KUBO

OVERVIEW:

Lesson Plan 2

FUNCTIONS

Grades:	**K-2**
Group Size:	**Pairs**
Setup Time:	**5 minutes**
Total Time:	**100 minutes**
Activities:	**4**

LESSON PLAN OUTLINE

- Activity 1: KUBO Plays – 25 minutes
  - › 3 tasks
- Activity 2: KUBO Takes the Bus – 25 minutes
  - › 2 tasks
- Activity 3: KUBO Has Recess – 25 minutes
  - › 2 tasks
- Activity 4: KUBO's Weekend Outing – 25 minutes
  - › 2 tasks

OUTCOMES AND ASSESSMENT

- By the end of this section, students should be able to:
  - › Make a function.
  - › Explain your functions to classmates.
  - › Come up with stories to fit your functions.
  - › Explain how your classmates' functions work.

TEACHER PREPARATION

- Make copies of worksheets for each student.
- Make sure all KUBOs have been fully charged before beginning.
- Find an appropriate place to do the activities. KUBO can be used on a table or the floor, but the surface must be level and clean. If you're using KUBO on a tabletop, make sure KUBO doesn't fall off the table.
- Help students find the TagTiles and activity map they will need. You might want to consider hanging up one activity map in front of the whole class to use for discussions and demonstrations.
- It's helpful to show students how to properly handle and store KUBO and TagTiles. Stress the importance of taking care of both KUBO and TagTiles.
- It's also helpful to let students know it's OK to make mistakes as long as they "debug" and figure out what they did wrong and how to fix it.
- When they create routes and functions, it is important for students to understand that KUBO has the same capabilities humans do. For example, KUBO can't drive through walls, fences, water, fire, and so forth.
- You might find it helpful to review with students what they have already learned before going on to teach the new material.

MANAGEMENT

- It is recommended the students be put in groups of two.

- You might find it helpful to create roles for students so that each student gets a turn being in charge of KUBO.

- You might find it helpful for students to detach KUBO's head from the body and put the tiles away in between activities or anytime you are giving instruction.

- You might also find it helpful to give students who are new to KUBO some time to free play and discover on their own so they will be more focused when receiving instruction.

- Circulate through the room and provide help as necessary. However, to encourage student-centered active learning, instruct students to follow the "ask three, then me" rule, in which they consult each other before they consult you.

CROSS-CURRICULUM CONNECTIONS

- The following cross-curriculum connections can be done as additional learning opportunities with the students and connect to different subjects.

  › Social Studies:

    · Teach students about local, state, and national government and voting in elections for those levels of government. Then, have students create a function for KUBO to get from the bus to the voting station to go vote for a mayor in the local government's election.

  › ELA:

    · Read a book about local, state, and national government to students or have them read the book independently. Two great children's book examples are Kid in Chief by Paul Maguire or If I Were President by Catherine Stier. Afterward, have students write or draw a story about KUBO running for president.

  › Math/Science:

    · Teach students about the engineering design process and how it works with the scientific method and experiments. Then, have students create an object or tool KUBO could use to play several different types of games.

ACTIVITY 1:

KUBO Plays

OUTCOME

- Work with functions
- Make KUBO "memorize" the route to the soccer ball by using the blue function and play tiles

TIME

- 25 minutes

MATERIALS

- Movement TagTiles
- Blue Record and Play Function TagTiles
- Activity map
- KUBO

TEACHER NOTES

- Students make KUBO start at the cafeteria (quadrant C7) and end at the soccer ball (quadrant A7).
- For Task 1, students create their own route from the cafeteria to the soccer ball.
- For Task 2, students use the route they created in Task 1 and turn it into a function.
- For Task 3, students create two new functions from the cafeteria to the soccer ball. These functions should be different than the function from Task 2.
- Watch the video on functions on KUBO.education to learn how to build functions (*kubo.education/getting-started-tutorials*). You will need to explain the concept of functions and let students practice.
- KUBO will be purple when reading a function, blue when finished reading a code, and green when executing the code on the Play Function tile.
- The Movement tiles in the route must be in the same order, but it doesn't matter which direction the arrows face. Functions must be built in one straight line.

DISCUSSION QUESTIONS

- Is there more than one way to get from the cafeteria to the soccer ball?
- Which route did you choose and why?
- Which tiles did you need to make the route?
- What is a function? How does KUBO remember routes?
- What are differences between how you memorize things and how KUBO memorizes them?

ACTIVITY 1:

KUBO Plays

- Did you build your function correctly?

- What is important to remember when making functions?

- What can robots do that we can't and vice versa?

- Where are robots found? What kind of work do robots do in factories? How can we use robots in school?

REFLECTION

- Can you think of mistakes someone could have made when creating their functions?

- What was hard about understanding functions?

EXTENSION

- Create a route from the soccer ball to the bike rack. Put KUBO down on the starting tile and execute your route.

- Lay your route in a straight line. Place a blue Record Function tile at the beginning and end of your route. Place KUBO down on the first Record Function tile. Place the blue Play Function tile in the soccer ball's quadrant. Place KUBO on the Play Function tile to execute the code.

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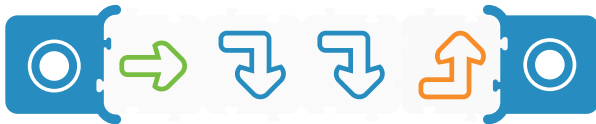
ANSWER KEY

Possible route students could create for Task 1:

Possible function students could create for Task 2:

Possible functions students could create for Task 3:

ACTIVITY 2:

KUBO Takes the Bus

OUTCOME

- Work with functions.

- Choose a route and make a function to take KUBO from the school bell to the bus stop using the blue Record and Play Function tiles.

TIME

- 25 minutes

MATERIALS

- Movement TagTiles

- Blue Record and Play Function TagTiles

- KUBO

- Activity map

TEACHER NOTES

- Students will need to be paired up so they can discuss the routes KUBO can take to get from the bell to the bus stop.

- After the pairs decide on a route, they need to make a function for it. They must use the blue Record and Play Function tiles. The blue Play Function tile needs to be placed in the square where the school bell is located.

- One member from each group plays the guest and visits another group, while the other stays back as the host to show their function to a different guest. The guest then tries to guess the route by tracing it out on the map with his or her finger. The host then places KUBO on the blue Play Function tile to see if the route was guessed correctly.

- The host and guest must discuss why the group chose that route. The students then exchange roles and the activity continues.

- In Task 2, if students struggle with the concepts of trading groups and explaining their routes, they might be more successful if you offer support.

- To help students keep their route in the correct order when turning it into a function, have one student take the tiles off the route one at a time and hand them to their partner. The partner should put them in the correct order one at a time when making the function.

DISCUSSION QUESTIONS

- Do you remember what a function is?

- Can you make a function to take KUBO to the bus stop from the school bell?

- What do the Record and Play Function tiles do?

ACTIVITY 2:

KUBO Takes the Bus

- Would one of you like to come to the front and show your classmates how to make a function?

- How long of a route do you think KUBO can memorize?

- What is the advantage of making KUBO remember things?

- Did the guest guess the right route?

- Did different groups make the same routes?

- How many routes were there in total?

- Why did you choose the route you chose?

- How did you guess the routes?

REFLECTION

- How can you tell if the route you created is the best route for KUBO to take?

- What easy trick or tip helped you remember how to create a function correctly?

EXTENSION

- Choose a route and make a function to take KUBO from the soccer ball to the flagpole.

- Using two KUBO robots, choose a route and make a function to make the KUBOs meet in the middle of the activity map.

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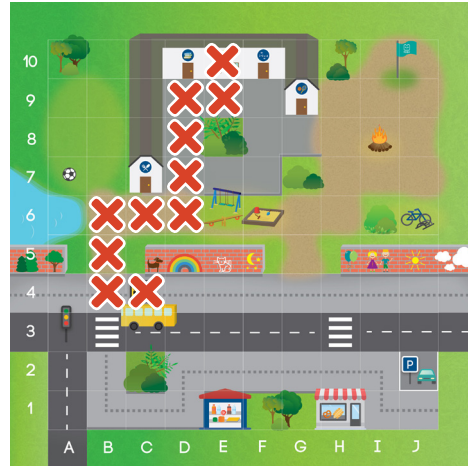## ANSWER KEY

Possible route students could create
for Task 1:

Possible function students could
create for Task 1:

ACTIVITY 3:

KUBO Has Recess

OUTCOME

- Work with functions.
- Create a game for KUBO to play at recess using the blue Record and Play Function tiles.

TIME

- 25 minutes

MATERIALS

- Movement TagTiles
- Blue Record and Play Function TagTiles
- Red Record and Play Function TagTiles
- KUBO
- Activity map

TEACHER NOTES

- Students must come up with a story that involves KUBO playing a game at recess.
- After the students have made their function, two groups get together to do the activity. They tell each other their stories and put KUBO on the blue Play Function tile. However, they are not allowed to show their function to each other.
- After KUBO has played the game, the groups have to guess which Movement tiles were used and try to re-create each other's functions using the red Function tiles. They must then test them to see if they were right and debug if necessary.
- If students are stuck on what kind of story to create, provide one or two examples of activities or games KUBO could do at recess to help give them some inspiration.
- When students use the red Function tiles to re-create each other's functions, make sure the red Function tiles are used as an additional function set, not as a subroutine.

DISCUSSION QUESTIONS

- Can you come up with a game for KUBO to play?
- Where did you take KUBO to play?
- Which game did you make KUBO play?
- What story did you make up for your game?
- Did you guess the other group's function correctly? If so, how?
- Was this activity harder than the previous one in which you had to look at the function and guess the route?

KUBO Has Recess

REFLECTION

- How was your recess game and story like the other group's? How was it different?

- What parts of the function were hard to guess? Why?

EXTENSION

- Create a different story and game for KUBO to play at recess. Make sure to include functions.

- Create a story and task for KUBO to do on the weekend. Make sure to include functions.

NOTES

Possible function students could
create for Task 1:

Possible route students could create
for Task 2:

ACTIVITY 4:

KUBO's Weekend Outing

OUTCOME

- Work with functions.

- Show KUBO around the map by making small assignments for your partner to do.

TIME

- 25 minutes

MATERIALS

- Movement TagTiles

- Blue Record and Play Function TagTiles

- Red Record and Play Function TagTiles

- KUBO

- Activity map

- Worksheet 2.3

TEACHER NOTES

- Students practice their communication skills with this activity.

- Have each student draw or write a story about KUBO on their worksheet. Students should include what KUBO can do and where KUBO would go.

- Students sit in a circle and share their stories and drawings with each other.

- Students go back to their groups and use the tiles to create routes for the stories they just shared.

- Have one student take his or her route and turn it into a function using the blue Function tiles. The other student will then take his or her route and turn it into a function using the red Function tiles.

- Students take turns having KUBO read and execute their functions. Then they will answer the question on the worksheet.

- If students are stuck on what kind of story to create, provide some story starter examples to help give them some inspiration.

DISCUSSION QUESTIONS

- What do you think KUBO will do during the course of the day?

- What details need to be included in a story?

- Do you think it will matter whether you use the blue Function tiles or the red Function tiles?

ACTIVITY 4:

KUBO's Weekend Outing

- Will the two different Function sets work the same or differently?

- What happened when KUBO executed the blue function?

- What happened when KUBO executed the red function?

REFLECTION

- What was the hardest part about having KUBO re-create your story? Why?

- How do you feel about using and understanding functions now

EXTENSION

- Create a story for another student that involves KUBO and the schoolyard so another student can make a function for KUBO.

- Create a story that involves KUBO and the bakery or grocery store so another student can make a function for KUBO.
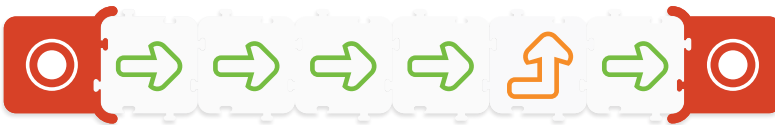
NOTES

Possible function students could
create for Task 2:

Possible function students could
create for Task 2:

Appendix

PRINTABLE PAGES

- Student worksheets
  - › In order by lesson plan and then activity
  - › Printable large images of the TagTiles on paper, which will allow younger students to more easily do Task 1 in Lesson Plan 1 and also Task 2 in Lesson Plan 3.
- Coding certificate diploma
- Activity map
- Blank activity map

All printable material can be downloaded from *kubo-robot.com/coding-license*

Standards Addressed

US ISTE CURRICULUM STANDARDS

Learning Outcome	KUBO CODING				KUBO CODING+		
	LP 1: Routes	LP 2: Functions	LP 3: Subroutines	LP 4: Loops	LP 1: Refresher course	LP 2: Advancing programming	LP 3: Challenge master
1a Students articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes.	●	●	●	●	●	●	●
1b Students build networks and customize their learning environments in ways that support the learning process.	●	●	●	●	●	●	●
1c Students use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.	●	●	●	●	●	●	●
1d Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.	●	●	●	●	●	●	●
2a Students cultivate and manage their digital identity and reputation and are aware of the permanence of their actions in the digital world.							
2b Students engage in positive, safe, legal, and ethical behavior when using technology, including social interactions online or when using networked devices.							
2c Students demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.							
2d Students manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.							
3a Students plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.							
3b Students evaluate the accuracy, perspective, credibility, and relevance of information, media, data, or other resources.							
3c Students curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.							
3d Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories, and pursuing answers and solutions.					●	●	●
4a Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.	●	●	●	●	●	●	●
4b Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.	●	●	●	●	●	●	●

Standards Addressed

US ISTE CURRICULUM STANDARDS

Learning Outcome	KUBO CODING				KUBO CODING+		
	LP 1: Routes	LP 2: Functions	LP 3: Subroutines	LP 4: Loops	LP 1: Refresher course	LP 2: Advancing programming	LP 3: Challenge master
4c Students develop, test and refine prototypes as part of a cyclical design process.	●	●	●	●	●	●	●
4d Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.	●	●	●	●	●	●	●
5a Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.	●	●	●	●	●	●	●
5b Students collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.	●	●	●	●	●	●	●
5c Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.	●	●	●	●	●	●	●
5d Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.	●	●	●	●	●	●	●
6a Students choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.	●	●	●	●	●	●	●
6b Students create original works or responsibly repurpose or remix digital resources into new creations.	●	●	●	●	●	●	●
6c Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.	●	●	●	●	●	●	●
6d Students publish or present content that customizes the message and medium for their intended audiences.	●	●	●	●	●	●	●
7a Students use digital tools to connect with learners from a variety of backgrounds and cultures, engaging with them in ways that broaden mutual understanding and learning.							
7b Students use collaborative technologies to work with others, including peers, experts, or community members, to examine issues and problems from multiple viewpoints.							
7c Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.					●	●	●
7d Students explore local and global issues and use collaborative technologies to work with others to investigate solutions.							●

Standards Addressed

UK NATIONAL CURRICULUM COMPUTER SCIENCE STANDARDS

	Learning Outcome	Curriculum Aspect	KUBO CODING				KUBO CODING+		
			LP 1: Routes	LP 2: Functions	LP 3: Subroutines	LP 4: Loops	LP 1: Refresher course	LP 2: Advancing programming	LP 3: Challenge master
AIMS	**The national curriculum for computing aims to ensure that all pupils:**								
	can understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation	CS	●	●	●	●	●	●	●
	can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems	CS	●	●	●	●	●	●	●
	can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems	IT	●	●	●	●	●	●	●
	are responsible, competent, confident and creative users of information and communication technology	DL	●	●	●	●	●	●	●
KEY STAGE 1	Understand what algorithms are	CS	●	●			●	●	●
	Understand that algorithms are implemented as programs on digital devices	CS	●	●				●	●
	Understand that programs execute by following precise and unambiguous instructions	CS	●	●			●	●	●
	Create simple programs	CS	●	●			●	●	●
	Debug simple programs	CS	●	●			●	●	●
	Use logical reasoning	CS	●	●			●	●	●
	Predict the behaviour of simple programs	CS	●	●			●	●	●
	Use technology purposefully to create, organise, store, manipulate and retrieve digital content	IT	●	●			●	●	●
	Recognise common uses of information technology beyond school	DL							

Standards Addressed

UK NATIONAL CURRICULUM COMPUTER SCIENCE STANDARDS

	Learning Outcome	Curriculum Aspect	KUBO CODING				KUBO CODING+		
			LP 1: Routes	LP 2: Functions	LP 3: Subroutines	LP 4: Loops	LP 1: Refresher course	LP 2: Advancing programming	LP 3: Challenge master
KEY STAGE 1	Use technology safely and respectfully	DL	●	●			●	●	●
	Keep personal information private	DL							
	Identify where to go for help and support when they have concerns about content or contact on the internet or other online technologies.	DL							
KEY STAGE 2	Design programs that accomplish specific goals	CS	●	●	●	●	●	●	●
	Write programs that accomplish specific goals	CS	●	●	●	●	●	●	●
	Debug programs that accomplish specific goals	CS	●	●	●	●	●	●	●
	Control or simulate physical systems	CS	●	●		●	●		●
	Solve problems by decomposing them into smaller parts	CS			●	●	●	●	●
	Use sequence in programs	CS	●	●	●	●	●	●	●
	Use selection in programs	CS							
	Use repetition in programs	CS				●	●	●	●
	Work with variables	CS							
	Work with inputs	CS	●	●	●	●	●	●	●

Standards Addressed

UK NATIONAL CURRICULUM COMPUTER SCIENCE STANDARDS

			KUBO CODING				KUBO CODING+		
Learning Outcome	Curriculum Aspect	LP 1: Routes	LP 2: Functions	LP 3: Subroutines	LP 4: Loops	LP 1: Refresher course	LP 2: Advancing programming	LP 3: Challenge master
KEY STAGE 2 Work with outputs	CS	●	●	●	●	●	●	●
Use logical reasoning to explain how some simple algorithms work	CS	●	●	●	●	●	●	●
Use logical reasoning to detect and correct errors in algorithms and programs	CS	●	●	●	●	●	●	●
Understand computer networks including the internet	CS							
Understand they can provide multiple services, such as the world wide web	CS							
Understand the opportunities they offer for communication and collaboration	DL							
Use search technologies effectively	IT							
Appreciate how results are selected and ranked	CS	●	●	●	●	●	●	●
Be descerning in evaluating digital content	DL							
Select, use and combine a variety of software (including internet services) on a range of digital devices to design and create a range of programs, systems and content that accomplish given goals, including collecting, analysing, evaluating and presenting data and information	IT							
Use technology safely, respectfully and responsibly	DL	●	●	●	●	●	●	●
Recognise acceptable/unacceptable behaviour	DL							
Identify a range of ways to report concerns about content and contact	DL							