Tactile Reader Pro

The Tactile Reader Pro can be used to program Blue-Bot, Rugged Robot and Loti-Bot.

Below is a selection of lesson plans that demonstrate how the Tactile Reader Pro can be introduced within your computing lessons.

These lessons come from a wider sequence of lessons alongside each robot.

- **Blue-Bot**: Programming with the Tactile Reader Pro
- **Blue-Bot:** Adding 45 degree turns and repeats with the Tactile Reader Pro

- **Rugged Robot:** Creating Algorithms Using the Tactile Reader Pro
- **Rugged Robot:** Create and Debug Simple Programs Using the Tactile Reader Pro

- **Loti-Bot:** Programming Loti-Bot with the Tactile Reader Pro
- **Loti-Bot:** Let's Dance

Blue-Bot: Programming with the Tactile Reader Pro

In this lesson, children will learn how to program Blue-Bot, and debug a program, using the Tactile Reader Pro.

Skills and Learning	Resources
• Understand how to implement algorithms as programs on digital devices • Use logical reasoning to predict the behaviour of simple programs	• Blue-Bot robots (ideally one between three or four) • Tactile Reader Pro and Command Tiles - Standard Pack (ideally one between three or four) • TTS Blue-Bot mats or homemade mats (ideally one between three or four)

Key Vocabulary and Questions	Assessment Opportunities
hardware, Tactile Reader Pro, command tiles, Bluetooth, instruction, sequence, steps, commands, algorithm, debugging • How do you use the Tactile Reader Pro and what does it do? • Does this hardware make it easier or harder to program Blue-Bot? Why?	• Can the children explain how Tactile Reader Pro works? • Can they program Blue-Bot to move around by creating an algorithm on the Tactile Reader Pro? • Can they debug using the Tactile Reader Pro?

Introduce	Retrieval: Children to use sequence cards or drawings on a whiteboard to show the algorithm for short sequences, e.g. 'Show/draw the algorithm for programming Blue-Bot to move two steps backwards and two steps to the right' etc. Explain that in today's lesson, children are going to use a piece of **hardware** (a physical part or device that can be connected to a computer, such as a keyboard) to build algorithms and program Blue-Bot. Show the children the Tactile Reader Pro and explain it sends commands wirelessly to Blue-Bot using Bluetooth. This enables Blue-Bot to be programmed from further away rather than using the buttons on top of the robot.

Learn and Explore	**Whole Class Activity** • Show the children how to connect the Tactile Reader Pro to Blue-Bot. Switch both devices on, press the blue connection button on the Tactile Reader Pro. Blue-Bot will turn blue, once it is connected. • Next show the children the Command Tiles. Each tile matches a command button on top of Blue-Bot. • If one tile is placed on the Tactile Reader Pro and the green 'send' button is pressed, what do the children think will happen? • Place another tile in the Reader so two tiles are now on the Reader. Ask the children to predict what will happen when the green 'send' button is pressed. • Now swap the two tiles around on the Reader and press the green 'send' button. Ask the children what happened. The order of commands performed should have swapped around,

(e.g. rather than Blue-Bot moving forward one step then turning to the right, Blue-Bot turned right first then moved one step forward).

- Explain that the first command to be sent to Blue-Bot comes from the first tile in the Tactile Reader Pro. The Reader will then continue to send commands in the order from left to right.
- Explain to the children that hidden inside each tile is a tiny electronic piece which tells the Reader what the command on the tile is.

Note: The blue line on each tile is at the top. So, whether using the Tactile Reader Pro horizontally or vertically, the forward command tile is always a forward command with the blue line at the top.

- Talk through the process:
  - Command tiles are placed on the Reader and the green 'send' button is pressed.
  - The tiles are read, and the commands are sent to Blue-Bot.
  - Blue-Bot then runs that complete program.
- If a tile is removed after the green 'send' button has been pressed it will still be executed by the robot as the full set of commands have already been sent.
- Explain that as tiles are placed on the Tactile Reader Pro, each tile window will light up to show it has recognised it.
- Once the green button is pressed, the tile windows will light up as it performs each command. Discuss - How might this help us?

Group Activity

- Once the children understand how the Tactile Reader Pro and command tiles work, give them time to practise and embed this learning by creating different algorithms using the Tactile Reader Pro and then testing them out.
- Remind them about debugging if any errors occur. How would they debug?

Challenge the children to get Blue-Bot from a starting point to a destination on a mat. Did it work or did they need to debug the program?

Make it accessible	Add a challenge
Use a smaller number of command tiles to make an algorithm and give the children more time to practise.	• Encourage the children to practise using the Tactile Reader Pro in different orientations. • Use a greater number of command tiles in an algorithm and, if ready, daisy chain two or Tactile Reader Pros together to create bigger algorithms.

Review and Reflect	
	• What are the similarities and differences between programming Blue-Bot on the actual robot and the Tactile Reader Pro? • What are the advantages/disadvantages of both? • Does the Tactile Reader Pro make the programming of Blue-Bot easier? If so, why?

Blue-Bot: Adding 45 Degree Turns and Repeats with the Tactile Reader Pro

In this lesson, children will develop their coding skills by using the Tactile Reader Pro to add 45 degrees turns and repeats into their programming.

Skills and Learning	Resources
• Understand how to use 45 degree turns and repeats in programming • Understand how to implement algorithms as programs on digital devices • Use logical reasoning to predict the behaviour of simple programs	• Blue-Bot robots (ideally one between three or four) • Tactile Reader Pros and Command Tiles - Standard Pack (ideally one between three or four) • Tactile Reader Tiles – Extension Pack (Ideally one between three or four) • (Optional) Tactile Reader Pro Guide – freely available on the TTS website.

Key Vocabulary and Questions	Assessment Opportunities
hardware, Tactile Reader Pro, command tiles, Bluetooth, instruction, sequence, steps, commands, algorithm, debugging • How do you use the Tactile Reader and what does it do? • What is a 45 degree turn? • What is a repeat? • How can you use 45 degree turns and repeats in programming?	• Can the children use 45 degree turns and repeats in programming? • Can the children use both 90 degree turns and 45 degree turns in their programming? • Can they program Blue-Bot to move around by creating an algorithm on the Tactile Reader? • Can they debug using the Tactile Reader?

Introduce	Retrieval: What is computer hardware? How does the Tactile Reader Pro work? How are the tiles ordered? From which end of the Tactile Reader does the command sequence start? Explain that in today's lesson the children are going to add some new commands into their programming, using the Tactile Reader Pro.

Learn and Explore	**Teacher Led/Whole Class Activity – 45 degree turns** • Explain that one of the commands that they are going to add to their programming is 45 degree turns. • Ask the children to stand up. Can they turn 90 degrees to the left? Can they turn 90 degrees to the right? Now ask them if they can turn 45 degrees to the left? Who turned correctly? Who knows how far 45 degrees is? • Model turning 45 degrees and draw 45 degrees next to 90 degrees on a flipchart or Interactive Whiteboard to consolidate understanding. Why might adding 45 degree turns to Blue-Bot's programming be useful? Allow time for the children to discuss then share answers. Establish that it allows for more precise turning (3D printers and robotic arms on production lines are some 'real life' examples of machines that are programmed using 45 degree turns).

- Show the children the 45 degrees turn command tile. How is it different to the 90 degrees turn command tile?
- Place a 45 degrees tile into the Tactile Reader. Can the children remember how to connect Blue-Bot to the Tactile Reader? Program Blue-Bot to turn 45 degrees and then move forward. How did Blue-Bot move? Establish that Blue-Bot moved diagonally.

Teacher Led – Repeats

- What happens when we repeat something? Why might we add repeat commands (also known as 'loops') into a program? Why is it useful? Establish that it is an efficient way to keep a command sequence shorter and saves having to add the same commands multiple times.
- Show the children the repeat command tiles with the brackets. Why do they think some of the tiles have got different numbers on them? Establish that this is the number of repeats that will be added to the program. Explain how the repeat bracket tiles work together in a program.
- Explain and demonstrate that to add a repeat on the Tactile Reader, the commands that need to be repeated must be put inside the brackets, and the tile with the number of repeats written on it placed on the outside of the brackets.

Group Activity:

- Allow time for the children to explore programming Blue-Bot to execute 45 degree turns and repeats.
- Confident children may wish to try completing an obstacle course or route on a mat using 45 degree turns and repeats.

Note: Explain to children that the code is 'cleared' on a Tactile Reader by simply removing the tiles from the Reader.

Make it accessible	Add a challenge
Include less steps and fewer tiles.	• Create longer obstacle courses that include a mix of 90 degree turns, 45 degree turns and different repeats. • Daisy chain 2 to 3 Tactile Readers together so longer command sequences can be created.

Review and Reflect

- How helpful was it to be able to add 45 degree turns and repeats to your programs? Was it easy/difficult?
- Why is it useful to be able to add 45 degrees and repeats into programs?

Rugged Robot: Creating Algorithms Using the Tactile Reader Pro

In this lesson children will use the Tactile Reader Pro to create an algorithm and run it as a program on Rugged Robot.

Skills and Learning	Resources
-Understand what algorithms are, how they are implemented as programs on digital devices, and that programs execute by following precise and unambiguous instructions -Use logical reasoning to predict the behaviour of simple programs	-Rugged Robots (ideally one between three children) -Tactile Reader Pro and Command Tiles (Standard Pack): one for each robot preferably Note: Make sure all devices are charged prior to the lesson.

Key Vocabulary and Questions	Assessment Opportunities
instruction, sequence, algorithm (a precise set of ordered instructions which can be turned into code), error, debugging, code, test, command cards, Tactile Reader (Pro), hardware -How do you use the Tactile Reader and what does it do? -Does using this hardware make it easier or harder to program Rugged Robot? Why?	-Can the children explain how the Tactile Reader works? -Can they program Rugged Robot to move around by creating an algorithm on the Tactile Reader?

Introduce	Introduce the children to the Tactile Reader Pro. Explain that this is a piece of **hardware** – a physical component of a computer. The Reader sends commands wirelessly to Rugged Robot using Bluetooth. This helps us to tell Rugged Robot what to do from further away rather than using the buttons on top of the robot. Is this useful? Why? The first step is to connect the Tactile Reader to Rugged Robot. Switch both devices on, press the blue connection button on the Tactile Reader and wait for the LED circle segments on top of Rugged Robot to go blue. This means Rugged Robot is connected.

Learn and Explore	**Introducing the Tiles as Commands** Introduce the tiles. Each tile matches a command button on top of Rugged Robot. **Note**: To avoid confusion, explain to the children that the standard command tiles on Rugged Robot turn 90° rather than the 45° if pressed on the actual device. The extension pack tiles which allows for more complex programs to be created does have 45° turn commands.

If one tile is placed on the Reader and the green button is pressed, what do the children think will happen? Place the same tile on the reader in a different orientation. Ask the children to predict what will happen. Talk about the blue line on the tiles.

***Note**: The Tactile Reader Pro can be used vertically or horizontally. The blue line on each tile indicates the top of the tile. So, whether using the Tactile Reader Pro horizontally or vertically, the forward command tile is always a forward command with the blue line at the top.*
Begin by displaying the tiles the same way i.e. all portrait or all landscape. Explain to the children that hidden inside each tile is a tiny electronic piece which tells the Reader what it is.

Talk through the process. Command tiles are placed on the Reader and the 'Go' button is pressed. The tiles are read, and the commands are sent to Rugged Robot. Rugged Robot then runs that complete program. If a tile is removed after the green button has been pressed it will still be executed by the robot as the full set of commands has already been sent. Explain that as tiles are placed on the Tactile Reader, the tile window will light up to show it has recognised it. Once the green button is pressed, the windows will light up in order as each command is carried out. How might this help us?

Time to Explore
Once the children understand how the Tactile Reader and command tiles work, give them time to practise and embed this learning by creating different algorithms and then testing them out. Challenge the children to get Rugged from a starting point to a destination. Did it work or did they need to debug the program?

Make it accessible	Add a challenge
-Use a smaller number of command tiles to make an algorithm and give the children more time to practise.	-Encourage the children to practise using the Tactile Reader in different orientations. -Use a greater number of command tiles in an algorithm and if ready, start to introduce command tiles from the extension pack to create more complex programs.

Review and Reflect	
	Encourage the children to reflect on today's lesson and consider the following: -What are the similarities and differences between programming Rugged Robot on the actual robot and the Tactile Reader? -What are the advantages/disadvantages of both? -Does the Tactile Reader make the programming of Rugged Robot easier? If so, why?

Rugged Robot: Create and Debug Simple Programs Using the Tactile Reader Pro

In this lesson children will use their prior knowledge to create and debug simple programs on Rugged Robot using the Tactile Reader.

Skills and Learning	Resources
-Understand what algorithms are, how they are implemented as programs on digital devices, and that programs execute by following precise and unambiguous instructions -Create and debug simple programs -Use logical reasoning to predict the behaviour of simple programs	-Rugged Robots (ideally one between three children) -Tactile Reader Pro and Command Tiles (Standard Pack): Ideally one per robot -Extension Pack of command tiles if required for more complex programs. Note: Make sure all devices are charged prior to the lesson.

Key Vocabulary and Questions	Assessment Opportunities
instruction, sequence, algorithm (a precise set of ordered instructions which can be turned into code), error, debugging, bug, code, test, command cards, Tactile Reader, hardware -What is debugging? Can you find the bug in the program and find a way to debug (fix) it? -Why is debugging important?	-Can the children explain what debugging means? -Can they identify bugs in the program? -Can they debug their algorithm to make the program work?

Introduce	Explain to the class that now we have created algorithms using the Tactile Reader to program Rugged Robot, we are now going to focus on finding issues with programs and fixing them. Can anyone remember what this process is called? (Debugging)

Learn and Explore	**Creating and Testing Algorithms** Build on prior learning using the Tactile Reader and ask children to set each other more complex problems. If outside, they might have to travel over the gravel or avoid the grass to get to a particular destination marked by an object or cone. Rugged Robot could start from different places or face away from its destination for an added challenge. Once an end destination is given, children observe the route they want to take, choose the command tiles needed and place them onto the Tactile Reader. Once they are happy, they should press the green button to test their program.

Debugging Challenge
If Rugged Robot does not get to the target destination, ask the children what they should do? They will need to identify where it has gone wrong and fix the issue by debugging.

Further Challenges
In pairs or small groups, ask one child to create a program using tiles on the Tactile Reader. Before running the program, can another child read the tiles and predict from the commands where Rugged Robot will end its journey.

To extend the level of challenge further, ask one child to program Rugged to go to a given destination with one deliberate error. Can their partner/group work out where the bug (error) is and debug it.
Remind children to make a note of their original program so they can see what has changed.

Make it accessible	Add a challenge
-Use less tiles in the algorithm and stick to the standard pack tiles for simpler command cards.	-Use a greater number of tiles. Children can also connect up to three Tactile Readers to make longer and more complex algorithms. -Add the extension pack tiles for creating more complex programs but ensure that the children are familiar with the commands and what they do first.

Review and Reflect

Ask children to reflect upon what they have learned today?

How did the Tactile Reader (hardware) help with creating algorithms and debugging the programs?

Can the children share their experiences from today? What did they find the easiest and hardest part of the lesson?

Loti-Bot: On The Move with the Tactile Reader Pro

During this lesson, children will learn the basic principles of writing algorithms and will use the Tactile Reader Pro to get Loti-Bot on the move!

Skills and Learning	Resources
Students will: • Understand what algorithms are, how they are implemented as programs on digital devices, and that programs execute by following precise and unambiguous instructions • Create and debug simple programs • Use logical reasoning to predict the behaviour of simple programs • Use directional language and knowledge of angles to move and turn Loti-Bot.	• Loti-Bot (ideally one robot for every 3 to 4 pupils) • Tactile Reader Pro and Command Tiles (Standard Pack): Ideally one per robot • Extension Tile Pack (these will offer more programming opportunities with the Tactile Reader Pro)

Key Vocabulary and Questions	Assessment Opportunities
algorithm, block-based coding, forward, backward, degrees, left, right, angle, debug - What is an algorithm? - How do we program Loti-Bot? - What do we do if something is wrong with our algorithm?	Observe children as they program Loti-Bot. - Can children program their algorithm? - Can children debug their algorithm?

Introduce	Retrieval: Children to use sequence cards or drawings on a whiteboard to show the algorithm for short sequences, e.g. 'Show/draw the algorithm for programming Loti-Bot to move two steps backwards and two steps to the right' etc. Explain that in today's lesson, children are going to learn how to program Loti-Bot to follow specific instructions and navigate to a destination the Tactile Reader Pro. This is a piece of **hardware** (a physical part or device that can be connected to a computer, such as a keyboard) that can be used to build algorithms and program Loti-Bot. Show the children the Tactile Reader Pro and explain it sends commands wirelessly to Loti-Bot using Bluetooth. This enables Loti-Bot to be programmed from further away rather than using the buttons on top of the robot.
Learn and Explore	**Activity 1: Understanding Algorithms** • Start by recapping the concept of algorithms in a simple manner. • *An algorithm is a set of step-by-step instructions/rules for completing a task, reaching a goal, or solving a problem.* • Show some real-life examples of algorithms, like a recipe for baking or steps to tie shoelaces. • Ask children to work in pairs or small groups to create an algorithm to complete a task, such as moving from their desk to the door. • Explain that just like these examples, we can use an algorithm (a set of instructions) to program our robot to move.

Activity 2: Tactile Reader Pro and Command Tiles

- Introduce the Tactile Reader Pro and the Command Tiles.
- The Tactile Reader Pro can be used either horizontally or vertically.
- Explore the different Command Tiles the children will be using today. You can introduce just the Standard Tile Pack (forwards, backwards, left turn, right turn and pause) or also include the Extension pack which includes more advanced tiles such as 45 degree turns and repeat command tiles. If you are also introducing the Loti-Bot tile pack this will include commands to change Loti-Bot's lights and play pre-recorded sounds.
- Ask children to create their own 'Tile Dictionary'. What does each command mean? And what will Loti-Bot do if we use that tile?
- If using the Extension Pack of Tiles, you may want to spend some time reminding children of the difference between a 90 degree turn and an 45 degree turn.
- Explain to children that the blue line on each tile is to show the top of the tile.
- Give children time to explore and experiment with inputting single commands or simple programs into the Tactile Reader.
- Some suggested discussion points:
    - Which way round do the tiles need to be placed in the Tactile Reader Pro?
    - How do you know when the tile command has been recognised?
    - What changes when you use the Tactile Reader Pro horizontally/vertically?
    - What do the two buttons do on the front of the Tactile Reader Pro?

Activity 3: Loti-Bot On The Move

- Create a simple path on the floor using markers or tape, consisting of straight lines and a few turns. Ensure that the path is clear and easy to follow.
- In pairs or small groups, let the students take turns to plan their algorithm and then program the robot to move along the path to reach the destination. They may want to take on different roles in the group, such as note taker, program tester, and 'driver'.
- If using the extension tiles, encourage children to think about whether they can include repeat commands within their program.
- If using the Loti-Bot tiles, children could explore with including lights or sounds into a program.
- Ensure students are explaining their programming choices by using the correct directional vocabulary and discussing which command tiles they have used to complete the task.

Debug – Children will need to 'debug' their algorithm when they spot errors, for example if they have programmed Loti-Bot to turn in the wrong direction. Allow time for them to reflect and re-test their algorithm.

Make it accessible	Add a challenge
Provide more opportunities for physical coding, e.g. with direction and turn cards. Children can trial creating algorithms with the cards and physically moving themselves, before using the command tiles.	Once the students are comfortable with basic movements, introduce a more complex path or maze for the robot to navigate. Join together 2 or 3 Tactile Reader Pros to extend the length of the program that children can input.

Review and Reflect

Gather the students and discuss their experiences with Loti-Bot and using the Tactile Reader Pro.

- How did the Tactile Reader (hardware) help with creating algorithms and debugging the programs?

If you have previously used the app to program Loti-Bot:

- What are the similarities and differences between programming Loti-Bot on the Tactile Reader Pro and using the app?
- What are the advantages/disadvantages of both?

Loti-Bot: Let's Dance

Students will use and apply their programming skills to design and choreograph a new dance routine for Loti-Bot on the Tactile Reader Pro!

Skills and Learning	Resources
Students will: - Understand what algorithms are, how they are implemented as programs on digital devices, and that programs execute by following precise and unambiguous instructions - Create programs that include sequences and loops. - Decompose problems into smaller manageable parts. - Test and debug a program.	- Loti-Bot (ideally one robot for every 3 to 4 pupils) - Tactile Reader Pro: one per robot as a minimum. If wanting to introduce longer programs, you can daisy chain up to 3 for each robot. - Command Tiles (Standard, Extension & Loti-Bot) - A large and clear space for the Loti-Bots to dance!

Key Vocabulary and Questions	Assessment Opportunities
algorithm, program, repeat command, algorithm, LED lights	Through programming their dance routine, you can assess if children can: - Work together and seek and respond to different perspectives. - Test and debug a program. - Include and combine different command tiles for different outcomes.

Introduce	Recap prior learning on algorithms and what the children know about Loti-Bot. Emphasise that coding and robotics can be creative and fun. In this lesson, students will explore more imaginative ways to program the robot's movements. Recap – what do we know about the Tactile Reader Pro? *This is a piece of **hardware** (a physical part or device that can be connected to a computer, such as a keyboard) that can be used to build algorithms and program Loti-Bot. It connects to Bluetooth and then sends commands wirelessly to Loti-Bot.*
Learn and Explore	**Set the Scene** • Explain to children that their challenge is to plan and choreograph a new dance routine with Loti-Bot. • You can choose the purpose for this, but it could be for children to perform a dance alongside their Loti-Bots or to set up a Loti-Bot Flash Mob and get as many robots dancing together as possible! **Dance Moves** • Children will need to work in small groups, ideally with one Loti-Bot per group and at least one Tactile Reader Pro. You could daisy chain up to 3 Tactile Reader Pros together to allow for a longer program. • Start by giving students some time to experiment with programming different dance moves, for example making Loti spin and twirl, move forward and backward etc.

- It may be helpful to watch some clips of different dance moves to offer some inspiration!
- Try to encourage children to think beyond simple movements, shapes, and paths.
- Share some examples of dance moves with the group and the tiles that were used to create this program.

More than just movement

- Within the different tile packs there are different tiles which expand the ways to program Loti-Bot beyond just simple movements. There are pause tiles, repeat tiles and also tiles to program Loti-Bot's lights, pre-recorded sounds and headlights.
- With the repeat tiles, explain that we can use loops (iteration) in our robot dance programming to repeat a sequence of instructions multiple times. This would ensure that Loti-Bot can repeat specific dance movements, helping to create patterns in their routines.
- Encourage children to explore with these tiles and begin to plan how to build them into their program in the Tactile Reader.

Choreographing Your Robot Dance

- Students will have a collection of 'command tile' code for individual dance routines, which they can now combine to create a mini Loti-Bot routine.
- Provide time for each group to plan out their routines.
- Encourage them to experiment with using Loti-Bots changing lights and pre-recorded sounds to match their movements.
- What impact does it have on the dance to change the lights before, after, or during a routine?

Dance Showcase

- Share and showcase the different Loti-Bot routines with the class.
- Encourage each group to explain the different movements programmed and the inspiration behind their dance.
- After each performance, encourage the other students to provide positive feedback and ask questions about the choreography. Which dance moves were the easiest to program?
- Facilitate a brief reflection session where each group discusses their creative process and what they learned.

Make it accessible	Add a challenge
Provide some examples of algorithms that children might want to use in their Tactile Reader Pro. Model how to combine the tiles to create a routine.	Can children use more than one Loti-Bot to program a paired performance! The two Loti-Bots could do the same routine or dance in symmetry with each other.

Review and Reflect

Recap the key points from the lesson, emphasising the creative possibilities of coding and robotics. Celebrate the students' creativity and efforts in choreographing their robot dances.

Ask the students to reflect on their experience of choreographing the robot dance and either write a short reflection or discuss with a partner:

- What did you enjoy the most?
- What challenges did you face?
- How did you overcome these challenges?
- What would you improve/do differently next time?
- How did you find programming using the Tactile Reader? Is this easier or harder than other ways you have programmed in the past?