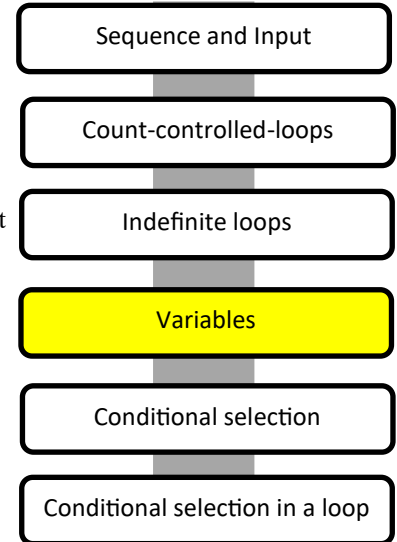


DRAWING WITH VARIABLES

How this module fits into a programming progression

Overview

Pupil explore how variables can be used in different ways before creating their own programs that use variables, sequences and loops.



To do before the session

- 1, Print pupil worksheets in colour double sided and staple into a booklet one for each student
- 2, Print 10 marksheets, sort into piles places where pupils can access them independently
- 3, Download the code needed and place in a templates folder on your school network or add to a Scratch Studio or link on your learning platform.
- 4, Download the variables slides that go with the concept introduction
- 5, Study the notes that go with the variables slides (if you have the Year 6 book)

To do at the start of the session

If you have not introduced **variables** with this class before do this first using the variable slides

To do after the concept has been introduced

It can also be helpful to show pupils how to create a variable if they haven't already done so and give them 20 mins to experiment with creating and using a variable without any directed theme. However useful this time is don't be tempted to believe that pupils have good understanding even if they can use variables in simple ways. They will need careful code comprehension in PRIMM to broaden their understanding.

Resource Name	Core Optional SEN	Teacher	Pupil Grouping	How Assessed	SCRATCH ACCESS
CONCEPT Variables that change	CORE	Leads Session	Solo whole class activity	Formative	NO
PREDICT	CORE	Support Poor Readers	Paired	Pupil Marked Marksheet Provided	NO
INVESTIGATE	CORE	Support Poor Readers	Paired	Pupil Marked Marksheet Provided	YES Variable fun
CHANGE	CORE	Support Poor Readers	Paired	Pupil Marked Marksheet Provided	YES Variable fun
CREATE	CORE	Assesses pupil work and checks pupil self assessment	Solo	Pupil Assessed & Teacher Assessed	YES Virginia Variables

Vocabulary
variable, assign, set, value, name

Core activities general instructions

- 1, Group pupils in roughly same ability pairs. For **investigate** and **change** worksheets pupils will work in pairs, for **create** they will work separately.
- 2, Give out the pupil booklets and explain that pupils need to follow the instructions on the sheets to explore how **variables** work.
- 3, Explain that each pupil will record separately whilst working alongside their partner and keeping to the same pace as their partner
- 4, Demonstrate where they can find the template code and explain that pupils will share one device for investigate and change but have a device each when they get to make
- 5, Explain that during each question only one person should touch the shared device and they should swap who that person is when there is a new questions.
- 6, Encourage them to discuss their answers with their partner. If they disagree with their partner they can record a different answer in their own booklet.
- 7, Show pupils where it says they should mark their work on the sheet and where the answer sheets are in the classroom.
- 8, Remind pupils to return marksheets after marking because there are not enough for every pair to have their own.

Key Programming Knowledge

Variables are used to store information to be referred to and changed in a computer programme or algorithm

Variables

- Have a name and a value
- read the name but act on the value
- Values can be changed during the algorithm or programme
- When writing the value of a variable we call it assigning

Variable Naming

- Always name a variable after the data that it stores or the task that it does
- Avoid naming variables with spaces teamScore (camelCase) user_name (underscore) are good methods to use

NOTE Scratch allows multiple word variables but few other programming languages do so it is better to get into good habits

Resources

Drawing with variables <https://scratch.mit.edu/projects/901296222/editor>

Virginia Computing Science Standards

Grade 4.1 The student will construct sets of step-by-step instructions (algorithms) both independently and collaboratively a. using sequencing; b. using loops; c. using variables to store and process data; and d. performing number calculations on variables (e.g., addition, subtraction, multiplication and division).

Grade 4.2 The student will construct programs to accomplish a task as a means of creative expression using a block- or text-based programming language, both independently and collaboratively a. using sequencing; b. using loops; c. using variables; and d. performing number calculations (e.g., addition, subtraction, multiplication and division) on variables.

Grade 4.3 The student will analyze, correct, and improve (debug) an algorithm that includes sequencing, events, loops and variables.

Grade 4.4 The student will create a plan as part of the iterative design process, independently and/or collaboratively using a variety of strategies (e.g., pair programming, storyboard, flowchart, pseudo-code, story map).

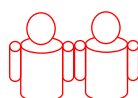
Grade 4.6 The student will break down (decompose) a larger problem into smaller sub-problems, both independently and collaboratively.



On the sheet if it says no Scratch they must work only on the sheet,



If it says Scratch with a green tick they can use Scratch



If it says work with a partner they must work at the same speed as their partner.



If it says work on their own they must do this using a separate device pairs can still discuss their work



DRAWING WITH VARIABLES

PREDICT



Read the code and the code labels carefully with your partner

Write or draw in the box what you think the code does

Assigns 50 to **distance** variable (Initialisation)

Move **distance** variable steps

Subtract 2 from **distance** variable

```
when this sprite clicked
  pen down
  set distance to 50
  repeat 10
    move distance steps
    change distance by -2
    turn 90 degrees
```

I predict this code will

When it is run

Assigns 0 **number_of_sides** variable (Initialisation)

Asks the users to type in a number and then assigns that number to **number_of_sides** variable

Loop **number_of_sides**

Divide 360 by **number_of_sides** and turn that amount of degrees

```
when this sprite clicked
  set number_of_sides to 0
  pen down
  ask Type in the number of sides as a number only and wait
  set number_of_sides to answer
  repeat number_of_sides
    move 30 steps
    turn 360 / number_of_sides degrees
```

I predict this code will

When it is run

Now mark your work using the predict marksheet

DRAWING WITH VARIABLES

INVESTIGATE



Work with a partner. Open Scratch and load Drawing with variables

Run the program as many times as you want. Work with a partner to answer these questions.

Look inside the Drawing sprite



1, How many lines of code are initialisation? HINT Initialisation code clears away the effects of running the code before so it can run the same way again

2, Finish the pattern to list all the values of the distance variable while the program is running

50, 48, _ , _ , _ , _ , _ , _ , _ , _

3, How many times is the turn 90 degrees block run?

4, Which line of code takes away 2 from the distance variable every time it goes through a loop?

Look inside the Shapes sprite



5, Once a number has been typed into an ask block, where does that answer go next?

HINT Answer is in the question (circle the right answer)

A, answer block B, number_of_sides variable C, Nowhere

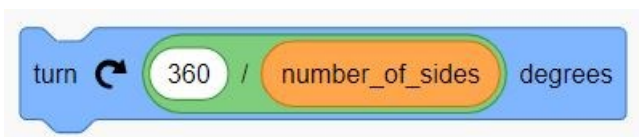
6, Once a number value is in the answer bloc where is it transferred to next? (circle the right answer)

A, answer block B, number_of_sides variable C, Nowhere

7, Complete the table

Users number	Repeats	Number of sides
3		3
7	7	
10		

8, What maths does this block do? (Add, subtract, multiply, divide)



Now mark your work using the investigate marksheet

DRAWING WITH VARIABLES

CHANGE

Work with a partner. Open Scratch and load

Drawing with variables



Work with a partner
of same ability

Make changes to the code to answer these questions



Make changes to Drawing

1, What three things can you do to make the program run faster?

A, B, C,

2, Change the code so that 50 lines are drawn. What did you change?

3, If the variable becomes a negative number what does the sprite do?

4, Change the code so that the lines starts at 100 steps before getting shorter. What did you change?

5, Change the code so that it draws a different shape pattern. What did you change?



Make changes to Shapes

6, Change the code so that shapes are drawn with another colour. What did you change?

7, Change the code so that all shapes drawn are larger. What did you change?

Now mark your work using the change marksheet



DRAWING WITH VARIABLES

CREATE



Work within Drawing with Variables to complete tasks 1 and 2

Task 1 Shapes

Create a new variable called length_of_side. Create code so that the user can input how long they want the shape side to be using a new ask and answer block.

Task 2 Shapes

Create a new variable called penSize. Create code so that the user can input how thick they want the shape lines to be using a new ask and answer block. HINT Set pen size to

Now work outside Drawing with variables to complete task 3

Task 3

Plan and make a program that starts with a large shape and then draws smaller and smaller shapes each time. Use variables to help you



Objects (sprites and back-grounds)	Algorithm Plan
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Teacher and Pupil Assessment

Circle one column on each row to show what you think you have achieved



	Not used a variable in my program	copied a variables idea exactly	Adapted a variable idea	Used variables in a way not shown in the example program
Variables	0 Marks	1 mark	2 marks	3 marks
			Not used previous programming concepts for real purpose	Used previous programming concepts for real purpose
Used previous programming concept such as loops correctly			0 Marks	1 mark

DRAWING WITH VARIABLES

PREDICT MARKSHEET



Read the code and the code labels carefully with your partner

Write or draw in the box what you think the code does

Assigns 50 to **distance** variable (Initialisation)

Move **distance** variable steps

Subtract 2 from **distance** variable

```
when this sprite clicked
  pen down
  set distance to 50
  repeat 10
    move distance steps
    change distance by -2
    turn 90 degrees
```

I predict this code will
Draw a square pattern that gets smaller OR an indication that the shape gets smaller (1 mark)
When it is run

Assigns 0 **number_of_sides** variable (Initialisation)

Asks the users to type in a number and then assigns that number to **number_of_sides** variable

Loop **number_of_sides**

Divide 360 by **number_of_sides** and turn that amount of degrees

```
when this sprite clicked
  set number_of_sides to 0
  pen down
  ask Type in the number of sides as a number only and wait
  set number_of_sides to answer
  repeat number_of_sides
    move 30 steps
    turn 360 / number_of_sides degrees
```

I predict this code will
Draw regular 2d shapes OR draw many shapes (1 mark)
When it is run

Now mark your work using the predict marksheet



DRAWING WITH VARIABLES

INVESTIGATE ANSWERS

Run the program as many times as you want. Work with a partner to answer these questions.

Look inside the Drawing sprite



1, How many lines of code are initialisation? HINT Initialisation code clears away the effects of running the code before so it can run the same way again

5 go to x and y, set rotation style, point in direction, set size, erase all (1 mark)

2, Finish the pattern to list all the values of the distance variable while the program is running

50, 48, **46, 44, 42, 40, 38, 36, 34, 32, 30 (1 mark)**

3, How many times is the turn 90 degrees block run?

10 times (1 mark)

4, Which line of code takes away 2 from the distance variable every time it goes through a loop?

Change distance by -2 (1 mark)



Look inside the Shapes sprite

5, Once a number has been typed into an ask block, where does that answer go next?

HINT Answer is in the question (circle the right answer)

A, answer block B, number_of_sides variable C, Nowhere **(1 mark)**

6, Once a number value is in the answer bloc where is it transferred to next? (circle the right answer)

A, answer block **B, number_of_sides variable** C, Nowhere **(1 mark)**

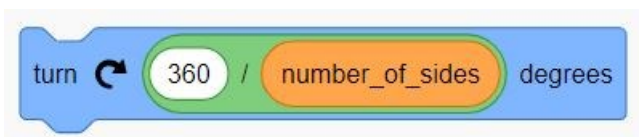
7, Complete the table

Users number	Repeats	Number of sides
3	3	3
7	7	7
10	10	10

(1 mark)

8, What maths does this block do? (Add, subtract, multiply, divide)

divide (1 mark)



DRAWING WITH VARIABLES

CHANGE MARKSHEET

Make changes to the code to answer these questions

Make changes to Drawing



1, What three things can you do to make the program run faster?

A, Change wait 0.3 seconds to a lower number B, Remove wait 0.3 seconds C, Change the say block to a number below 1 second such as 0.5 seconds (3 marks)

2, Change the code so that 50 lines are drawn. What did you change?

Change repeat 10 to repeat 50 (1 mark)

3, If the variable becomes a negative number what does the sprite do?

Moves backwards (1 mark)

4, Change the code so that the lines starts at 100 steps before getting shorter. What did you change?

Change set distance to 50 to 100 (1 mark)

5, Change the code so that it draws a different shape pattern. What did you change?

Change degrees it turns (1 mark)

Make changes to Shapes



6, Change the code so that shapes are drawn with another colour. What did you change?

Change set pen color (1 mark)

7, Change the code so that all shapes drawn are larger. What did you change?

Change move 30 steps to a larger number (1 mark)

DRAWING WITH VARIABLES

CREATE TEACHER HELP SHEET

Work within Drawing with Variables to complete tasks 1 and 2

Task 1 Shapes

Create a new variable called `length_of_side`. Create code so that the user can input how long they want the shape side to be using a new ask and answer block.

Task 2 Shapes

Create a new variable called `penSize`. Create code so that the user can input how thick they want the shape lines to be using a new ask and answer block. HINT Set pen size to

Now work outside Drawing with variables to complete task 3

Task 3

Plan and make a program that starts with a large shape and then draws smaller and smaller shapes each time. Use variables to help you



There are lots of ways to do this

```
when this sprite clicked
  set number_of_sides to 0
  set length_of_side to 0
  set penSize to 0
  set size to 50 %
  set pen color to red
  pen down
  erase all
  go to x: 18 y: 49
  ask "Type in the number of sides as a number only" and wait
  set number_of_sides to answer
  ask "How long would you like the sides to be? (number only)" and wait
  set length_of_side to answer
  ask "How thick do you want your line? (number only)" and wait
  set penSize to answer
  repeat (number_of_sides)
    set pen size to penSize
    move length_of_side steps
    wait 0.3 seconds
    turn 360 / number_of_sides degrees
    wait 0.3 seconds
```