Creating the Next Generation of Billionaires - Part 3


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Who am I?

PhD, Member of BCS.

Interested in developing appropriate teaching methods for Programming in Python for School Children and encouraging them to take it up as a hobby like music.

Building up a worthwhile Computer Science department in Schools
Interested Child
Governments Worldwide have dubbed:-

Computer pRogramming is the 4th ‘R’ along with Reading, wRiting and aRithmetic.

https://bulldogjob.com/news/82-how-computer-science-classes-are-conducted-around-the-world-5-key-conclusions

https://mapchart.net/world.html
Interested Child

Curious Grown-Ups!!

Me as Well!!
“The Subject is so young that teachers and curriculum designers have little pedagogical research to guide them”.

Economist
I developed my own framework
The Great Debate

To Teach a Block-Based Language First

![Scratch block-based language example]

To Teach a Textual Language such as Python First

![Python code example]

CLNandi (Dr)
Introduce Textual Programming Languages such as Python from the Very Beginning & as Early as Possible (as Opposed to Block-based Languages such as Scratch, etc.)

Discuss the advantages and disadvantages of Brexit? (8 marks)

Children are accustomed to processing complex textual data in a proficient manner.
Adopt a Bottom-Up Approach (as opposed to the ever popular Top-Down Approach Method of Teaching)

We found that children/young people/students embraced the Bottom-Up Approach.
Treat the teaching/learning of Computer Programming Languages in a similar fashion to teaching/learning Human Programming Languages.

This approach is to strengthen the grammar and fundamental building blocks.
Modifications to the Approach

(1) Primary Emphasis is on Correct/Expected Output

```python
# Program 1
Apples = 10
Bananas = 12
Total = Apples + Bananas
print(Total)
```

Output
22

Advantage is People Start Testing and Debugging from the beginning and this empowers them and frees the teacher!!

(2) Fundamental Unit is a Useful, Working Block of Code.

```python
For j in range(1,10):
    print(j)
```

```python
Sum = 0
While j < 5:
    Number = int(input("Enter a number "))
    Sum = Sum + Number
print(Sum)
Average = Sum/5
print(Sum)
print (Average)
```

(3) Teacher-Led Examples & Importance of Repetition & Memory

We memorise poetry, pieces of music, multiplication tables.

(4) Introducing the “Wow Factor”

Any Working Program is sufficient to enthuse the learner.
Curious Grown-Ups Codes

Programs Created of Own Volition

```
1 for x in range(7, 59, 9):
2     print(x)
```

```
for x in range(1, 110, 7):
    print(x)
```

Output

```
7
16
25
34
43
52
```

```
1
8
15
22
29
36
```

“For Loop - I like it particularly, because it does all the laborious calculations so quickly and saves a lot of time....also codes eliminate human mistakes which could arise out of boredom of doing the same task over and over again”
Curious Grown-Ups Codes

Worked Example

1 # Program 2
2 def Addition2(a,b):
3     Total = a + b
4     print(Total)

1 # Calling Program 2
2 Addition2(100,200)

00

1 Addition2(32,28)
0

Programs Created of Own Volition

1 def add_travel(b_number):
2     return b_number+20

1 add_travel(70)
90

1 def add_apartments(j_number):
2     return j_number+2000

1 add_apartments(900)
2900

1 def deduct_cars(H_number):
2     return H_number-40

1 deduct_cars(700)
660

Examples with Applications
“I like Selection and Conditional statements - I find it interesting that if, else and else take into account different situations and come up with different options - which could help with making small or big decisions”
 Interested Children Codes

Worked Example

```python
# Program make a simple calculator
# This function adds two numbers
def add(x, y):
    Total = x+y
    return(Total)

# This function subtracts two numbers
def subtract(x, y):
    Total = x-y
    return(Total)

# Check if choice is one of the four options
if choice == '1':
    Result = add(num1,num2)
    print(num1, "+", num2, "=", Result)
elif choice == '2':
    Result = subtract(num1,num2)
    print(num1, "-", num2, "=", Result)
else:
    print("Invalid Input. Try again")

# End While
main()
```

Question 1 - Now extend the above program to:

- Include an Option which allows users to choose Multiplication
- Include an Option which allows users to choose Division
- Allow the user to input both real and integers
- Include an option which calculates the MOD of the numbers entered.

Answer to Question

```python
# Put your code here
# Program make a simple calculator
# This function adds two numbers
def add(x, y):
    Total = x+y
    return(Total)

# This function subtracts two numbers
def subtract(x, y):
    Total = x-y
    return(Total)

def division(x, y):
    Total = x/y
    return(Total)

def mod(x, y):
    Total = x%y
    return(Total)

# Check if choice is one of the four options
if choice == '1':
    Result = add(num1, num2)
    print(num1, " +", num2, " =", Result)
elif choice == '2':
    Result = subtract(num1, num2)
    print(num1, " -", num2, " =", Result)
else:
    print("Invalid Input. Try again")
```

Tests

- 1. Added the extra functions at the correct places
- 2. Studied the structure of the program and knew where and how to add these extra functions
Interested Children - Guess the number program

Question 7 - Write a Function where the Computer Randomly generates a number between 1 and 100. And you as the user have to guess the number until you get it right. The Program will report on whether the number you have guess is too high or too low or if you can guess it correctly.

Program Created

```python
# Put Code Here
import random

def Guess_the_number():
    computer = random.randint(1,100)
    print('Enter a number between 1-100')
    if User_input == computer:
        print('you got it right')
        Active = False
    elif User_input > computer:
        print('too high')
    else:
        print('too low')

Guess_the_number()
```

Suggested Answer

```python
1 def Guess_Number():
2     import random
3     Computer_Number = random.randint(1,100)  # Computer Generates a Random Number between 1 and 10
4     print('The Computer has generated the Number ', Computer_Number)
5     while True:  # Notice a different way of putting the condition here
6         User_Guess = int(input('Enter a Number '))
7         if User_Guess == Computer_Number:
8             break  #The break statement allows you to come out of the WHILE block
9         elif User_Guess < Computer_Number:
10             print('Try Again. Your Guess is Too Low ')
11             else:
12                 print('Try again. Your Guess is Too High ')
13     print('Well done. You have guessed the Correct Number')

1 Guess_Number()
```

1. Wrote Program from Scratch
2. Provided Slightly different structure from given answer
3. Inadvertently highlighted that there is more than 1 solution to a problem.
4. Also, tested the program.
Interested Children Codes

Exercise 9 - Please see the lists below for the number of people vaccinated in various different countries (data taken from John Hopkins website)

1. [China, USA, India, Germany, UK, Brazil]
2. [223299000, 161473715, 85453618, 38843476, 36099727]
3. Write a Program which calculates the total number vaccinated in this group. Use a FOR loop for this.
4. Extend the above program to calculate the average number of vaccinations in this group.

Program Created

```python
vaccines = [223299000, 161473715, 85453618, 38843476, 36099727]
print("Sum using inbuilt function ", sum(vaccines))

def number_vaccines():
    sum = 0
    for j in range (len(vaccines)):
        sum = sum + vaccines [j]
    average = sum / len(vaccines)
    print("\nSum", sum, "\nAverage ", average)
number_vaccines()
```

(1) He has solved the problem in 2 different ways:-

(i) Using Built-In Sum Function

(ii) Creating the Function

(2) He has developed the Program from Scratch

(3) He is using Real World Covid-19 Data from a Respected Scientific Source

(4) He has created the Program after studying lots of Worked Examples and playing with them.

They liked these large numbers!!

545 million

109 million
Conclusions & General Observations

(1) Interested Children had a more analytical approach whereas the curious grown-ups exhibited a more creative approach.

(2) Interested Children were more comfortable with the concept of errors and correcting them whereas the grown-ups placed more emphasis on precision.

(3) Interested Children had a more intuitive grasp of coding concepts whereas grown-ups had to be explicitly taught. However, the grown-ups seemed to appreciate the ideas better.

(4) Curious Grown-Ups voiced more interest in what would be the real-life applications of all of this.

(5) This framework of a teacher-led explanatory approach with an emphasis on memory, repetition and blocks of code appeared to be successful.

(6) Both curious adults and interested children felt they were making good progress and felt happy.
“I never teach my pupils, I only attempt to provide the conditions in which they can learn”

(Albert Einstein)
Any Questions?

Thank you for your time.

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