

First Steps in ... Coding through Mathematical Thinking and Game-Based Learning

Grades K-8

FORWARD

Since childhood, Bruce Jackson, CEO & Founder of Kai's Education would pull apart anything with electronics to see how it worked; his inquisitive mind constantly challenged the status quo. His mantra is 'to take one fearless step at a time, one brave decision at a time, one courageous action at a time. These choices, decisions, and actions transform challenges into exploration, failure into learning, risk into reward, and fear into determination. Bruce pushes boundaries with his passion for providing young people with opportunities and training to help build their STEM skills for their futures.



It's all about that step ladder approach of getting [kids] on the first rung of the ladder, having some fun, having a good engagement level, and slowly getting them up that ladder and then getting them onto block-based coding and into text-based coding as well. It begins with cards from beginner to advanced. They are based on Python, text-based coding. KaiBot scans the sequence of cards and then plays back what's been scanned. With just robots, tiles and cards, one can have a lot of fun and learn how to code.



In the next step, one pairs KaiBot with Kainundrum, a virtual world on the computer and iPad. **Learning takes place from concrete to abstract.** It is this feature that first caught our attention when we met Bruce and his team early in 2022.

This, our eBook, "First Steps in Coding through Mathematical Thinking and Game-Based Learning", is written for the teacher, the parent and the student. It presents information, ideas, lesson plans and suggested activities for beginner to intermediate to advanced in learning to code from concrete to the abstract.

KaiBot is a finalist in the DA top EdTech product of the year award in 2023 and won the AI Smart Toy 2022 Award in Dubai.



PREFACE

The Role of Manipulatives

Learning takes place from Concrete to Abstract.

Learning Objects or Manipulatives like robots help to move learners along the pathway from concrete to abstract. Their use assists the learner to visualize mathematical symbols, operations and ultimately concepts. They are critical in the **learning and understanding of mathematics**.

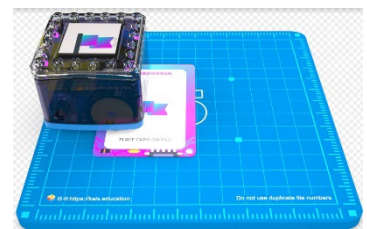


The Role of Robots

Robots engage the minds of students in rich, exploratory, open-ended enquiries, thereby creating, “Communities of Innovation”, as students work together and share their explorations and findings.

The robot facilitates a learning environment in which:

- there is a relationship between the concrete (action) and the symbolic (code).
- the student develops critical thinking skills.
- learning is student-driven and personal.
- students, teachers, parents learn by teaching (coding) a robot.
- one teaches the robot which then gives feedback, which reflects the thinking by giving a visual, concrete response.
- a mistake is a step to new learning - an opportunity to risk and learn.



- students are encouraged to investigate and to discover.
- students engage in oral and written communications.

The robot promotes the intuitive development of number sense. It also promotes patterning skills of recognition, creation, and extension.



The Role of The Teacher and Parent

This eBook is written for the teacher, the student and the parent. Teachers and parents make learning possible for all students by establishing an **environment of trust for risk taking**. They are guides, essential support and often partners for students as the student constructs knowledge. Coding and robotics can develop in students one of the most effective learning paths - the path to self correction.

A note to parents. Learning for your student (and you) is a process of building **through understanding not just memorization**. When you share in the process, you also have an opportunity to learn alongside. Enjoy the experience with your child in following a path to understanding and through that, learning.

The Role of Coding

Coding, a marketable skill for the 21st century, provides limitless creative opportunities for all students, teachers, and parents now and into the future.

Understanding how to code makes it possible to then use coding as an expansive, creative, learning tool. The processes of understanding how to code



takes the learner through a rich field of mathematical concepts. When you create code, you are speaking mathematics. In coding, one teaches a robot which then gives feedback, to reflect the thinking by giving a visual, concrete result.

The Role of Journaling.

We suggest that Journaling be used extensively. Journaling is one of the best forms of asking students to draw on and express understanding of what they are learning.



The journal gives students a record of their understandings and can be reviewed when needed. Journals also give teachers a trustworthy source of true evaluation.

In this book, the **JOURNAL** icon indicates where journaling is suggested. The journal should also be used whenever the student, teacher or parent feels it is appropriate or useful.

The journal will be most productive if the student sees it as “their” book and approaches it as a source for their own understandings and questions expressed in their own words.

If a student finds understanding is incorrect or incomplete, they can use a new journal entry to record their evolving knowledge. Students need to realize that reflection is the key to understanding and thus journaling effectively is important.

eBook Layout

To help the user in making selections, we categorize some information, ideas, lesson plans and suggested activities at their beginning, under the following general categories.



Beginner
perhaps
ages 5-8

Intermediate
perhaps
ages 9-12

Advanced
perhaps
ages 13+



However, it should be noted that we recommend, that beyond Chapter 1, everyone do all activities categorized for the beginner as well. Some sections of the eBook, lend themselves to recording in the **Journal**. Some sections in this eBook are programs to check Screen Free or through Online Coding. Some sections are exercises where the student is directed to predict by writing on a page or a chart of the eBook. In that case, feel free to make a copy of the page.

