Working with Robotics from an early age demystifies the complexity of robots that students may encounter in society.

Of course, learning to program with a physical device is far preferable to learning to program on screen. Time and time again studies have shown how kinesthetic learning allows students to make sense of abstract concepts. Using floor robots, like Glow and Go, allows our earliest learners to make sense not only of the world around them but their impact on controlling a simple machine. These concepts are built through our programming range, allowing students to experience programmable movement, debugging, the use of input, outputs, and handling of sensor data.

Loti-Bot allows for true STEAM integration into your classroom, using a variety of sensors to harvest live data and an incredibly accurate drawing capability – the only limit is students' imagination.

Often students at the top end of their primary stage are limited to on-screen programming. However, with our more advanced robot Oti-Bot, older students are immersed in the awe and wonder of social robots, meeting their learning objectives with marvel and curiosity.

SO WHY A PROGRAMMING JOURNEY?

Our range of robotic devices allows for a graduated approach to computational understanding. Students progress to a more advanced device at their own pace, allowing teachers to differentiate and personalize the learning for their students.

A school group choosing to employ the full programming journey for its students is investing in its learners' futures. As students progress through their understanding of each robot they are also learning to problem solve, work with creativity and build resilience that will serve them well for their futures.

And for the things we don't know about yet, Oti-Bot is fully upgradable, to meet the needs of learning outcomes we don't even know about yet!

PROGRAMMING JOURNEY

TTS Programming Journey: The only robotics range to develop computational thinking and programming skills from Early Years to age 12 and beyond.

BEGINNER

Action • Reaction

(Unplugged)

INTERMEDIATE

Algorithm • Debugging

(Unplugged Programming & App Based)

ADVANCED

Variables • Iteration

(App based)

> **Develop future skills and embed programming across the curriculum with Loti-Bot.**

GLOW AND GO

BEGINNER

Action • Reaction

Glow and Go® is a multi-sensory, rechargeable robot, which will captivate young children's interests as they plan its illuminated journey, whilst laying firm technological foundation skills.

This highly engaging robot has simple, clear and literal button controls that are, when pressed, textured and colourful. They also illuminate and create sounds, enabling the child to explore cause and effect. Suitable for 10mths+.

3 MODES

Choose between 1-10 movements, dance mode or no sound effects at all, to include all children.

MOTOR STOPS WHEN PICKED UP

Ensures safety should Glow and Go be picked up for any reason.

SUITABLE FROM 10 MONTHS

Glow and Glo Bot evolves with the child, igniting curiosity and developing critical thinking, knowledge of cause and effect and gross motor skills. Glow and Go is an age-appropriate, non-screen introduction to technological foundation skills.

BEE-BOT

> All of our robots have been designed to be sequential, so that the student and the teacher can progress from one robot to the other.
>
> *Jed Brown, Lead Product Designer*

INTERMEDIATE

Algorithm • Debugging

Bee-Bot® is a perfect starting point for teaching control, directional language and programming.

Along with a memory of 200+ steps, Bee-Bot can detect another Bee-Bot or Blue-Bot® and say hello.

Bee-bot will play a default sound or the students can record their own. Students can also record audio to play back when each button is pressed, making it more accessible to all students, including those with auditory or visual processing needs.

INTERACT WITH OTHER BEE-BOTS & BLUE-BOTS

Add an extra layer of communication to your lessons and introduce inputs and outputs.

RECORD AUDIO & CONFIRM COMMANDS ARE ENTERED

Perfect for adapting your robot to subject specific lessons and for increasing accessibility.

STORES AND EXECUTES 256 STEPS

For endless possibilities in your lessons, without the need for screens.

BLUE-BOT

INTERMEDIATE

Algorithm • Debugging

The Blue-Bot® programmable floor robot is the perfect place to start for teaching control.

The Bluetooth functionality means you can wirelessly control it with your tablet or PC.

Blue-Bot can detect another Bee-Bot® or Blue-Bot and say hello. They will play a default sound or the students can record their own. Students can also record audio to play back when each button is pressed, making it more accessible to all students, including those with auditory or visual processing needs.

Compatible with the TTS TacTile Code Reader

For increased accessibility and expansion of unplugged programming opportunities.

FEATURES BUILT-IN TEACHING CONTENT

Learner games and challenges included in the app.

CUSTOMISE THE EXPERIENCE

Customise the app experience to your own school curriculum.

RUGGED ROBOT

Rugged Robot Data Logging Backpack

INTERMEDIATE

Algorithm • Debugging

Rugged Robot® is the first programmable robot from the TTS range, specifically designed for outdoor use! Boasting Bluetooth functionality and designed for robust challenges, Rugged Robot can be controlled via tablet or the TTS TacTile Code Reader.

With a memory of up to 256 steps, Rugged Robot will be able to carry out the most challenging of activities. With 3 speeds, students can set how fast the robot moves. It also boasts an obstacle sensor which can be turned on and off to prepare students to the more complex programming that lies ahead.

DESIGNED FOR INDOOR & OUTDOOR USE

Take programming to the great outdoors, in all weathers!

FREE PROGRAMMING APP AVAILABLE FOR IOS & ANDROID

Develop students computational thinking by introducing debugging and iteration via the app.

ONLY ROBOT WITH 3 TORQUE SETTINGS

Carpet, grass, sand or snow! Rugged Robot loves to get his wheels dirty!

LOTI-BOT

> By using the robots, it has given the children something tangible to think of when using coding blocks.
>
> *Northfield Primary School*

ADVANCED

Iteration • Variables • Sensors

(App Based)

Loti-Bot® is the newest member of the TTS bot family, featuring programmable movement, highly accurate drawing capabilities and a variety of inputs and outputs.

Loti-Bot is the prefect bridge from early programming with Bee-Bot® and Blue-Bot® to advanced programming with Oti-Bot®.

SUPPORTS LEARNERS WITH COMPUTATIONAL THINKING SKILLS

Develops a deeper understanding of working with sensors and variables.

HIGHLY ACCURATE DRAWING CAPABILITIES

For engaging maths lessons and real-world simulations.

A WIDE VARIETY OF SENSORS

For live, rich data harvesting and dynamic programming.

OTI-BOT

ADVANCED

Machine Learning

(App Based)

Oti-Bot® is a STEAM robot designed with the future in mind.

Suitable for supporting your learners across all subject areas, Oti-Bot is a versatile, social and upgradable humanoid robot designed for the 21st Century classroom.

MACHINE LEARNING THROUGH FACIAL RECOGNITION

Program Oti using face data as an input, embedding the the foundations of AI learning in your classroom.

PROGRAMMABLE MOVEMENT AND EMOTIONS

To introduce social robotics to your classroom.

INTERCHANGABLE TUMMIES

Allow students to replicate real life examples of robotics in industry, such as catering and hospitality, healthcare, logistics and more.

ICT Skills Matrix

Develop Computational Thinking skills from an early age with our progressive range of computing resources.

Each resource has been mindfully created with the skills of the child in mind to ensure that concepts are secured at each stage.

Match our resources with the needs of your students, rather than just the age range, for a personalised learning experience.

- EARLY SKILLS
- 21ST CENTURY LEARNING SKILLS AND STEAM
- COMPUTATIONAL THINKING SKILLS

	GLOW AND GO BOT 10+ months	BEE-BOT 3+ years	BLUE-BOT 3+ years	TACTILE CODE READER 3+ years	RUGGED ROBOT 5+ years	LOTI-BOT 6+ years	OTI-BOT 7+ years
Cause and Effect	●				●	●	●
Hand-Eye Co-ordination	●				●		
Fine Motor Skills		●	●	●	●		
Directional Language	●	●	●	●	●	●	●
Critical Thinking	●	●	●	●	●	●	●
Collaboration	●	●	●	●	●	●	●
Creativity	●	●	●	●	●	●	●
Communication	●	●	●	●	●	●	●
STEAM	●	●	●		●	●	●
Algorithmic Design	●	●	●	●	●	●	●
Pattern Recognition	●	●	●	●	●	●	●
Abstraction		●	●	●	●	●	●
Decomposition				●	●	●	●
Debugging		●	●	●	●	●	●
Inputs and Outputs		●	●		●	●	●
Looping and Iteration			●	●	●	●	●
Storage of Different File Types						●	●
Working With a Wide Variety of File Types							●
Data Logging /Working with Data					● (with backpack)		●

Compare our bots

Our ICT Robot Feature Chart lists key information on each resource, to help teachers choose the right resources for their student's ICT journey. Mix and match resources - both across years and within the same classroom - enabling children to have personalised learning experiences, while still building skills and working towards lesson outcomes.

	GLOW AND GO BOT 10+ months	BEE-BOT 3+ years	BLUE-BOT 3+ years	RUGGED ROBOT 5+ years	LOTI-BOT 6+ years	OTI-BOT 7+ years
Distance of movement		15cm	15cm	20cm	Customisable	Customisable
Turn radius		90	90	45	Customisable	Customisable
Memory count of steps	10	200			Customisable	Customisable
Connection: B - Bluetooth, W - wireless			B, W	B, W	B	W
Charge via: U - USB, D - docking station	U	U, D	U, D	U	U	U
Includes: P - PC software, T - Tablet app, PI/TI - Software/ app can be used independently from the bot		T, I	P, T, TI	T	T	T
Method of movement	Wheels	Wheels	Wheels	Wheels	Wheels	Caterpillar tracks
Sensors		Other Bee/ Blue Bots	Other Bee/ Blue Bots	●	●	●
Continuous remote control			Via app			Via app
Pen holder/drawing		Via accessory	Via accessory		●	●
Sound input & output		●	●		●	●
Bloc programming			●	●	●	●
Internal storage						●
Programmable buttons	●	●	●	●		
Display output						●
Video/photo/livestream input (camera)						●
Facial recognition						●
QR reader						●
Programmable voice activated functions						●
Programmable body lights	●				●	●
Follows lines						●
Colour sensor						●
Ability to execute offline	●	●	●	●		●
Can be used outdoors				●		
Additional accessories		●	●	●		●
Can be used with the tactile code reader			●	●		

LEARNING IN THE DIGITAL WORLD

Active Learning by Digital Doing

TECHNOLOGY AND CHILDREN

In recent decades, the spread of technology has not only brought huge changes to industry, the economy and society, but has also made a strong effect on the home and the institutionalised environment of education. In everyday life, children are exposed to and in many cases use digital technology from birth (e.g. smart TVs, smartphones, tablets: to watch, play, get information, communicate). Across the spectrum of education, pupils are also surrounded by a wide range of electronic devices (interactive displays, mobile devices, robots, 3D printers) that they can use in some way for teaching and learning.

The long-lived questions are: how will these tools be used, and which methods are the most effective for learning? One thing is for sure, it is vital to put the learner at the centre!

LEARNER-CENTRED: WHAT IS ACTIVE LEARNING?

Learning involves both passive and active learning; both are necessary for successful learning, but the social, economic and societal demands of a globalised world should tip the scales in favour of active learning. While passive learning is characterised by remembering, using and interpreting knowledge (Bloom's taxonomy), active learning is characterised by analysing, creating and evaluating knowledge.

The use of technology in learning is an active process, characterised by, and split into, four categories devised by Dr Puentedura as part of a research-based model: substitution and augmentation, and the modification and redefinition of knowledge (SAMR). Higher levels of integration of learning and technology require active learning methods, where the emphasis is on learner activity and thus learner-centredness.

DIGITAL TOOLS FOR ACTIVE LEARNING

Active learning can be supported by all traditional and digital tools, but the latter can also help to improve access to information, communication, collaboration and creativity from an early age. Access to and visualisation of information is well supported by a variety of displays (e.g. interactive displays, smart devices), including augmented and virtual reality technologies, digital microscopes and cameras. For storing and organising the knowledge acquired, computers and smart devices can be useful, which of course require appropriate software (at a younger age easy access is important). Higher levels of learning (e.g. analysis, creation) are explicitly supported by software (graphics, video, 3D) and hardware for any kind of digital creation, such as robotics (e.g. educational robots, programmable microcontrollers) or makerspace tools.

LET'S GET STARTED!

ORGANISING ACTIVE LEARNING

If you have the goal and the (digital) tools, let's get started! To organise active learning, it may help to follow this plan:

- First, introduce the topic to the learners, either in the form of a question or a statement (e.g. a problem statement). As a thought-provoking activity, you can use an online poll, wordclouds or online canvases.
- Next, students can work in pairs or groups to carry out online or offline searches while thinking and exploring the topic together.
- This can be followed by a collective discussion within groups, between groups and the teacher, or with the whole class.
- Once the information has been processed, the students can present the knowledge they have acquired to the class, either through a class product (e.g. a presentation, a short essay, a program, any tangible construction, a 3D model) or by answering the questions asked.

When organising active learning, keep in mind that student engagement is a priority.

As the presence of mobile devices is becoming more and more accepted in today's (learning) environment, learners are eager and active in using their devices, even their own. Give them the opportunity to use apps, and if they are unsure of the right ones to use then this is where adult guidance is important. Encourage students to work together (collaboration, cooperation), even online with their mobile devices, including with external experts. Supervise and facilitate online searches, especially for young learners, both to shorten the time spent searching and to help them evaluate the resources they find.

IDEAS FOR ACTIVE LEARNING

Here are some ideas on how to create active learning in the classroom!

Let's link learning to real life situations!

Learning, especially at an early age, should not be too abstract; children can enjoy learning if it is meaningful and they can apply the knowledge and skills they have acquired. Programming, while abstract in itself, can be brought to life with a playful robot, making it tangible, giving immediate results and real-world knowledge.

Let's learn outside the classroom!

Mobile devices are a great opportunity to leave the walls of the classroom and go exploring. For example, students can use the sensors on their mobile phones or other digital devices to search for hidden treasures (geocaching), take measurements (using the built-in sensors) or even become photographers or videographers.

Let's role play!

This is a great way to develop your students' inter- and intrapersonal skills. Role-playing can be done with the participation of the pupils, but can also be done with puppets, which can be used to create digital stories (Digital Storytelling). Using digital tools, it is easy to create short films, even using simple techniques such as stop-motion, for which there are many free apps available.

Let's create something tangible!

At an early age, it is very motivating to have a product to go with your learning. Are we looking for an answer to a problem from our pupils? Think, design, create and present the answer! Creative pedagogy can now be supported by a wide range of tools, limited only by the imagination.

Don't delay, start today!

All learning is good, except the boring kind. Without learner motivation, without active learner engagement, there is no (effective) learning. To keep pupils active, we need to put them at the centre, with freedom, teacher support and tools. Available digital tools can offer great opportunities to make learning motivating and effective!

About the author:
Balázs Czékmán, PhD
Teacher, Researcher, Digital pedagogical-methodological expert and consultant

PROGRAMMING FOR EARLY YEARS

Introducing the Glow and Go Bot

We are all aware that for many 21st century children they are immersed in a world where technology is omnipresent in their daily lives. It is imperative therefore as educators we really examine and scrutinise how it can support their learning. The caveat is that it needs to be in a really considered, quality, curated, safe and developmentally appropriate way. There is often attention drawn, frequent concern, and indeed criticism of how much time children spend on screens, absorbed in a virtual, often solitary world. However, technology can take many forms in early years education without a screen in sight and with the ability to support learning richly and developmentally appropriately. This is what the hugely exciting Glow and Go Bot® is all about.

Children's development at the core

From the initial stages of design we were galvanised in the belief that technology was being utilised to enrich, engage, enliven and to add value to the learning. It was also about blending what we know about how a child learns and at what stage. Dialogue about pedagogy abounded as did theoretical viewpoints. I do feel though that if such visionary influencers such as Montessori and Malaguzzi were pondering provision and skills today they too would have reflected on the possibilities that technology can offer. Now that does not mean we forget the traditional materials, the blocks, the manipulatives etc, but reflect how they can work seamlessly in harmony and be mutually supportive.

We may also want children to learn in a play based, STEAM led learning way, with rich quantities of awe and wonder, fascination, and creativity. The design and its capabilities had to align with understanding of how a child learns and the skills needed both cognitively and physically. The curious, capable, confident child, eager to experiment, explore, to make connections, was at the forefront of the thinking. Children need the foundation skills, those key ingredients in their learning diet.

> The youngest children need a plethora of opportunities to make connections, to hone their critical thinking skills, to be immersed in an environment that is interactive, collaborative, and fulfilling their needs and interests.

We involved leading experts in our quest to understand the right kind of provision to offer toddlers, pre-schoolers, etc. We worked with Carol Allen, a leading Technology and SEND expert who guided our choices. She steered us how to use light, texture, pattern, colour and sounds to not only make it more multi-sensory and therefore sending messages to our brains in an array of ways, but also to make it so much more inclusive. The size of the buttons, the way they were pressed, and the pace of the movements were all carefully engineered.

It was also imperative that it was cross-curricular, open ended and versatile. It needed to be accessible for children to work independently of the adult. It also was required to be rechargeable. Our audience gave us a huge list of factors to consider, and we were very grateful for their powerful insights.

Our much adored, global, and acclaimed Bee-Bot® has stood the test of time because of its simplicity and understanding of the child's needs. However, for the even younger children we realised that they would benefit from having something that moved more literally and behaved differently. They needed something that helped lay those early enquiry skills, in a non-prescriptive and precise way, where awareness of cause and effect was being fostered, where connections were being made and all in a fun, magical, illuminated and sound filled way.

Supporting a variety of ages

The TTS Glow and Go Bot was designed to interest and engage children from ten months up. Now we know that their needs will change as they grow, so a variety of modes were created in order to offer adaptability. The older children could go on to devise journeys of up to 10 steps, carefully selecting the route. They could estimate, plan, predict and evaluate, often working collaboratively. They may choose to design the environment, the landscape for the robot and immerse it in an elaborate narrative. The robot took on various guises. The ten-month-old who is sitting up may joyfully take great delight in pressing the buttons over and over again, seeing them light up and make a sound. For some children it really supported their schematic interests, from lining things up, making him rotate, to getting the bug to enter tunnels and houses.

Children's mathematical vocabulary can be extended and enriched with number games and maths challenges. As they press the buttons, they learn about one-to-one correspondence. It is also great for learning about space, shape and measure, as well as the development of estimation and prediction skills.

The safety for such young children was also paramount and stringent testing occurred throughout. Another considered feature was that the children move around with him and mirrored his actions. We wanted active participation. If the bot goes left, they go left, and the number of movements can be built up until a chain is formed for them to copy. There is also a dance mode that can be isolated. It is wonderful to see the children joyfully moving to the lively music.

About the author:
Catherine L Clark

Catherine is an Early Years Specialist, former teacher, and former Divisional Director for Product Innovation at TTS Educational Resources.

THE GLOW AND GO BOT IN PRACTICE

Our observations and work with various settings showed so many rich possibilities could unfold. Liz Ludden describes how children's skills across science, technology, engineering and language were supported:

Science – We observed the children investigating, testing, predicting, evaluating and gathering evidence.

Technology – We saw that the children negotiated with each other and with the team in developing real solutions to real problems, getting the Bot in and out of spaces, and had the skills to control change in the Bot. The literal buttons on the Bot gave children the opportunity to control beyond cause and effect.

Engineering – We noticed that the older children were able to begin to plan and design the environment space to manoeuvre the Bot around and through a given space, using blocks and tunnels and different surfaces.

Language – The robot is the catalyst for numerous conversations. Older children can make up stories, writing adventures around the character. Younger children may love to narrate, enriching their vocabulary and language skills. Scenarios can be created around the robot, with children coming up with names for it and deciding the adventures it goes on.

Paola Lopez – Senior Program Director at Kinderoo Children's Academy in Florida (USA) reviews the

TTS Glow and Go Bot

Upon opening the box, we saw a beautiful and futuristic robot. The bot is a charming, magical merge between awe and wonder with technology. We were immediately curious to observe and analyse its potential.

We observed this product in two classrooms with children of age four. I hope that after reading our observations, you can agree that there's still so much that we need to explore! Both classrooms gave us different perspectives based on their experiences, and it's clear that students and educators need more time to explore other pedagogical concepts and STEAM theories. Today's observations were fascinating and positive!

Making a careful observation of how the students who participated behaved in front of this resource, we appreciate how the Bot, full of light, sound, and movement, can promote joy and cognitive development through a child's specific interest.

HOW THE CHILDREN INTERACTED:

We were able to see how the children who participated were capable of creating innovative strategies to have creative outlets in resolving inquiry questions that were presented to them. All the concepts described about the Glow and Go Bot® on the TTS website were confirmed and observed today!

We also saw situations where the children were working on spatial orientation concepts and prepositions of place and direction (the Bot is in front of me/ I am behind the Bot). The directionality (the Bot moves forward, backward, to the right, to the left) thus adds to language development, providing the child with the possibility of increased exposure to speech and non-verbal language.

An aspect worth highlighting is the child's ability to face obstacles through problem-solving. **Their predictions were so creative it led them to immerse themselves in a world of probing, testing, and investigation— with intensity.**

This innovative resource is full of exciting elements such as sound, light, and movement, also promotes the development of independent learning and organisation, leading the child's thinking to the creation of STEAM ideas strategies, and purposes.

We noticed different interest patterns with the other group of four-year-olds. A student who is interested in the study of light, the first thing she identified was the reflection of the Bot's light on her hands. For this experience, we dimmed the lights to use the Early Years Projector. The children were able to see the Glow and Go Bot's shadow, and its vibrant colours against the surface areas as one child moved the projector to follow the Bot.

We all have a natural bias towards pattern recognition. When we see something that is not entirely uniform, such as an object in shadow form, patterns will emerge. In this case, the Glow and Go Bot took on a new identity each time the children programmed the Bot to move in a different direction.

The Early Years Projector is an excellent companion for the Glow and Go Bot for their STEAM approach; both resources engage children who are learning about technology alongside other skills like math & science at developmentally appropriate levels; it enables them to explore different possibilities through investigation, which promotes creativity among all Early Years learners!

This innovative resource is full of exciting elements such as sound, light, and movement, and also promotes the development of independent learning and organisation, leading the child's thinking to the creation of STEAM ideas strategies, and purposes.

Another student involved a friend, showing that collaboration and interpersonal relationships are nourished during these types of experiences; the children took turns handling the Bot and programming it with instructions; they soon made up a game-using the Bot as a carrier, carrying an object in different directions. We witnessed math connections during this game as the children had to estimate how many times the Bot's button was pressed and then used that information to get the robot to its projected destination.

We also observed the children getting nervous when they saw the Glow and Go Bot move closer to the obstacles they had built around the carpet area. They had to react quickly so as not to allow it to collide, asking their friends for quick answers to solve problems. We noticed a social-emotional connection emerging. Empathy towards the Bot was demonstrated as the children were seen moving the obstacles so they wouldn't get "hurt." This is a concept that needs more observation and exploration. If children can develop empathy for a robot, can this behaviour translate to human compassion and social justice?

DEVELOPING CRITICAL SKILLS:

The Glow and Go Bot is helping our students navigate through a technological journey where they're learning to develop skills and gain an understanding of how technology works.

One student used the Glow and Go Bot to engage in dramatic play; for him, the TTS bottles were used to give potions to the Bot. Thus, he could control his movements (recognising beforehand that it would happen).

The children spent a long period of time exploring the Glow and Go Bot; this enabled us to see an interactive robot designed to help the children learn about coding. They gained a new understanding of properties like early programming that will shape their future quest for knowledge on robots in this rapidly changing world we live in today!

The Glow and Go Bot can help us create a world where children can be creative and flexible in all aspects of their lives. TTS is helping Early Learning educators accomplish this by fostering growth through technology, with an emphasis on emotional intelligence (EQ), cognitive flexibility(CF), creativity – also known as generative thinking or idea generation skills.

EVALUATION OF THE GLOW AND GO BOT:

I am now convinced that we need more Glow and Go Bots for our other classrooms. **The value-to-cost ratio outperforms any resource we've tried so far with our students.** Unlike many other products on the market, which are designed to be played with only once or twice before they break down and cannot be used again due to their short lifespan (usually less than three months), the Glow & Go Bot is made of durable materials that will last for years.

After observing what four-year-olds can do with this resource, we are curious and excited to test theories with our toddlers and three-year-olds.

As a reminder, we are educators and play facilitators, we must take the time to play with this type of technology because we need to be 21st-century learners to be 21st-century Educators.

The educators involved in this pedagogical observation were: Jenny Gallego and Gabriela Urdaneta.

LANGUAGE & COMMUNICATION

The new landscapes of educational technology and its integration in *digital environments*

> *"Dreams install aspirations, desires and, more than once, projective platforms that constitute paths to walk."*
>
> Litwin (2009, p.13)

TECHNOLOGICAL REVOLUTION

We are currently experiencing a real technological revolution, which affects our habits and lifestyles. Education plays a very important role, as the teacher must adapt to the continuous changes and accompany their practices with these changes (Rodrigues, 2019, p.53).

The framework of theoretical references on digital integration from the area of digital educational technology (TED) in Rodrigues (2022) suggests that the paths that are part of the Technological Environments of Digital Integration (ETID) put in tension different terms that must be distinguished: implementation, incorporation, meaning and appropriation (Figure 1). As Litwin (2005) points out, we must carefully observe our context regarding educational technology, since these different modalities of linking with technology are expressed in education in particular ways of understanding and experiencing its use at the initial level.

Figure 1: ETID Digital Integration Technology Environments

Here the pedagogical dimension of the ETID becomes evident, because the technological scaffolding is also simultaneously pedagogical, whose key element in this situation is the digital tool/resource in the teaching and learning paths. Paths that the teacher faces first, then signifies them and then, through implementation, incorporates them in their didactics, achieving their appropriation. This appropriation, which Gros Salvat (2000) also points out, speaks of the computer as an invisible computer, and towards the appropriation of the computer in education, with a clear vision contemplating ICT and the school, where new elements are introduced in the training and education of people, in our case programming and robotics with pedagogical robots such as the Bee-Bot or the Blue-Bot.

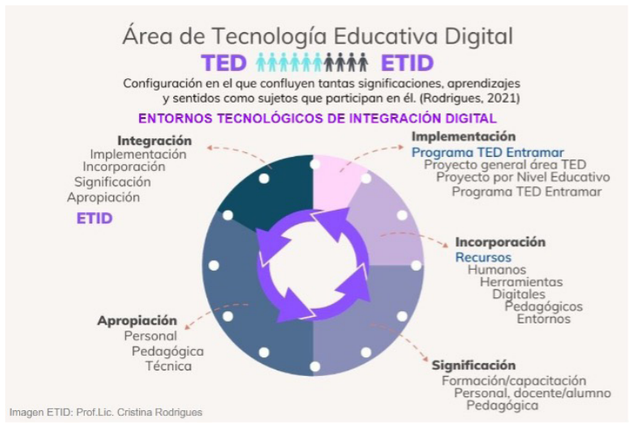


Imagen ETID: Prof.Lic. Cristina Rodrigues

PROGRAMMING AT AN EARLY AGE

The paths towards programming and robotics at the initial level deserve first to consider the relevance in the acquisition of previous skills and competences from digital literacy and digital educational technologies (DET), to then reach the conceptualizations of programming and robotics. It is worth mentioning, that the experiences that we contemplate in this document start from the ETID, where the environments use the scaffolding in the zone of proximal development (ZDP) (Vygotsky, 1984) and the teaching and learning paths as necessary steps for both teachers from education and training and for our NI students. In the same way, it is essential to have sustainable initiatives and strategies for the implementation, incorporation, meaning and appropriation of TED prior to involving computational thinking, as I have already mentioned regarding the incorporation of TED in NI.

Nowadays it is logical to observe that, if we provide a pedagogical robot of the Bee-Bot or Blue-Bot type to our students, they can almost immediately play with it and even achieve logical path orders. But these landscapes are mere playful implementation, we will not find there the real purpose and implications.

WHY IS IT IMPORTANT TO LEARN TO PROGRAM IN KINDERGARTEN?

The little ones can program by facilitating logical mathematical thinking, creativity, problem solving, systematization, and fun playing above all things. They start with their daily actions, then with body and space, games with robots, such as Bee-Bot or Blue-Bot, and then move on to programming with languages such as Scratch Junior.

Programming and robotics accompanies us with the use of tools such as computers, tablets and pedagogical robots. The incorporation of these resources/tools in our initial level environments generates a new way of positioning ourselves in front of them. This technology gives us the possibility of ubiquitous learning, as Burbules (2009) mentions "anytime, anywhere" as well as pedagogical robots. It allows us to move through different spaces, and at the same time it favours interaction between teachers and children, as well as between children. "From a learning point of view, spatial ubiquity means continuous access to information to an extent we have never witnessed before," (Burbules, 2009, p.16). It is a dynamic and motivating tool that accompanied TED landscapes, both digital

literacy and ETIDs. For our TED in NI project, they are landscapes that accompany a journey with their own foundations to incorporate the area of Programming and Robotics in NI (Figures 1 and 2). And with it the indispensable scaffolding towards the landscape of computational thinking.

It is important to consider in this field of computational thinking Jeanette Wing, who since 2006 stated that "computational thinking involves solving problems, designing systems and understanding human behaviour, based on the concepts fundamentals of computer science" (Wing, 2006, p. 33). The author explains that this skill should be for everyone to develop, and not only for computer professionals or experts in these areas, this landscape is reflected in our program: Learn to Program playing in Family, which was created in the period of health contingency from a deep reflection to continue learning from homes, providing the how and why to address programming and robotics in NI. Therefore, the teaching of programming and robotics is thought and programmed as another tool of the digital environment in which we want to deepen with a real opportunity to articulate with technology, with the contents of the entire curriculum design, with the didactics and with the pedagogy of the teacher. In this sense, it is often very difficult for teachers to interpret the use of the pedagogical robot from their didactics, as well as the skills of computational thinking.

The challenge we set ourselves is to awaken the teacher's interest, for example, in the area of mathematics with numbering on the grid, or about laterality playing in space with geometry, or searching for their names for language practices with letters on the routes.

This already takes on a different colour, and the illuminated landscape with the true horizon begins to appear. From the TED area, we must empower teachers to recognize the possibilities of these tools and thus be able to apply them with their real pedagogical sense in their classrooms, giving our NI students the opportunity to be in contact with a diversity of proposals that bring into play the social practices of language in all its forms, of mathematics, science and collaborative play in an environment enriched with good practices, where they learn with sequences of logical order by playing and doing, solving problems and taking errors as a success of learning.

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Use of Blue-Bot pedagogical robot in the graphic and concrete

Use of the Bee-Bot pedagogical robot application in the virtual in an example with Smart TV Touch

Simple educational robots can contribute significantly to children's development

THE REALITY OF USING ROBOTS IN EDUCATION

The process of learning and developing personal skills does not begin at school, nor does it end there. That is a process that accompanies us throughout our lives. Many people accompany us on this long journey: parents, grandparents, siblings, teachers, and other educators. In the case of children with special educational needs, the circle of support faces the same challenges as the children themselves (for example, children with ASD or ADHD). Therefore, from the university and specialized centers, we try to offer and adapt solutions at all levels. The use of simple educational robots in the classroom and at home can be a source of significant advances in the learning and development of these children.

More and more research papers are showing positive results from the use of humanoid robots in learning routines with children with special educational needs. The problem is that it is currently impossible to bring these types of robots to all schools, support centers or homes, due to both their price and technical complexity of handling. Based on our experiences, we have opted for other types of robots that are easier to use and cost much less. The objective is clear: to popularize their use inside and outside the school.

From our experience, the early introduction of robots in the classrooms of children with special educational needs allows for achieving significant results in learning and/or improving social and functional skills. However, to maintain and enhance these results it is essential to work continuously over time, which requires teaching other, non-traditional, "educators" such as therapists and family members.

EXPLORATORY STUDIES

At the beginning of our exploratory studies, we asked ourselves the following questions:

- Could we achieve improvements in the learning and behavior of children with special educational needs by using educational robot models that are easy to use and economically accessible?
- Could we develop formulas or work methodologies that could be easily extrapolated to other cultural environments and even to the family environment?

To answer these questions, we have started to develop joint work (Estonia-Spain) using accessible and easy-to-use educational robots. We selected simple educational robots, such as the Bee-Bot® model. After some handling guidelines and the design of a working method, the robots were used both in the classroom and in therapeutic work with children diagnosed with ASD and ADHD. In all cases, the robot was used as a mediator or facilitator of activities.

As our studies were developed during the COVID-19 pandemic, this robot model was also selected for its ease of cleaning, and materials were developed for easy sanitization after use. In our experiences with the Bee-Bot, we have obtained equivalent positive results, both in Estonia and in Spain. We obtained greater intensity in communication, verbal and non-verbal, a higher level of commitment or involvement of the child in the proposed activity. It should be noted that positive results have been obtained both in children with ASD and in children diagnosed with ADHD. According to the results obtained in our preliminary studies, we consider it very interesting to use these types of educational robots in the classroom and at home with good results.

ROBOTICS SUPPORTING CHILDREN'S NEEDS AND DEVELOPMENT

We conclude from our work that it is not always necessary to use complex and expensive robots as facilitators of learning or therapeutic work. A simple educational robot, operated by direct programming or through a device that is appropriate to the child's level of development (remote control, computer, Tablet…), can offer good possibilities for development. It is important to stress here once again, that the activities and the educational robot to be used must be appropriate to the child's level of development. However, in general, we can say that the current models on the market are a viable way to introduce new motivating elements in the classroom and in therapeutic sessions.

In addition, the current supply of such robots and easy-to-use educational materials also allows parents to find a model adapted to their child's needs. This makes it easier for the routines established at school or at the support center to be continued at home. For this, parents only need to receive simple instructions from formal educators (teachers and therapists) or, if necessary, training that allows them to collaborate in the activities that will facilitate the coexistence and integration of children in both the family environment and in the classroom.

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Estefanía Martín-Carrión, educator-therapist at Fundación Esfera, an entity specialized in care and support for the social integration of people with functional diversity (children and adults), Spain.

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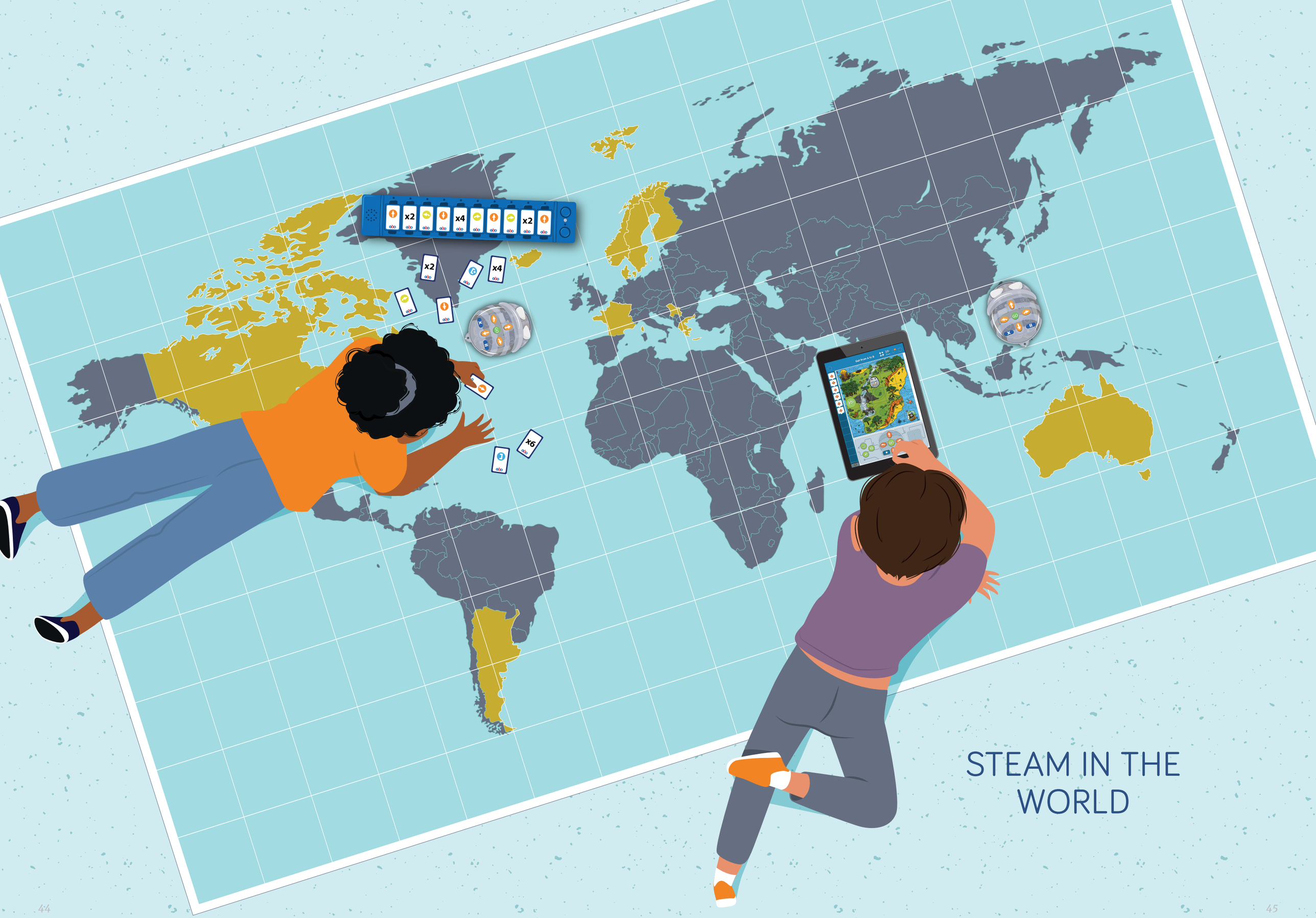

STEAM IN THE WORLD

STEAM:
Discovering the world through experience

Spending my days in class with children is the best experience I could have in my life. Each day I learn something new and this is also the case for the children. This particularly came to light even more when we started using robotics in the class. One day one student came to school with his new robot, it was something similar to a toy, but students were so interested in it that I bought another robot and we started using them for our math class. This was my first step in the STEAM world and I think that it represents what STEAM is for me.

WHAT IS STEAM?

STEAM is an educational approach that incorporates the arts into the STEM model, which includes science, technology, engineering and mathematics. Integrating art in the educational field offers students the opportunity to discover their own place in the world. STEAM means trying out materials and learning by doing. I observed children making things with materials they didn't know before without being afraid. Adults usually make something if they know all the instructions and what could happen, students on the other hand don't need to have complete knowledge of the materials as they simply enjoy discovering the use of those materials. STEAM is exactly this in my opinion; using the materials available, creating something, virtual or real, and testing it out.

ACQUIRING NEW KNOWLEDGE THROUGH HANDS-ON LEARNING

During the year in 5th grade I proposed to build a roller coaster using paper tubes as recycled materials. It was the first time I proposed this activity and I was so surprised to see the great work the children engaged in.

When students take part in these kinds of experiments they have the opportunity to test and learn concepts that will surely be more difficult reading them in a book. STEAM gives students the opportunity to make learning real and it helps to develop practical skills that will be useful when they will grow up. STEAM involves hands-on learning and is full of exploration, including children exploring and discovering new ways of learning. If one thinks of entering the class and talking to students over the course of 2 hours about what STEAM is, it isn't a real STEAM lesson, it is only a traditional lesson about scientific concepts. You can't talk about STEAM with your students, you have to challenge their thinking through playful challenges which permit them to discover the world. When students enjoy the challenge they will discover more than what they could listen to from my explanations. After my first experience with robots similar to toys I started using educational robotics in the classroom. I was never afraid to engage in something new with my students. I brought the robots into the classroom and I asked my students to discover how to use them with me.

Isn't this the real meaning of the acronym STEAM? It is discovering the world through experience.

USING BEE-BOTS DURING OUR LESSONS

The Bee-Bot® resembles a bee in its looks, and it has buttons on the top of it with arrows to show the directions the robot can take. Children can code the movements of the robots using the arrows. The Bee-Bot is perfect for the first classes of the primary school. Usually we use a map with a grid, in this way the children can count the squares to code how many steps the robot needs to take. If the robot doesn't arrive in the place they wanted they can easily try again. Isn't this the scientific method? Children have the opportunity to test out their ideas, evaluate their decisions and make changes.

Some adults observing this might think children are 'only playing'. I would say to them that yes, they are playing, but they are also learning something new, and robotics offers us a great opportunity to teach in a different way.

TAKING ROBOTICS OUTDOORS

If the school has an outdoor space there is also a robot called Rugged Robot® that permits students to explore the garden. This robot has the option to insert a mini video camera or a smartphone, so while the robot is moving through the garden it can record what it sees. This allows us to organize amazing games with the children as we discover the outdoor classroom space together. For example, it is possible to divide the class into 2 teams, one can go outside discovering and recording the space, the other team watching to see what the robot is recording, and they can try to draw its path. This is amazing work because you invite students to have experience with math, robotics, art, geography… all subjects that build on top of what STEAM is; a way to explore and understand the world around us.

EMBRACING ROBOTICS

I know colleagues that don't want to introduce robotics in their classes because they think it is another task to have at school. The right path to follow however is to integrate robotics in the lessons we organize so that the robot will be only an instrument to acquire knowledge. The STEAM world offers the opportunity to be creative and find solutions to the challenges one finds in life.

Teachers and educators don't have to be afraid of this world but they need to discover it together with the students, because they will remember longer what they create with their own hands than what they listen to.

We are living in a world where it is really important to have practical skills and STEAM gives the opportunity to develop 21st Century skills; particularly problem solving, team working, communication skills and critical thinking. All these skills will permit our students to have their place in the world.

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Explorer KIDS: Computational thinking and programming *for everyone*

THE BIRTH OF A NEW PROJECT

How do we teach computational thinking and programming to children without exposing them to excessive audiovisual resources? If the excess of screens and lack of supervision in their use is alarming and brings damage to cognitive development, how can we balance the use of technologies in an educational way, aiming at the development of skills of the present and the future of these children?

This was the motivation that definitively took an educational prototype out of the drawer and gave birth to the Explorador KIDS Project in Brazil, which aims to develop computational thinking, literacy and mathematical knowledge in early childhood education and the early years of primary schools, also serving special education in all its stages. The project currently benefits more than 90,000 children from public schools, aged between 3 and 10 years, offering teachers and students a didactic resource with high creative potential and easy adaptation to school curricula.

Developed so that children can learn the initial concepts of computational thinking in a fun way and integrated into the school curriculum, the KIDS Explorer Project is a complete solution containing physical and digital resources and teacher training.

The Blue-Bot® robot from TTS Resources is the technological basis of the solution and was chosen for its unique features such as resistance to falls, durable and rechargeable battery, unplugged programming through directional buttons and especially its applications that allow children to experience programming at different levels of complexity and progression of knowledge. The set also includes five teaching mats, a book with lesson plans for the teacher, accessories and a platform with incremental content such as costumes, printable materials and video lessons for teachers.

With more than a thousand schools participating, the success of Explorador KIDS is supported by the tripod of quality physical material such as the Blue-Bot floor robot, didactic material made by education specialists and the training and monitoring process. The entire pedagogical process is based on the Brazilian National Common Core Curriculum, a normative document that defines the organic and progressive set of essential learning that all students must develop throughout the stages and modalities of Basic Education.

EMBEDDING COMPUTING INTO EDUCATION EARLY

A major advance for the teaching of programming in Brazil in 2022 was the approval by the Ministry of Education of the National Common Curriculum Base (BNCC) for Computing that encompasses the guidelines for basic education, specifically for computing, such as the inclusion of content related to programming, logic, information security, computer science, artificial intelligence and responsible use of Information and Communication Technology (ICT).

All these actions seek to qualify Brazilian education by bringing cognitive and behavioural skills into the classroom, such as: decomposition, abstraction, generalisation, data analysis, algorithms, projects, simulation, programming, computer modelling and decision-making. We also emphasise the need to develop problem-solving skills, teamwork, respect for diversity, social responsibility, and the ability to adapt to change.

In this context, we have worked hard to make Explorador KIDS a project that helps schools to implement the development of this knowledge in a comprehensive and permanent way. The teacher training methodology was designed in 3 training moments that can take place in person or completely online, from our live broadcast studios. In addition to learning about all the materials, pedagogical possibilities, support and service, teachers participate in 3 anonymous surveys that provide important data for the constant improvement and evaluation of Explorador KIDS.

Some data that we can analyse are related to the previous knowledge of teachers, in a survey with 1700 participating teachers, only 6% stated that they knew and developed practices involving computational thinking in the classroom before the KIDS Explorer project. This is an important fact that reveals the need for more actions involving teacher training in this area. Regarding the intention to include activities involving computational thinking after the first stage of training, 96% of the participants say they intend to start activities with the project.

Among the practices that are part of the methodology of the KIDS Explorer project, the significant delivery is one of the most exciting.

When the robot arrives at school, it is welcomed by the children and teachers, who begin a journey of exploration and construction where even the process of naming the robot is part of the intentional pedagogical context.

It is necessary for children to carry out tests, experiments and interact with all the resources, so that they can learn in a meaningful way. Here in Brazil, Blue-Bot receives hundreds of names like Sol, Joaninha, Bob and many other names, because when we receive a new member in the family it becomes dear and special.

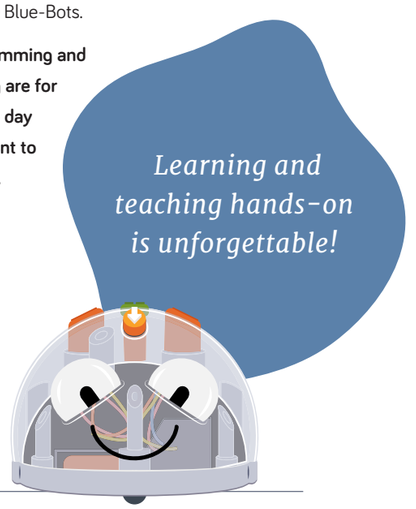
ACCESS TO PROGRAMMING FOR EVERY CHILD

Explorador KIDS was designed so that all children can learn about computational thinking and programming, and one of our concerns is to empower teachers who work with students with special learning needs. Brazilian legislation provides that education systems must ensure that students with disabilities, global disorders and high abilities have specific educational resources that can meet their needs.

In Brazil, Explorador KIDS has proven to be an important companion for everyone's learning, providing teachers who work in specialised educational care with the opportunity to adapt activities according to the needs of each student. The Blue-Bot's sound recording feature and raised keys help visually impaired children to programme their projects and interact with technology. The pedagogical possibilities of the project delight teachers and school administrators, who include it every day in their curricula and educational practices.

With a successful history and present in the lives of thousands of children, the Explorador KIDS project is preparing to receive its version 2.0 at the beginning of 2024, receiving new teaching materials, accessories such as the Tactile Reader and the collective recharging base for the Blue-Bots.

We believe that programming and computational thinking are for everyone, and so every day we take our commitment to more Brazilian schools.



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Blue-Bot® on board the EDUbus

BLUE-BOT AS A ROBOTIC AID TRULY ATTRACTED CZECH EDUCATORS

The recent change in the educational content in the subject of informatics has set Czech schools in motion in terms of purchasing robotic aids. Before 2020, Czech schools included robotic aids in teaching very carefully and slowly. Finally, the change in curriculum helped accelerate the use of robots in teaching. Very quickly, Blue-Bot found its place in schools, which was paved by an older sibling Bee-Bot, previously used in kindergartens and teachers of 1st and 2nd grades in elementary schools.

Blue-Bot, whose basic control of buttons on the body is based on Bee-Bot, has made it easier for 1st grade teachers to start teaching new informatics thanks to the possibility of connecting with a mobile device or computer. On one hand, they use the possibilities with which many have experienced thanks to Bee-Bots already, on the other hand, the Blue-Bot and Blue's Blocks applications have opened the way to fulfilling the outputs of the computer science course in the 4th and 5th grade.

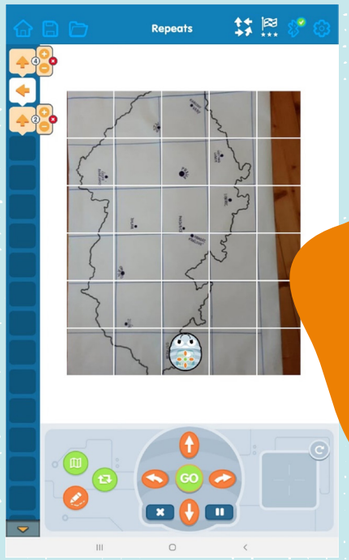
Many teachers, for whom the wide range of aids on the market is confusing and were unsure in this area, chose Blue-Bot for teaching because of the simplicity and intuitiveness of the control.

AND HOW DID BLUE-BOT GET OUR ATTENTION?

We were interested in the variability of controlling this tool in the form of buttons and at the same time the possibility of using applications for the development of skills and competencies incorporated in the subject of informatics. We like the possibility of its involvement in the school environment both at the very beginning in the 1st grade and in teaching the subject of informatics in the 4th and 5th grades.

Thanks to the creativity of first-level teachers, the use of Blue-Bot in various subjects becomes commonplace. Teachers create their own pads, cards for composing the algorithm, or worksheets alone or together with their children.

The Blue-Bot program offers an interesting environment with the writing of individual steps in the form of a choice of arrows defining the movement of the Bot on the pad. In addition to simple algorithms, the development of patience and planning of individual steps leading to the goal, the program also offers the inclusion of repetition of the step or their sequences and thus shortening the algorithm. Pupils can start with basic Bot control and continue with mastering the basics of algorithms in assignments of different levels. The advantage of the program is the possibility of recording your own pad and thus working with the teacher's own materials, or preparing individual or group work of pupils.

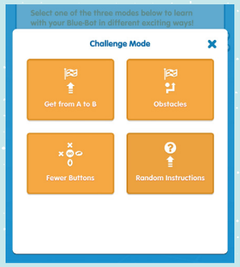


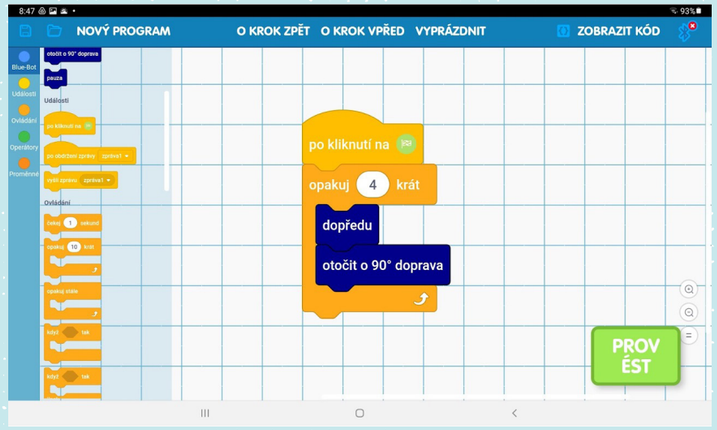
Take a look at our example here of the application environment with the specified repetition and upload of the students' own created pad, which is a simplified map of the Czech Republic.

The advantage of the application is the possibility of its use both in school with a robot and in the home environment, for example when working with the challenges that the program offers in three different levels.

The Blue's Blocks program teaches pupils to orient themselves in the environment of a block programming and to create simple programs. The execution is then possible freely on the floor or on the prepared pad. Even the movement of the Bot programmed in blocks can be transferred to various subjects, from dancing to a specific composition in music education, through to traveling on maps, or connecting words on a mat in language preparation.

As you can see our program is completely converted to the Czech version.





HOW DO WE USE BLUE-BOT IN OUR EDUTEAM PROJECTS?

For teachers, we currently offer a 4-hour accredited seminar focused on all types of work with Blue-Bot, from control on the robot body, to the use of applications across the spectrum of first-level subjects, including computer science. In EDUbus, we have prepared programs such as teaching units for pupils called Beginnings with Blue-Bot and Blue-Bot Programming. During these programs teachers observe their pupils while working with Blue-Bot to see how they interact, and whether they are inspired by the included activities and decide if Blue-Bot is a tool that they would like to include in the equipment of their school.

The photographs and images included in the text are either a screenshot from the environment of the programs, or preparations of programs for children and educators by the author of the article and photos from the realization of programs in EDUbus.

About the author:
EDUteam

EDUteam is a company in the Czech Republic that is accredited by the Ministry of Education to help teachers and schools in the use of modern technologies and methods in their classrooms. EDUteam offers workshops, seminars and the EDUbus – a mobile laboratory on a bus that offers students and teachers to explore, learn and be inspired in areas of natural and technical science.

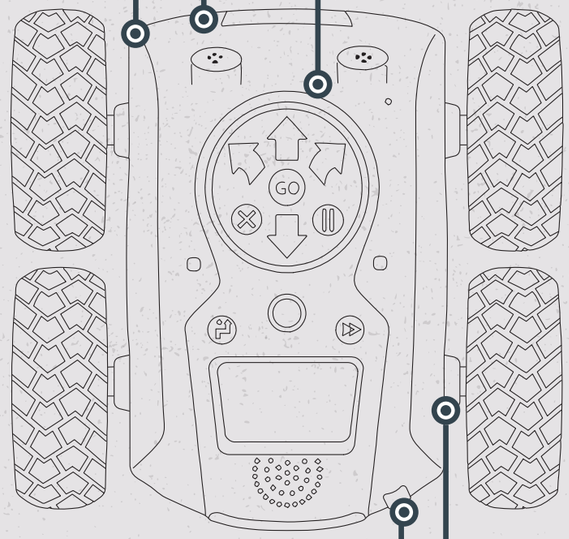
OUTDOOR PROGRAMMING ROBOTS

Rugged Robot® controls crib sheet

- Built in distance sensors to avoid obstacles
- Built in storage area to hold and transport items

- Program using 45° turns
- 20cm travel distance for eachstep (5cm longer that Bee-Bot

- Recordable message to confirm when commands have been entered
- Memory of up to 256 steps



Go! – executes the stored algorithm

Forward – moves Rugged one 20cm step forward

45 degrees left – turns Rugged 45 degrees to the left

45 degrees right – turns Rugged 45 degrees to the right

Backward – moves Rugged one 20cm step backwards

Clear – deletes all previously stored commands

Pause – pauses motion for 1.5 seconds

- **Obstacle avoider on**– Rugged will turn to avoid obstacles
- **Obstacle avoider off**– Rugged will not avoid obstacles on his own

- **Mode Selector**– 3 modes to choose from depending on your terrain, the higher the mode the more rugged the terrain
- **Terrain level 1** – a smooth surface like a hall floor (no light)
- **Terrain level 2** – a slightly less smooth surface like carpet or your playground (light on)
- **Terrain level 3** – a rugged surface like long grass or sand (blinking light)

Outdoor friendly with a weatherproof casing

Charging point

- Rechargeable
- LED ring to show charge level

Download on the App Store

GET IT ON Google Play

Free downloadable App (Android and iOS)

Cross-curricular links

Rugged Robot is so versatile that with a little imagination he can be used across a variety of different subjects. Here are a few suggestions to embed Rugged Robot into other curriculum areas:

MATHS

- Rugged Robot loves to draw shapes and trace perimeters. Working in multiples of 20cm learners can calculate and draw the perimeter of many shapes.
- Rugged Robot has a 45 degree turn which can be used to teach angles.
- Using a number line with 20cm increments Rugged Robot can begin to introduce fractions.

SCIENCE

- Rugged Robot could be used to investigate forces – learners could investigate how well and at what speed Rugged Robot moves through a variety of terrains (grass, sand, soil etc.) and plot their findings in a graph.
- With his camera fitted, Rugged Robot can be used to record outdoor adventures and observations.

DESIGN TECHNOLOGY

- Students could design a 3D course for Rugged Robot using their skills to ensure that the materials chosen are suitable to accommodate Rugged Robot's weight and shape.

COOKING AND NUTRITION

- Using a World Mat Rugged Robot can be programmed to carry different foods to the areas of the world where it is produced.

GEOGRAPHY

- Using the Rugged Robot App and a fitted camera, Rugged Robot is the perfect way to record outdoor fieldwork.

HISTORY

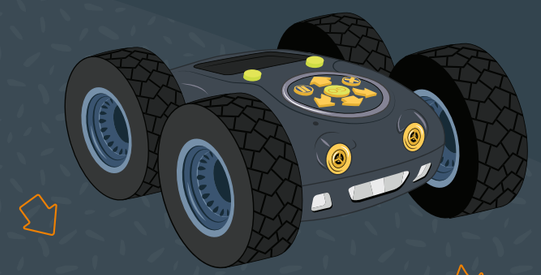
- Rugged Robot could be transformed into a Roman Chariot!
- He could also be used on a giant timeline.

MFL

- Students could build a high street or town environment representative of the country they are studying. Rugged Robot could be used to navigate the town and students could share directional instructions in the correct language.

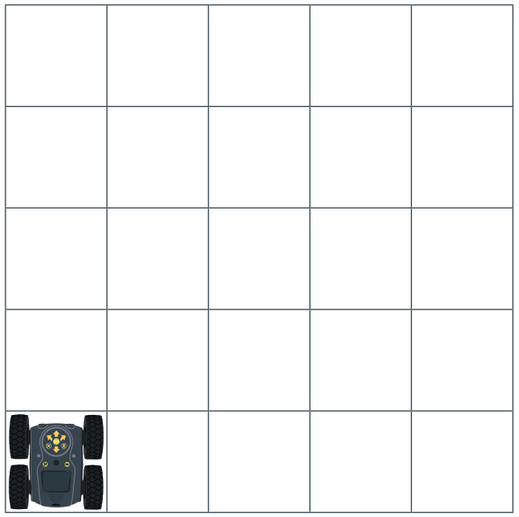
MUSIC

- Rugged Robot could be programmed to dance to a particular piece of music!

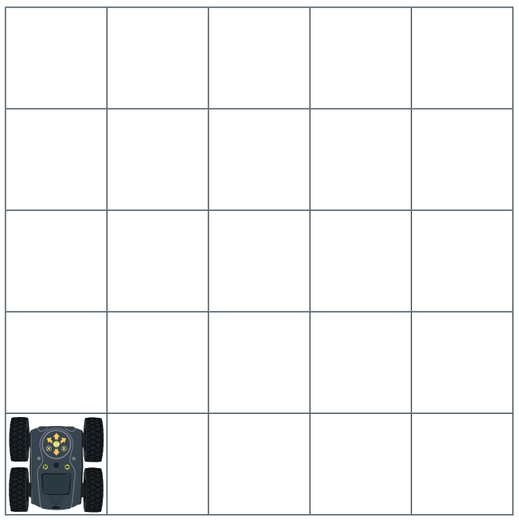


Rugged Robot

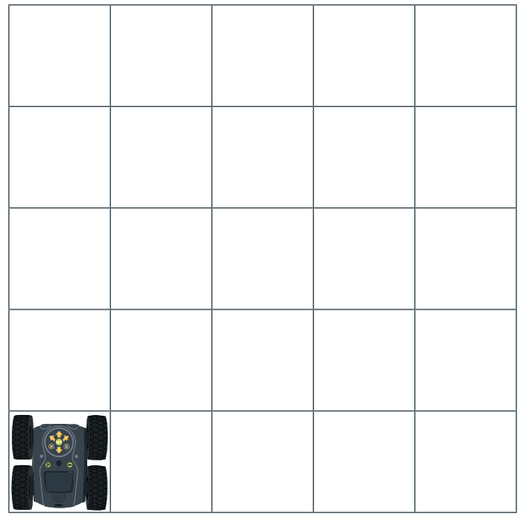
challenge sheet



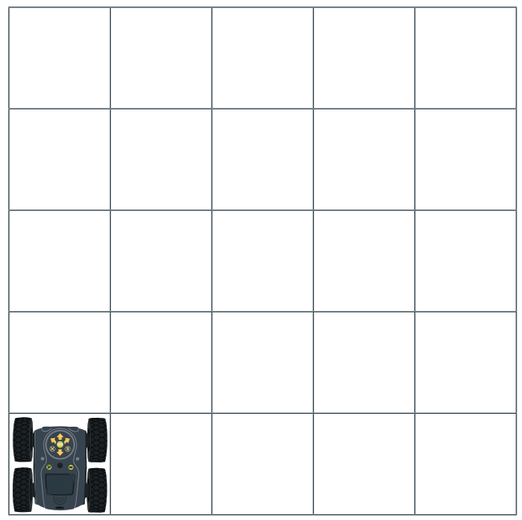
What instructions would I need to give Rugged Robot to draw a square?



What instructions would I need to give Rugged Robot to draw a rectangle?



What instructions would I need to give Rugged Robot to draw a square?



What instructions would I need to give Rugged Robot to draw a rectangle?

From stepping stones to alternative algorithms:

The Mars expedition

CHILDHOOD ROBOTICS RESEARCH

In Hungary, at the Department of Digital Pedagogy of the Faculty of Teacher Education and Early Childhood Education of Eötvös Loránd University, we have been working on early childhood robotics research since 2003. The program presented here can be applied to children aged 6-10 years. We have tested every step of the process with pupils, made video recordings of each phase of the testing, analysed them and used them to develop our final program.

It is important to note that the teachers involved in this work are not only academics, but also practising teachers who are familiar with the age characteristics of this age group.

The theoretical background for our research was provided by pedagogical and psychological research, as well as neuropsychological research, including analysis of brain imaging findings. As a model of algorithmic thinking, we have taken the BBC's "Introduction to computational thinking" as a starting point, which in our experience is a much more accurate approximation of the brain processes of digital age learners than older, single-view models.

THE UNPLUGGED SECTION

In the literature, there are many types of unplugged coding games (coding without the use of devices). However, we considered it important that these are not primarily mathematical in nature, and especially not theoretical in approach.

We have designed unplugged activities that are primarily fun, interesting, motivating, playful, but also naturally related to coding.

As a first step, we set the pupils a problem:

According to the framework story, the children are in control of a rock-collecting robot moving on the surface of the planet Mars, which has to navigate through obstacles, mainly blocks of rock and lava flows. The goal is to obtain a rock sample, which will later be transported to planet Earth for analysis. The Mars rover is controlled by 4 basic commands: forward, backward, right and left (which means a 90 degree turn).

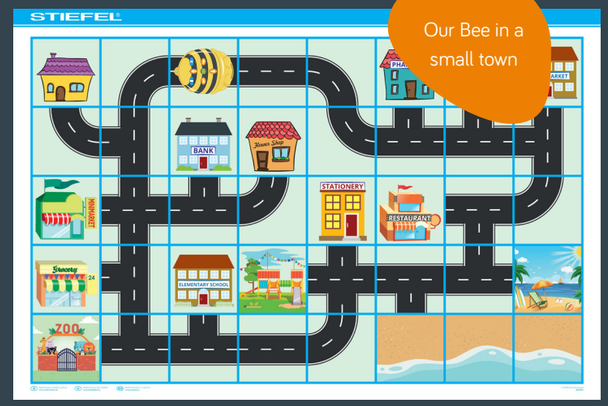
One pupil plays the role of the Mars rover, the others control it using the previous four instructions. The unit is one step. The tracks are made increasingly complex using paper rock and lava imitations (see photos).

Right and left sides can be confused, especially when the Mars vehicle's point of view is not the same as the point of view of the controlling learner: typically when the learner is moving in front of it. We analysed the children's solutions, the structure of the algorithms, typical errors and how they were corrected. For example, turning in the wrong direction was not always overcome by turning back in the opposite direction, but by going backwards instead for example.

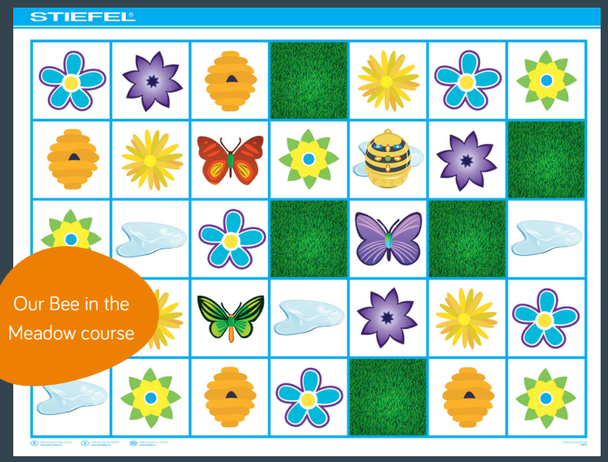
WORK WITH ROBOT TRACKS AND TTS FLOOR ROBOTS DEVELOPED IN-HOUSE

Our experiences were subsequently deepened and tested with 3 different TTS robots on 3 15cm robot tracks designed by us and implemented by Stiefel. We used Bee-Bot®, Blue-Bot® and Rugged Robots® for the work with great success. The 3 tracks we designed can be used from preschool to 10 years of age for tasks of varying difficulty. Our 'seasons track' is also suitable for drawing connections and causal inferences. Our 'bee in a small town track' is also suitable for playing complex stories and trying out alternative realisations (see photos for the 3 different tracks.)

On these tracks, pupils solved tasks in a system we created. The level and complexity of the tasks varied, in each case following the level of development of the pupils' algorithmic thinking, their existing coding experience and their previous coding experience. We clearly observed the existence of individual learning habits that are considered relatively recent in the literature. In our system, we have broken the centrally imposed pace of progress and uniform curricular structure that is compulsory for all learners. In the following, we present our system for creating task cards corresponding to the levels of algorithmic thinking, which teachers can use in the order and at the pace appropriate to the pupil's specific needs. We named our system AlgoKat (Algorithmic Thinking Categories).



Our Bee in a small town



Our Bee in the Meadow course

Our Seasons track

Task cards based on the AlgoKat system

INTRODUCTION TO THE ALGOKAT© SYSTEM

Based on our experience and the literature, the levels of application of the algorithms have been incorporated into a proprietary system, Algokat©. This system and its categories will be used to describe the tasks in the presentation of each pathway. The colour codes of Algokat© also help to identify the level of the tasks.

It is very important, and our research confirms this, that not all learners need to go through all the stages and that the categories do not always imply more advanced thinking. The entry and duration of each phase is specific to the individual and can be seen as the stages in a constructive process. The possibility of acceleration or stepping up can be taken advantage of here and, as we have seen, often occurs spontaneously.

ALGO1*: Playing a specific algorithm, with your own body or under the verbal guidance of a partner, unloading it with arrows, or stepping off with a Bee-Bot imitation (e.g. cap, cut-out drawing, nutshell) or coding it with Bee-Bot: moving between two points without conditions (from A to B), testing and analysing during execution, possibly modifying. (*In our further course descriptions and task descriptions, we will use the colour codes corresponding to each level).

ALGO2: Playing a specific algorithm, using own body or verbal guidance of a partner, unloading it with arrows or stepping off with Bee-Bot imitation (e.g. cap, cut-out drawing, nutshell), or coding with Bee-Bot: moving between several points, touching, tilting, moving fields or objects. (from A to B, but touching C and/or not touching D) Important: Here we still provide the algorithm, i.e. we unload, code or discuss and explain the code sequence. During implementation, testing and analysis, possibly modify.

ALGO3: Transforming an existing algorithm based on given conditions: changing the algorithm, playing it, using your own body or verbal guidance from a partner, unloading it with arrows, or stepping off with Bee-Bot imitation. (e.g. a cap, a cut-out drawing, a nutshell) or coding with Bee-Bot: transforming an Algo1-level task by imposing some condition (How would we change this instruction set by adding more arrows (by typing) so that the Bee can still go from A to B, but visit C? During implementation, test and analyse, possibly modify.

ALGO4: Creating a simple algorithm with given conditions, playing it with their own body or with verbal guidance from a partner, unloading it with arrows, or stepping off with a Bee-Bot imitation (e.g. cap, cut-out drawing, nutshell), or coding it with a Bee-Bot: For Algo1 level problems, they can code the Bee-Bot independently, but before that, they can play it if necessary. During implementation, testing and analysis, possibly modification.

ALGO5: Creating a more complex algorithm with given conditions, playing it with their own body or with verbal guidance from a partner, unloading it with arrows, or stepping off with a BeeBot imitation (e.g. cap, cut-out drawing, nutshell), or coding it with Bee-Bot: For Algo2 level problems, they can code the Bee-Bot independently, but before they can play it if necessary. During implementation, testing and analysis, possibly modification.

ALGO6: Create, compute, code alternative algorithms for Algo1 and Algo2 level problems. Generate several variants of the algorithm under a given condition, analyse them, group them (e.g. which one has the fewest steps, which path is the shortest, fastest, funniest, most exciting, etc.). During implementation, testing and analysis, possibly modification.

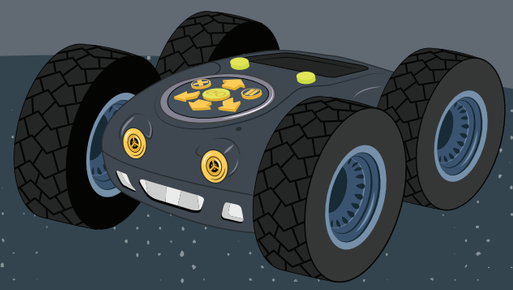
ALGO7: Algorithmizing creative problems other than the Algo1-6 problems: creating path mirror images, coding sequences of movements (dancing Bee-Bot), coordinating the movements of several Bee-Bots, etc.

About the author:
András Lénárd PhD

Eötvös Loránd University, Faculty of Teacher Education and Early Childhood Education, Department of Digital Pedagogy

FINAL CONCLUSIONS

In implementing our program, we have found that the development of algorithmic thinking is a constructive, individual-specific process that does not always follow clearly from a given age. Development is based on action, analysing experience, testing and modifying algorithms, and refining them according to experience. We believe that our research will be of great help to teachers in the use of TTS robots and in the design of differentiated learning programs adapted to the specific needs of the pupils.



Rugged Robot

takes out the trash!

This article provides an inspirational activity idea on the topic of sustainability whilst incorporating educational robots and the use of QR codes.

Promoting and encouraging sustainable development is a primary goal at Andungen Kindergarten in Norway. During a period of focus on waste and recycling, our children visited a local factory that receives waste, they have been on litter picking adventures in the local area and even worked on art projects which involved repurposing our waste into their very own creations. Last but not least, it was Rugged Robot's turn to navigate our purpose-built outdoor programming track, 'HEI', to sort our rubbish into the correct bins.

HEI means Hello in Norwegian. Every day, children and adults say hello to each other. The track gained its name to reinforce the importance of being polite and nice to one another. In addition, we can use HEI to talk about letters. For example, I can ask the children: What begins with the letter H? Did you manage to program throughout the letter H? etc.

In preparation for this programming activity, I have taken pictures of various things from the kindergarten. Something they see every day, such as plasters or food items. We discussed where should they be thrown away after use. Each item has been pictured next to the correct rubbish bin.

When the children came to the rubbish, they could choose which item they wanted Rugged Robot to throw away. Once the choice had been made, they took a closer look at the picture and could see which rubbish bin was to be used.

I prepared each Rugged Robot with QR code flags in the correct colour according to the corresponding rubbish bin. The QR codes can be scanned to play an audio file that congratulates the child on programming Rugged Robot to the correct bin. To create the QR codes, I used a simple App called 'Cloud QR'.

Watch the film through the QR code provided!

Before taking the robot to the "HEI" track, they had to find the miniature garbage can on the programming track.

Now everything was ready to send Rugged Robot on his journey to take out the trash to the correct bin! The children were shown a set of directions to follow (an algorithm) which was displayed on the wall in front of the track. The sequence of directions would lead Rugged Robot to the correct bin, but only if they correctly programmed the number of steps and directions of the arrows on the robot.

When Rugged Robot started his journey towards the rubbish bin, tensions ran high in anticipation to see if it was correctly programmed and the right rubbish bin selected. Included in the trip were two QR codes on a pole. If the programming was correct, the robot stops right in front of the iPad. Here it is scanned and a voice tells them whether it is the right trash can. If it's right, there will be great cheering from the speaker, and very happy children!

If the children had selected the brown bin for a plaster, I would have reversed the QR code. Then they would hear: "It was wrong, try again".

Rugged Robot is a super outdoor and indoor robot. With the appropriate activity, a child as young as three years old will enjoy playing and exploring with this robot. It is large, robust and easy to use.

When we were on a trip with the children the day before a three-year-old boy asked;

"Kjellis, can we play with Rugged Robot?"
"Yes" I say, "we can, but wait until we get back to kindergarten" Then the boy smiles and says "good".

Teaching through robotics can truly be a cross curricular experience for children. Rugged Robot is an educational tool which on this occasion has helped to make children aware of what to throw away. A perfect supplement to reinforce our learning journey about the environment, whilst also practicing spatial awareness, mathematical concepts, extending our vocabulary and gaining exposure to new technologies whilst enjoying the great outdoors and the many learning opportunities that this presents!

About the author:

Kjell Gunnar Ytre-Eide

Kjell is an Early Years Assistant from Andungen Kindergarten in Norway, he has been in the profession for almost 30 years. Kjell runs a company called IKT og Lek. Here he blogs about his work with digital tools in kindergarten. He holds inspirational courses for other kindergartens and schools.

Blog: Iktoglek.com *Facebook and Instagram: IKT og Lek*

ADVANCED PROGRAMMING

Loti-BOT

THE BLOCK-BASED PROGRAMMABLE ROBOT

Inspire learning and discovery of **21st century skills** through **cross-curricular** coding experiences

Loti-Bot® supports learner development, enabling progression from a Junior block based environment to a Scratch block-based programming environment using a variety of inputs and outputs.

FIND OUT MORE

Testimonials

Many thanks to the children at Church Road Primary School who were Terrific Testers and put Loti-Bot through its paces for us.

Here are the views of five children from the Year 6 class.

"Loti's presentation is amazing and she is modern and user friendly. I think that Loti-bot will be useful in future computing lessons as it has had major improvements on features and looks."

Ayesha

"She's amazing and it's a big improvement. I think she'd be great for Computing days and I'd like doing things like building her a maze and coding her to travel through it."

Olivia

"I think that Loti-bot will be good in the classroom as it's coding system is similar to Scratch, which most children know how to use so it will be user friendly. I also think it will be good for classroom projects."

Gethin

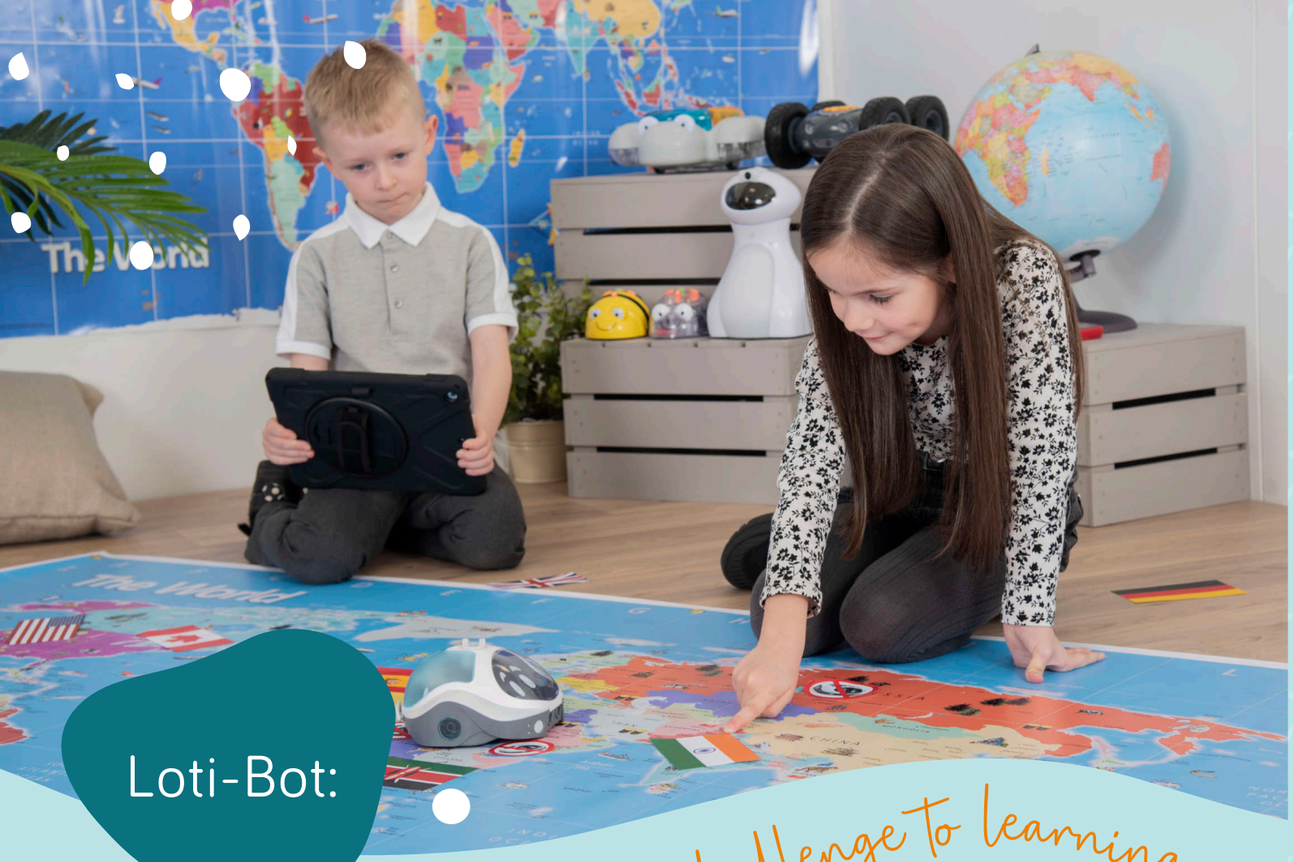
"I think it's easy to program and it's sturdy so if it accidentally gets dropped it will survive."

Daksh

"It looks sleek and I love the presentation. It is quite interactive, which is great for smaller children too and will encourage more coding in classes.

I also really like the coding platform as it is similar to Scratch, which I use everyday, so I can use the same skills with ease."

Reagan



Loti-Bot:

Finding ways to add challenge to learning

Looking for an educational robot that lets you take the next level with programable robots within education? Meet Loti-Bot®, a robot simple to start with but full of sensors and features that will challenge the young learners that need a more challenging way to control a robot with coding.

It has been on the wish list for a long time that Blue-Bot® got an update or a sibling that had some more advanced features. So I was thrilled when I first heard about Loti-Bot, and still am after trying it out!

A ROBOT THAT FOLLOWS CHILDREN'S DEVELOPMENT

Loti-Bot is a software-based robot, which means you need to connect Loti-Bot to the app of the same name. The app is free to download and easy to use.

As a former pedagogue and ICT teacher in a Swedish school for over 12 years, and with my current job as a STEAM-expert and Teacher trainer for schools and preschools within ICT and STEAM, I appreciate a pedagogical tool that is easy to get started with but can also follow progression according to the developmental curve of children, or through different grades of students. And with Loti-Bot you get just that. A programming robot that in its simplest use can be programmed in different directions. What we call a directional robot. Loti-Bot has no physical buttons that work as directional commands, but the coding takes place in the Loti-Bot app. You code Loti-Bot with block-based coding in a Scratch-like coding environment with the option to switch between level 1 and 2. Level 1 similar to Scratch Jr with icon-based blocks, and level 2 more like traditional Scratch blocks. All movement forward and backwards is in millimeters and the turns take place in the degree number that you decide, which makes it perfect for use in mathematics.

EXPLORING ALL THE POSSIBILITIES WITH LOTI-BOT

On the top of Loti-Bot's back there is a holder for a pen so you can draw with Loti. Why not try writing letters or drawing different shapes? Unsure of how your code will make Loti move? Just disconnect Loti from the app for a short while and let's try the code in the simulator. Then just reconnect and run the code on the real Loti-Bot. This is a great way of doing debugging.

Loti also has several different sensors, speakers, and RGB lights that can be programmed to light up in different colors. What I also like about Loti-Bot is that it can multi-task. That is, you can have two programs that are started at the same time. You start Loti with the "green flag block" and you can have several green flag blocks at the same time. This allows you to make Loti-Bot become a dancing disco bot that runs in different directions while changing the colour of its lights.

What I really like is that you can see a simulation of the Loti-Bot's movements, colours and in level 2 the values of the different sensors if you use the sensors in your code. In level 2 you can also activate the Loti-Bot's distance sensor and try to make the Loti-Bot become a "self-driving bot" that detects obstacles and drives around them. A fun and educational way to understand how, for example, a reversing sensor on a car works as children hear Loti generate sound and see Loti light up as it gets closer to an obstacle.

About the author:
Richard Duncan

STEAM Expert and Teacher Trainer at Lekolar/ Hands-On Science, Sweden

Let Loti challenge you each time you learn new ways to tweak the code for Loti-Bot to make it do even more fun and exciting things!

Embracing Robotics

Loti Bot in Action

Educators are increasingly embracing robots as a valuable tool for developing STEAM (Science, Technology, Engineering, Arts and Mathematics) skills in students. By integrating robotics into the classroom, you can create immersive, interactive learning that prepare children for a future full of possibility. Such experiences improve competencies such as critical thinking, problem-solving, computational thinking, creativity, and collaboration.

'STEAM-based activities that relate to the real-world help students become innovators of tomorrow.'

Despite the numerous advantages, many schools have yet to fully embrace the technology. Enter Loti-Bot® - a robot equipped with a wide array of sensors, offering endless opportunities for innovative projects.

One of the greatest phrases to hear from a child is, "I wonder what will happen if...?" It signifies their inquiry mindset and eagerness to explore and discover answers. With Loti-Bot, students will love experimenting with its many features, sparking their curiosity as they interact with and investigate their surroundings.

Loti-Bot boasts an impressive range of sensors, including temperature, light, sound, proximity, and bumper. Additionally, its headlights can be activated, and the colour-changing sidelights can be independently programmed. Not to mention the 20 sound effects that can be incorporated into projects!

Loti-Bot is an excellent introductory robot and provides a great entry point for children new to robotics. Moreover, it extends the learning experience for students with prior experience using Bee-Bots®, Blue-Bots® or Glow & Go® Its versatility makes it suitable for a wide age range, from younger students aged 5-6 to upper Key Stage 2 students aged 10-11. Loti-Bot caters to both early coders and experienced programmers.

THE LOTI-BOT APP

Loti-Bot is controlled using an app that is compatible with Apple and Android devices. A major advantage of Loti-Bot and its accompanying app is the inclusion of two coding levels, effectively providing a progressive coding experience from junior blocks to 'Scratch-style' block-based coding.

The app itself is user-friendly, featuring logically organised blocks in sections. The design ensures ease of use and intuitive navigation for students.

The simulator at the side of the screen offers the chance to plan and test programs. This feature is particularly useful as it enables children to debug (identify and fix errors) their code before running it on Loti-Bot when it is their turn. Students can save and load projects, allowing them to revise, remix and continue coding across multiple sessions.

'Adding paint to a math lesson doesn't make it a STEAM activity.'

STEAM activities aim to equip students for the future by providing opportunities to develop essential skills that enhance their success and employability in an ever-competitive landscape, rather than predicting or imitating specific career paths.

Here is a selection of ideas to get started with Loti-Bot, but the possibilities are endless:

1. **Story Retelling:** Use Loti-Bot to retell a story by guiding it through scenes in order, recorded by children. It can also be applied to various instructions like brushing teeth or making a recipe, varying Loti-Bot's speed and incorporating wait blocks to represent the duration of each stage.
2. **Number-Line Arithmetic:** Roll two dice, add/subtract the numbers, and navigate Loti-Bot to that place on a number line. Make it competitive by placing team-coloured tiles for a 3-in-a-row game. Of course, you can extend this to multiplication and use a 100-square or multiplication grid.
3. **Maze Exploration:** Create a maze using paper and pens or tape on the floor (straws, wooden blocks or even Lego make great walls too!). Code Loti-Bot to reach images or topic-related items for collecting. Students can create various mazes and challenge each other to navigate Loti-Bot through them. Increase difficulty by adding non-right-angled turns. Design a course to explain scientific concepts, such as digestion.
4. **Obstacle Course:** Set up an obstacle course using blocks or other objects. Students can program Loti-Bot to navigate through the course, avoiding obstacles using the proximity and bumper sensors.
5. **Shape Drawing:** Students select shape/symbol cards and use Loti-Bot to recreate them. Extend to letters, words, or names. Introduce symmetry by drawing the other half of a shape using a mirror. Draw shapes in patterns or follow artwork like aboriginal designs.
6. **Map Journey:** Print maps and draw journeys across them, incorporating local areas or fictional adventures (Bee-Bot mats are a great place to start if you have any available!). Loti-Bot is great at helping introduce or develop directional language, whether that is forwards/backwards, up/down, straight/turn or north/south. A map of the world, country or local area is a great way to talk about compass points, as well as mapwork skills such as grid-references. Why not extend this by looking at scale and ratio, linking mm on the app to km on the floor map?
7. **Code a Dance Party:** The A in STEAM of course stands for the arts, which includes dance, music, drama, languages, and design. Students can program Loti-Bot to dance to a specific beat or rhythm using the sound effects, colour-changing sidelights, pauses and varied speeds. They can experiment with different dance moves and choreograph a dance routine for Loti-Bot.
8. **Mini Golf:** Design holes using tape and a coloured spot, code Loti-Bot to complete the course and award points based on accuracy. Reinforce measurement conversion and estimation. Decide on a scoring system and host a tournament?
9. **Angle Exploration:** Code Loti-Bot to draw acute, obtuse, and reflex angles, then label them in another app. Estimate or measure angles and then code Loti-Bot to draw over printed shapes, starting with different types of triangles.
10. **Loti-Bot's Adventure:** Students can create a story using Loti-Bot as the main character. They can program Loti-Bot to move to various locations, triggering sound effects or displaying colours on the sidelights to represent different parts of the story.
11. **Mathematical Operators:** Use operators (and, or) with Loti-Bot to explore mathematical concepts like greater than, less than and equal to.
12. **Temperature Explorer:** Have students program with Loti-Bot's temperature sensor to explore different areas of the classroom, recording and comparing temperature readings. They can create a temperature map of the classroom or investigate temperature differences in various locations.
13. **Light Seeker:** Program Loti-Bot to follow a light source using the light sensor. Students can experiment with different light intensities and angles to see how it affects Loti-Bot's movement.

Keep in mind these suggestions are starting points. You can adapt them according to your students' age and skill level or align them with specific interests and curriculum objectives. Why not explore connections to the 17 Sustainable Development Goals (SDGs)?

By integrating robotics into education, we empower students with the tools they need to thrive in an increasingly technology-driven world while nurturing their ability to think critically and solve real-world challenges. Get ready for an exhilarating adventure!

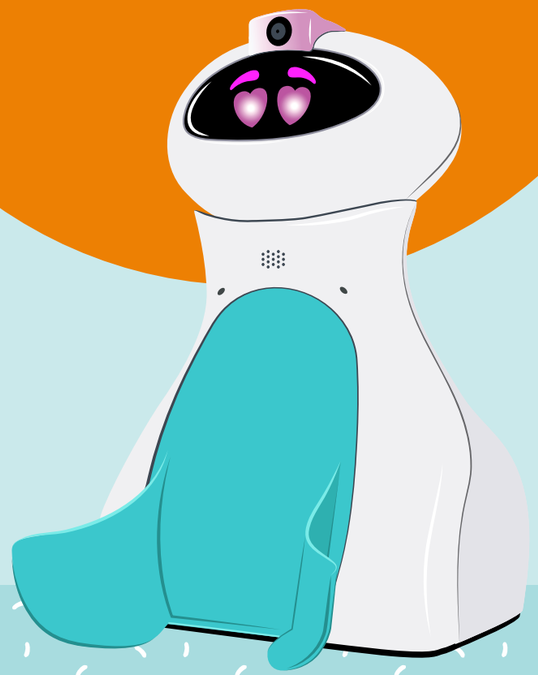
'The key is to provide opportunities for hands-on experiences that develop higher-order thinking skills.'

SOCIAL ROBOTICS - THE FUTURE

MEET OTI-BOT

a STEAM robot designed with the future in mind. Oti-Bot® is a versatile, social, engaging and upgradable social robot designed for the 21st century classroom. Oti's many different functions and features can be programmed by pupils to support. Computing outcomes but can also be used to support learning in other subject areas, allowing for a holistic use of a robotic device throughout the curriculum.

This makes Oti the perfect robotic device to familiarise learners with working alongside a humanoid device and replicates real-life examples of how robotics can be used in society.



OTI-BOT'S APP

Oti-Bot's features can all be controlled and programmed in different ways within the free Oti-Bot app. Children can progress from simple manual control right through to using a block-based environment to program Oti. For example, some children may manually navigate Oti around a path, whilst others can use the block-based environment to program Oti's journey whilst controlling the different inputs and outputs.

Within the app, Oti-Bot's camera can also be used to capture photos, videos or to live stream to multiple tablet devices. Children can send Oti on a classroom adventure while the rest of the class observe, helping to support a collaborative approach to his use.

FACIAL RECOGNITION

Oti-Bot can be taught to recognise and store up to 40 unique faces and can therefore be programmed to react differently to different individuals. All facial recognition data is safely and securely stored locally – without the use of a cloud service. This gentle introduction to machine learning is the perfect way to introduce pupils to AI (Artificial Intelligence) technologies in a safe and engaging way.

STORAGE AND TEACHING ASSISTANT MODE

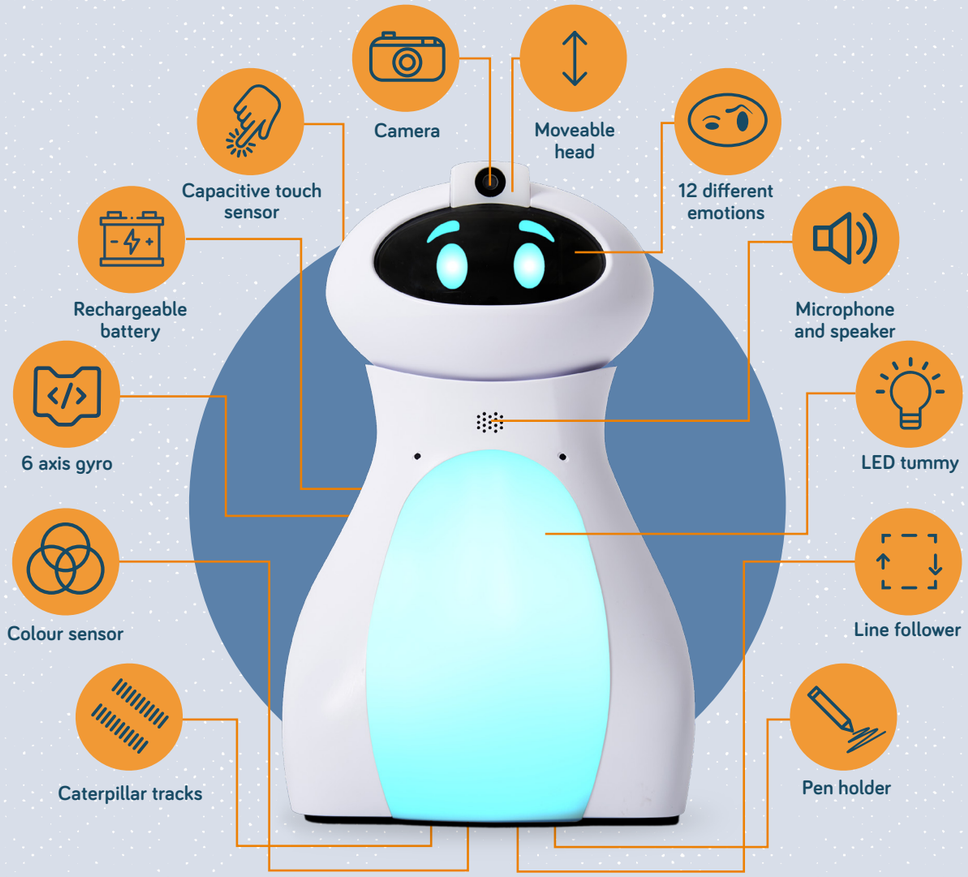
In addition to his programmable capabilities, Oti-Bot can also be used as a storage device for pupil work. Children can record video and take photos which are all stored on Oti's internal storage. Each child can be assigned a unique QR code and when using these with Oti, each pupil's work is recorded and stored in their own folder. All saved files can then be viewed and downloaded by plugging Oti in to a computer.

OTI-BOT'S TUMMIES

With a selection of interchangeable tummies, Oti-Bot can deliver a wide variety of STEAM lessons. From lifting and moving, programming, measuring and drawing – the only limit is your imagination.

The interchangeable tummies also allow for low-cost upgrades to expand and enhance the functionality of the robot. Without needing to purchase a new robot entirely, Oti can be easily modified to suit many different learning outcomes.

Getting to know Oti-Bot



Oti-Bot is equipped with many different functions and features that can be controlled and programmed by pupils. These features include:

- Caterpillar tracks that allow for more accurate programming of the left and right motors.
- Line follower enabling Oti to follow a black line.
- Colour sensor that allows Oti to recognise and react when moving over different colours.
- Moveable head that can be altered to look up and down.
- 12 different emotions which can be seen on Oti's face and through a change of colour to the LED tummy.
- Capacitive touch sensors on Oti's back and head that can be used as an engaging input device.

Skills and learning with Oti-Bot

Technology has now become an essential part of most people's lives. Computational thinking and confidence with technology are skills that children will need as they move through their education and into the workplace.

COMPUTING

Here are some of the computing learning outcomes that can be supported through learning and working with Oti-Bot.

Computer Science: Computational Thinking and Programming

- Understand what algorithms are and how they work.
- Use logical reasoning to predict the behaviour of simple programs
- Detect and debug any errors in algorithms and programs.
- Solve problems in programs by decomposing them into smaller parts.

USING OTI-BOT ACROSS THE CURRICULUM

Throughout our lives we use technology in many different ways, such as for learning, work and leisure. Oti-Bot allows us to demonstrate to children and young people how we can work alongside technology and use it to support and facilitate learning across many different areas.

Here are just a few suggestions of ways Oti-Bot could be used across the curriculum:

English

Whilst developing creative writing skills, children could create their own story environment and take Oti on an adventure through it. Use live stream or video to capture what it is like and encourage children to talk about and describe what they see and feel through Oti's eyes.

Maths

Explore and measure distances with Oti to develop children's mathematical skills. Children can also use and apply their knowledge around equivalent measures, as Oti is programmed in mm.

Science

Use Oti-Bot's basket, pusher or forklift tummy to sort materials by properties. With a range of different materials, children can program Oti to deliver each material to the correct location. They might even use facial recognition to only give certain children materials with specific properties.

Art and Design

Explore art with Oti-Bot by using the colour copy mode to travel over artwork and watch as Oti's tummy changes with the different colours in the picture. Some great pieces to use are The Snail by Henri Matisse, Composition with Yellow, Blue and Red by Piet Mondrian, or art from Wassily Kandinsky.

Emotional Wellbeing

Use Oti to explore, discuss and learn about different emotions. With children, talk about the different things that can make us change emotions, look at their own facial expressions and then represent these with Oti's programmable moods.

ROBOTICS FOR INCLUSIVE EDUCATION

Debug'd Coding:

Making Coding Experiences Inclusive and Accessible for ALL Children

Children as young as 3-4 years old are engaging with robots and creating coding programs with other young roboticists in schools around the world. They make predictions, test those predictions and regroup when their predictions aren't correct – they don't give up, but instead become even more determined to pinpoint where the problem lies. When they finally get it right, they share their excitement and long for the next coding session, anticipating that it will be just as much fun! The rich engagement these experiences offer is undeniable.

Coding has been formally incorporated into the maths and STEM curriculum expectations in many school districts, for a variety of good reasons. The skills that children gain from coding provide an important foundation for those who wish to pursue it academically. However, it also provides children with soft skills that are just as important, or potentially even more important, for lifelong learning and daily living. These skills include communication, collaboration with peers, critical thinking, the rewards that come with planning, persevering while problem solving, and the confidence that results from creating a product independently. Children truly shine when they experience independent success.

INCLUDING ALL LEARNERS

The ability for all children to engage with coding, depends both on the design of the robot application and the instruction provided. Most robot applications were not designed with all children in mind – they follow a "one size fits all" approach rather than a "universal design" approach. Children who experience fine motor, visual, cognitive, communication and socio-emotional challenges don't often have the same opportunities to code because of the barriers posed when using these robot applications.

What if there was a curriculum for robots like Blue-Bot®, which are so popular in early childhood and elementary school settings, that took a universal design approach so that every student could join in the fun? This is precisely the approach taken by a new product called debug'd Coding, which addresses the barriers in four different popular robots, including Blue-Bot!

Coding is learned through hands-on exploration. But what if children lack the visual or physical ability to engage with the robots according to the manufacturer's design? Debug'd provides differentiated levels, and alternate ways to manipulate materials, using print (regular and embossed) and digital materials accessible with alternate pointing devices, switches, eye gaze and screen readers.

To create something truly inclusive and accessible, the debug'd team asked the experts. They took a co-design approach to development – students, teachers and other relevant professionals and family members helped shape every debug'd kit by putting all lessons and resources to the test. The most important validation learned through co-design is that all children, even those with complex needs, are able to enthusiastically engage in coding, integrate new coding concepts and apply those skills to other areas of the curriculum and their daily lives. This co-design approach also helped to reinforce the fact that scaffolding is essential, both for teachers new to coding and for students – it ensures that important steppingstones are travelled in the pursuit of new knowledge. The co-designers reinforced the importance of leveled materials which provide the options necessary for participation by all. They confirmed that those with different abilities can make use of differentiated materials to learn and apply the same coding concepts while they access the materials in different ways.

HOW DO YOU ENSURE THAT CODING IS ACCESSIBLE FOR ALL CHILDREN?

- Provide communication materials to give children who are non-verbal a voice and those who struggle with language more autonomy while learning to code.
- Include physical and digital materials to allow children who cannot access buttons and blocks to create and show what they know, as independently as possible.
- Create symbol supported planning and thinking aids so that children who struggle with language and difficult concepts can successfully work through ideas at a comfortable pace.
- Use vocabulary cards, reference materials about how to successfully work with a small group, social stories and visual schedules to build confidence and social skills and to help children who struggle with change and collaboration.

It isn't surprising that all the materials created with a universal design approach, absolutely necessary to support complex learners, are truly beneficial for all! This design approach incorporated into the debug'd comprehensive curriculum delivers meaningful coding instruction to support every child in any learning environment – truly inclusive, accessible (and fun!) learning opportunities for all!

DEBUG'D INCLUDES:

- Step-by-step instructions, with scripting
- 9 scaffolded lessons
- Instructional slide decks for every lesson
- Anchoring of new learning
- Guided modelling of new skills
- Intentional introduction of new vocabulary
- Scaffolded practice opportunities
- Application challenges
- Extend and connect activities

debug'd coding for Blue-Bot

About the authors:

Christy McDonald, Leanne Husk and Susie Blackstien-Adler are the authors of debug'd coding curricula. They have worked in various roles in the field of education for years, supporting general education and special education teachers and students (K-12) to provide inclusive instruction so that all students are able to access learning. They have presented nationally and internationally on topics related to inclusion and assistive technology. They are currently creating a debug'd resource kit for early childhood settings.

Robots in school and the possible positive impact they can have on children with special needs

All children have the right to schooling and learning to spell and calculate. It is a universal right, even for children in need of support. In Denmark, the government has a goal that all children should have the opportunity to attend the general primary school, and this sets some high demands on the learning environment and on teachers and pedagogues who are to take care of the daily teaching.

Research has shown that autistic children who are in an environment of understanding and acceptance have good conditions for having a quality adult life, without having to receive support.

In 2020, Celso Arango, Professor of Psychiatry, conducted research which showed that early intervention is crucial for the quality of life for both children and adults. In relation to autism, Celso points to a study, conducted back in 1985, which shows that early intervention is crucial to the success of the intervention.

SYSTEMATIC SUPPORT IN DAYCARE AND SCHOOLS

Early screenings will help to diagnose many children with autism at the crucial times when they can be supported most effectively, this can be by creating a safe and suitable environment, and allowing for additional support to be provided in educational settings. This would not only allow children to be supported in the best possible ways for them as individuals, but also ensure they are being and feeling understood, and not experiencing the negative mental impact of feeling pressured to keep up with children of the same age.

Autistic children in school in Denmark often get such a strained nervous system that many find it difficult to be in social situations and thus take part in learning. By detecting the child with autism in good time, early on, you can provide appropriate support and create an inclusive classroom.

Additionally, robots as a learning tool can promote community in the classroom environment and can help avoid bullying.

THE PHYSICAL ENVIRONMENT

The environment should be calm and predictable. This means that it is difficult to create autism-friendly settings at a large school with 100's of students. It can be challenging for children to have to go through too many unpredictable hallways and common areas before they get to their class. In the class itself, you can have many physical setups to consider. There may be shielding, the way the class faces in relation to windows and doors, the various sensory stimuli, etc. There must be a focus on not having too many people physically to relate to at all times. The premises must be consistent and predictable; moving resources, furniture and changing the layout of the environment too often and unannounced can be very unsettling for autistic children in particular.

AN INVISIBLE DISABILITY

Autism is a neurobiological disability, which means that it is invisible what help is needed for the individual child with autism. This requires that the educators and any other individuals who work with children with autism have the right resources and conditions to be able to support children to develop and learn in the ways which are individual to them.

For physical disabilities, we can build ramps, make wide doors, etc. When it comes to cognitive disabilities however, it is the professionals who are the children's ramps.

Teachers need to really execute their good relationship building skills, particularly when supporting children with autism. The teacher needs to understand each individual child in order to create the right level of calmness, structure and predictability. As a teacher, you must want to familiarize yourself with technology and want to use aids, such as a robot.

ALTERNATIVE TEACHING METHODS

School management and teachers must be open to alternative teaching methods. It can be an advantage to use online teaching, both for children from home, but also as teaching at school. Many people with autism have difficulty with blackboard teaching, and may find it easier to access learning through online courses with support from educators in class. Here, a telepresence robot will be good to use, so that the child who is staying at home, or in a screened room at school, continues to be represented in the class, and can see and sense the other students in the class in teaching sessions.

Conversely, some children with autism will need practice training. And therefore, it is an advantage to invest in robotic solutions that can help the teacher and children with learning, through logical intuition and joint play.

The goal of robotics is to design machines that can help and assist humans. And this is where many different learning robots come into the picture.

As an example, the robot Bee-Bot®, is a good starting point for children of kindergarten and school age from 3-7 years. It represents concrete actions which make it easier for autistic children to engage in social contexts and cooperation. Bee-Bot is designed to run on different learning mats, such as the alphabet learning mat. An educator can benefit from using Bee-Bot to supplement their teaching, and in this way, children who need to hear, see, touch and do can achieve learning which truly motivates them.

The electronic development is seen to be at its first stage in Denmark, and there are no actual major research results to refer to. But hypothetically, for children who attend kindergarten and school, it would be inclusive to bring the common third, which a robot is, into the collaboration on learning. At the same time, it will be a good entertaining item to use for breaks for autistic children, as it is often breaks that are the most difficult to engage in due to the many stimuli in kindergartens and schools during these times.

We are all biologically born with our own thinking styles, and this will influence all situations we find ourselves in, whether we are autistic or non-autistic. Autistic brains think more logically and analytically with very little focus on sensations, and non-autistic brains think more through the senses and emotions, rather than logically/analytically.

In a learning situation with robotics such as Bee-Bot, it will be possible to develop the autistic child's self-esteem, as with the multiple learning opportunities of robotics, children can have an easier time remembering and transferring experiences to future learning. The autistic brain may have difficulty transferring a learned experience to a similar situation, so robots today, by means of touching, hearing, seeing and doing, will be able to contribute to the learning being motivating and fun, and form the foundation for later learning.

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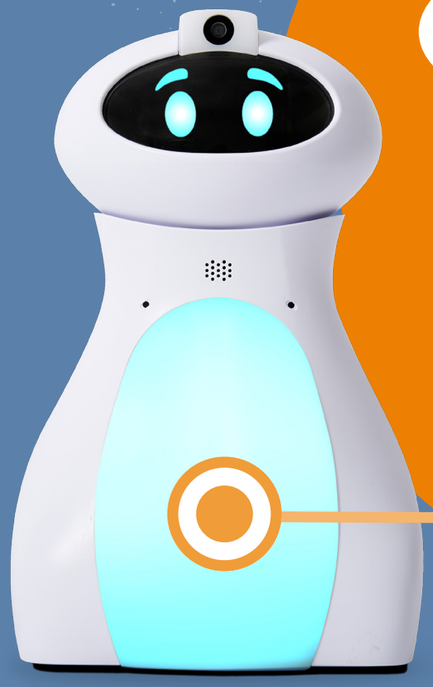

INCLUSIVE OTI-BOT

Oti-Bot® has been designed for inclusive teaching and learning within the classroom. Here we explore the different ways that **Oti can be used to support all learners** including those with special educational needs and/or disabilities (SEND).

DIFFERENTIATION

With Oti-Bot offering so many different functions and features, teachers can differentiate learning to individual needs with one device.

Whether children need to explore manual control with cause and effect, or more advanced programming within a block-based environment, Oti can be used to offer each pupil a learning challenge at their own level and pace.

Teachers will be able to grow in confidence using Oti and to scaffold and differentiate learning in different ways without the need to learn how to use multiple devices.

Oti-Bot offers teachers one robot and app with many different learning opportunities across the whole curriculum.

ENGAGEMENT

Educational research shows that children's engagement levels are higher when working with a social robot rather than on a screen.

Oti-Bot has been designed with a number of features that will help children to build a relationship with Oti and therefore increase motivation and engagement levels.

Children can program how Oti responds to their touch, e.g. Oti's eyes could move, tummy change colour or head move up and down when touched.

Oti can be programmed to respond in a specific way when seeing a particular child.

When using the 'follow a face' function, Oti's head and body will move to follow the child, helping to increase engagement with Oti as a companion.

Using Oti's camera can be a motivating alternative for capturing learning.

EMOTIONS

Each of Oti's 12 different emotions will show through facial expressions and will also alter the colour of the LED tummy.

They can be changed and programmed which opens up the possibility of using Oti to support learning about feelings and emotions.

Children can explore the different emotions and how Oti changes with each one. They can discuss what the different colours and facial expressions represent and also reflect on their own changing emotions.

For individual children who may need additional support, Oti could be used to facilitate discussions around feelings and enable them to represent how they are feeling through Oti.

VISUAL AND AUDITORY

Oti's face and colour changing LED tummy provide learners with additional visual feedback as they work alongside Oti. With a built in camera, microphone and speaker, children can also create additional auditory or visual cues or responses. Oti's app provides clear visual prompts to support pupils on their programming journey.

PUPIL VOICE

Capturing and listening to the thoughts and feelings of children with special educational needs is so important when planning for their provision. It can sometimes be hard for children to express themselves and providing technology can help.

Children may find it easier to take pictures, talk to and record their thoughts onto Oti so that they can share these, for example at SEND review meetings.

CAPTURING LEARNING

Some children really benefit from being able to record their learning in different ways. With the use of Oti's camera and microphone, children can easily capture videos and photographs using Oti. With uniquely assigned QR codes, all learning can be stored in a pupil's own folder, making it quick and easy for staff to review any learning captured using Oti. Recordings and images can also be easily viewed and shared with the class on an interactive whiteboard.