Taking Part in the Greatest Experiment in History

[During the Pandemic Lockdown: Online Teaching and Learning in Computer Programming for High School Children aged 11-18 by CLNandi (Dr)]

EuroPython 2020

CONTENTS

<u>1.0 Introduction</u>

In Computer Science, with the sudden commencement of Lockdown, we, at a High School in the UK, also joined the worldwide online learning and teaching forum, alongside an estimated 900 million children in over 100 countries. In years to come, the scale of the venture will be surely be considered as one of the greatest experiments in online teaching in the history of mankind.

Because of the pandemic, only virtual/online mediums of instructions were permitted. Naturally, everyone - teachers, students, parents, myself included, began to ask themselves about how could the online medium could possibly supplement and complement the face-to-face teaching practices which have been established and perfected over many centuries.

And the key to making the episode of teaching and learning on online mediums run smoothly and well, came with the realisation that "*the medium is the message*", this is a phrase coined by a Cambridge graduate and philosopher, Professor Herbet McLuhan. This essentially means that each medium of instruction has its own unique signature accompanied by its own set of strengths and advantages. It only remains for us to discover those assets and to capitalise on them. We discovered amongst other things that the online medium was very good for better listening which in turn can lead to good understanding.

In the end, I personally found the whole experience of online teaching and learning Computer Programming in Python to a group of young High School students, extremely educational, informative and highly rewarding and I would like to briefly share some of my experiences and findings with you.

During this period we decided to continue to focus on the very important topic of the fundamentals and building blocks of Computer Programming through the Python programming language. We looked at 3 important areas of Computer Programming - that of Development, Testing and Modelling. It is important to realise that these are universal templates and not just confined to Computer Programming and Computer Science.

2.0 Development

With regards to "Development", we started off by discussing the role development plays in the real-world. We did not have to look far for typical examples - the COVID-19 vaccines are undergoing a developmental process. This developmental process is occurring in phases with one phase being completed before another phase can begin. We can say that the developmental process is somewhat modular in nature. Hence, the idea that a problem is divided up into modules (or units) is prevalent in society. In a somewhat similar manner, the Computer Program can be divided up into modules with each module dedicated to a particular task. We then looked at examples of Computer Programs containing modules. Interestingly enough this idea of modules is something children grasp intuitively when introduced to them and one student wrote:-

"I enjoyed learning about functions (i.e modules) and how to define them so you could access them at any moment". (Alex, aged 11).

Below is a program which uses a function to generate a random password by Nikhita (aged 12).

```python
     'Stephan']
51   Sampling = random.choice (Names)
52   print(Sampling)
53
54  Random_Name()
55  |
56  '''
57  # Program 8 – Generating a Random Password of 8
    characters using a 2nd method
58  import random
59  import string
60  LowercaseLetters = string.ascii_lowercase
61  print("Lowercase Letters ", LowercaseLetters)
62  UppercaseLetters = string.ascii_uppercase
63  print("Uppercase letters ", UppercaseLetters)
64  DigitLetters = string.digits
65  print("Digits ", DigitLetters)
66  All = LowercaseLetters + UppercaseLetters +
    DigitLetters
67
68  def Generate_Password_Method_2():
69      Sampling = random.choices(All,k=9)
70      print(Sampling)
71      New_Password = ''.join(Sampling)
72      print(New_Password)
73
74  Generate_Password_Method_2()
75
```

```
Lowercase Letters  abcdefghijklmnopqrstuvwxyz
Uppercase letters  ABCDEFGHIJKLMNOPQRSTUVWXYZ
Digits  0123456789
['Z', 'i', 'J', 'h', 'Q', 'Q', 'W', 'P', 'i']
ZiJhQQWPi
>
```

3.0 Testing

Then we went to look at the idea of "testing" of Computer Programs. Again the idea of testing is not merely academic - perhaps the Pandemic highlighted the fact that technology and Computer Programs are now a critical part of the infrastructure of a modern society - in the same way roads, bridges and planes are. Very much at the heart of progress of modern the society are working Computer Programs. Software which works properly saves the economy billions of pounds. One of the aspects in testing is identifying different types of errors in the programs called Syntax errors and correcting them. It is not unusual for a Computer Programmer to spend half an hour writing a program and then spend several hours identifying and correcting the Syntax errors. This part of Computer Programming is identified as a necessary evil and I introduced the subject in a somewhat apologetic manner to the children. To my surprise, the children were quite enjoying identifying and correcting Syntax errors. Here are some of the comments made by the children:-

"To me the most interesting part was the mistakes. When we made them they could have been minor but made such a difference. It was interesting to see how that counted and how intricate a system really is". (Lily, aged 12).

"I have enjoyed learning how to create a code that generates a random password. I liked working on this partly because, when I wrote it out it had a syntax error; this made me experiment which was very fun. After fixing it, I decided to improve it as well, which made another problem:…" (Harry, aged 11). Below is the improved program produced by Harry In it he has defined a set of playing cards and the program when run randomly selects one of these playing cards.

```
29
30    def Playing Cards():
31        Playing Cards = ['AH','2H','3H','4H','5H','6H','7H',
          '8H','9H','10H','JH','QH','KH','AS','2S','3S','4S',
          '5S','6S','7S','8S','9S','10S','JS','QS','KS','AD',
          '2D','3D','4D','5D','6D','7D','8D','9D','10D','JD',
          'QD','KD','AC','2C','3C','4C','5C','6C','7C','8C',
          '9C','10C','JC','QC','KC']
32        Sampling = random.sample(Playing Cards, k=1)
33        print(Sampling)
34
35
36    Playing Cards()
```
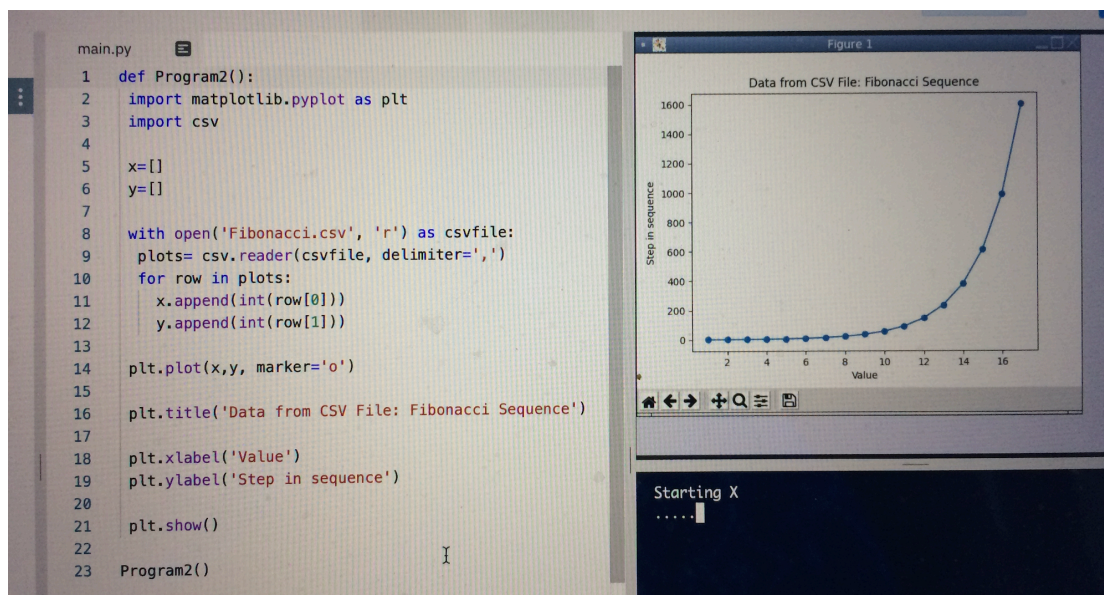
Page 5

4.0 Modelling and Simulation

Finally, we looked at Modelling and Simulation. Here also we did not have to look far for important examples of modelling and simulation. The COVID-19 forecasts have arisen as a result of Modelling and Simulation, and the Python programming language has played an important role in all of this. And graphs are integral to Modelling and Simulation. So, we looked at how we can create Computer Programs to generate graphs. Here is an example of some code written by a student (Shivonne, aged 13) to plot Fibonacci numbers.

Fibonacci.csv

1	1,1
2	2,1
3	3,2
4	4,3
5	5,5
6	6,8
7	7,13
8	8,21
9	9,34
10	10,55
11	11,89
12	12,144
13	13,233
14	14,377
15	15,610
16	16,987
17	17,1597

```python
def Program2():
  import matplotlib.pyplot as plt
  import csv

  x=[]
  y=[]

  with open('Fibonacci.csv', 'r') as csvfile:
   plots= csv.reader(csvfile, delimiter=',')
   for row in plots:
     x.append(int(row[0]))
     y.append(int(row[1]))

  plt.plot(x,y, marker='o')

  plt.title('Data from CSV File: Fibonacci Sequence')

  plt.xlabel('Value')
  plt.ylabel('Step in sequence')

  plt.show()

Program2()
```


5.0 Some Other Exciting Moments

Some other exciting moments arose from the spontaneous comments, reactions and questions from the children - *"will you tell my parents?" Ben, aged 12,* kept on asking every time he had a working Computer Program. *""I have written a program to generate a passcode of 6 digits",* said Anna, aged 12. *What Programming language is Excel written in?"* Boris, aged 13 enquired. *"How do I make the program do…."* Asked Annette, aged 13. *"I will share my screen ",* said Anton aged 13. as he volunteered to show his working program to the whole class.

6.0 Conclusion

(1) Accessing the power and the motivating power of online teaching - when properly done - are enormous! it has been a great privilege to partake in online teaching/learning

(2) It is very exciting to be part of a field which is in its infancy and rapidly developing. We look forward to the day when these wondrous experiences can be enjoyed by everyone.

7.0 References

1. YouTube Channel: lil anonymous
2. Website: https://computersciencegcsealevel.wordpress.com
3. Email: demo999@yahoo.com

8.0 Live Poster Session

(1) Live Poster Session on Thursday 23rd July 2020 between 11:15pm - 12pm (UTC)

9.0 Live Talk Details

(1) Live Talk on "*Creating the Next Generation of Billionaires - Part II*" Friday 24th July 2020 between 1:45pm and 2:15pm (UTC) in the Microsoft Room.

- The End -