An Experience Report on the Effectiveness of Five Themed Workshops at Inspiring High School Students to Learn Coding

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Outline

• Background and aim
• The five themed workshops
• Data collection & Questionnaire design
• Results & Lessons learned
• Conclusions
Background and aim

• Problem
  • Fewer students pick coding studies because of negative stereotypes

• A fun and educational event to
  • “Inspire teenagers in Cyprus to take an interest in coding”

• Kick-off funding
  • Cyprus Fulbright - Alumni Small Grants Scheme (2013)

• First Code Cyprus
  • First **Code Cyprus** on March 8th 2014
  • Since then, First Saturday of March every year
Approach

• A fun and educational event

• Plenary keynote on the “beauty and value of coding”

• Parallel hands-on workshops
  • More about these soon...

• Lunch

• Treasure hunt with prizes
Workshops

• Goal: Introduce three fundamental coding concepts
  • Variables, Conditionals, Loops
• Typically two hour-long
  • First part lecture/tutorial
  • Second part hands-on practical
• Workshops during data collection (March 2017):
  • Beginners programming
  • Games challenge
  • Robotics challenge
  • Querying data with SQL
  • Programming microelectronics with Arduino
Workshop: Beginners programming

• Aimed at ‘newbies’
• Based on Python
• Designed to be interactive (i.e. use an online interpreter that presented the output immediately)
Workshop: Games challenge

• Aimed at ‘intermediate’ level participants
• Introduced concept of algorithms
  • Maze solving with left(or right)-wall-following algorithm
• Practical using Code Combat with Python
Workshop: Robotics challenge

- Aimed at ‘intermediate’ level participants
- Based on the Engino Robotic Platform (ERP)
- Practical included the programming of ERP to realize the ‘line following algorithm’
Workshop: Querying data with SQL

• Aimed at ‘advanced’ level participants
• Covered standard coding constructs (conditionals and loops) as well as SQL selection queries
• Practical using a custom-made interactive web application to form appropriate queries
Workshop: Programming micro-electronics with Arduino

• Aimed at ‘advanced’ level participants
• Using a standard Arduino micro circuit board
• Windows-based IDE and C++ based code
• Practical challenge was to develop a traffic lights prototype
Data collection

• Research question
  • “Are individual workshops/themes more effective in engaging participants to take an interest in coding?”
  • Effectiveness: understand more, appeal more

• Approach
  • Participants to fill in individual questionnaires during the workshops and compare the results

• Questionnaire consisted of 4 pages (parts A, B, C, D)
  • Parts A and B were filled before the workshop start
  • Parts C and D were filled after the workshop end
Questionnaire design

• Part A
  • Demographic data (age, gender) and self-assessment of math/programming skills

• Part B
  • Questions to identify participants’ understanding of variables, conditionals, loops before the workshop

• Part C
  • Similar to Part B but aims to measure the participants’ understanding after the workshop

• Part D
  • Self-assessment of their progress and personal impression on programming
Questionnaire design

• Part B excerpt

Part B – What do you know

7. What do you think the following code will print? If you don’t know programming yet, just try to answer anyway:

```plaintext
set anna to 6
set bill to 5
set ed to anna + bill
print "Anna and Bill together have " + ed
print 3
print "(euro"
```

Answer: ____________________________

8. What do you think the following code will print? If you don’t know programming yet, just try to answer anyway:

```plaintext
set count to 1
repeat 4 times
  do set count to count + 1
print count
```

Answer: ____________________________

9. What do you think the following code will print? If you don’t know programming yet, just try to answer anyway:

```plaintext
set temperature to 17
if temperature <= 15
  do print "It's cold today"
else
  do print "It's warm today"
```

Answer: ____________________________
Results & Lessons learned

Table 1: Summary of participants - demographic data

<table>
<thead>
<tr>
<th>Workshop</th>
<th>Ard.</th>
<th>Beg.</th>
<th>Gam.</th>
<th>Rob.</th>
<th>SQL</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
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<td>34</td>
<td>18</td>
<td>29</td>
<td>10</td>
<td>99</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Ard.</th>
<th>Beg.</th>
<th>Gam.</th>
<th>Rob.</th>
<th>SQL</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
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<td>16</td>
<td>12</td>
<td>16</td>
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<td>62</td>
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<tr>
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<td>18</td>
<td>5</td>
<td>13</td>
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<tr>
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<td>0</td>
<td>0</td>
<td>1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Ard.</th>
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<th>Total</th>
</tr>
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<tbody>
<tr>
<td>Min</td>
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<td>11</td>
<td>12</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
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<td>14</td>
<td>15</td>
<td>14</td>
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<td>16</td>
<td>18</td>
<td>18</td>
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<td>21</td>
</tr>
</tbody>
</table>
Participant self-rated math and coding skills, grouped by workshop
Participants’ view of programming, grouped by workshop
Comparison of correct answers before and after the intervention, grouped by workshop
Conclusions

• Compared effectiveness of 5 themed workshops at “inspiring high school students to take an interest in coding”
  • Verified ‘gender gap’ engaging young persons to learn coding
  • Confirmed the value of ‘themed activities’, like the use of robotics
  • Identified challenge of attracting the ‘right audience’

• You might also want to look at:
  • Code Cyprus page, http://about.codecyprus.org
  • Treasure hunt app, https://github.com/NPaspallis/CodeCyprusApp
  • Backend, https://github.com/nearchos/uclan-thc
Questions?

• Thank you!