ALGORITHMS AND INITIAL PROGRAMMING: DIFFERENT PUBLIC, DIFFERENT TEACHING-LEARNING?

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Abstract

How to teach the first steps in programming is an old question: How to teach? What to teach? Who learns best? What is the right age to start? Women are just as capable as men? All these issues concern IT teachers. We can have much experience teaching algorithms and initial programming but we have no certainties; we need have the best clues to improve performance.
The study of this paper compares two completely different groups: one consisting of college students a 1st cycle degree in computer science and another group of unemployed adults. The surveys were completed at the beginning and at the end of an introductory module to programming concepts, using top-down and algorithms. The first survey (initial) focuses on taste, dexterity, use and computer prior knowledge, the second (final) on the ease/difficulty with algorithmic reasoning, as well as its self-assessment for some taught knowledge during the module (such as read/write variables), use of cycles and if-then-else. The focus is to teach each person differently according to their characteristics. That would be excellent.
This study characterizes the students so that they learn best.

Keywords: Technology, curriculum, higher education, initial programming.

1 INTRODUCTION

The introductory teaching of programming in the early years of the computer science area has a high rate of failures [1]. The introductory programming courses (U.C.) have an unquestionable importance in the 1st cycle Informatics curriculum by the importance of their materials either by its positioning in 1ºs years of the plans of the courses. The performance in these U.C. will decisively influence the success or failure of the rest of 1st cycle studies. Since she graduated the author has been teaching introduction to programming. So it has directly observed various types of difficulties encountered by students: in the apprehension of knowledge and by the fellow teachers in form and content to teach. This type of U.C. have high failure rates [2] [3] [4] [5]. In these years I have investigated in order to find clues to an improvement of this teaching / learning: different approach different the public, content (what to teach?), programming languages (an old question in the teaching of programming). This article is the comparison between two very different student groups: a group consisting of students from the first year of a degree in computer science and another group consisting of unemployed who wish to (re)enter into the world of employment and who attended a web programming course. Both groups attended to one initial module of initial programming and algorithms. The two were asked to answer two surveys: an initial characterization and another final to measure the difficulties encountered.

2 THE INQUIRIES

Both inquiries were answered with Google Drive. They intended to be anonymous for obvious reasons, however was sought so that the number of student (in the case of the first group) and name (in the case of the second group) were filled in order to check whether any students answer to more than one investigation and to be able to cross the original investigation and final, as well as the grades obtained.
In this first survey were asked: a) Personal information: Number of student, year birth, Sex. To the second group were asked about qualifications and area of qualifications. b) Relationship with technology (1-none to 5-very): Taste for technology? Interest in technology? Technological possess? And Motivation for learning ITs. c) Do you have an account on Facebook, Gmail, YouTube, Instagram, Snapchat, Twitter, LinkedIn, Google+ Blogs / WordPress? d) Often uses

digital library, Wikipedia, Google. e) Usually the web serves to: Social networks, newspapers, digital libraries, Games, E-mail. f) It has 3G, 4G, PS4 (or similar), Portable, Tablet, Smartphone. g) In Word can do: sections, chapters Index of figures / tables ... Manage references, Headers / Footers different, Cross-reference. h) In Excel can do: Insert formulas / functions, using filters, create graphics, sorting. I) In PowerPoint you can do: Timings, Animations, Use the Slide Master, Transitions. j) To the first group: any TI discipline in the secondary? If yes: what subjects they had? In what years? If yes: these disciplines have been useful? In what way? The second group was asked if had programming knowledge and if so was asked to explain this knowledge.
In the second survey were asked: a) some of the personal information of the first investigation. b) Rate 1 (nothing) to 5 (very) "In the future I see myself as a computer programmer." C) Rate 1 (nothing) to 5 (very) "My difficulty is in understanding the problems," "My difficulty is writing the steps of Top-Down" and "My difficulty is decorating the organization of the algorithm". D) Assuming that took 25 hours of Course, how many hours did study outside the classroom? Self-evaluate ([0, 4[, [4, 8[, [8, 12[, [12, 16[and [16, 20]: Read and write variables, If-Then-Else, Cycles.

3. CHARACTERIZATION OF THE TWO GROUPS

3.1 First Group

The first group consisted of 16 students of a university course with an average age of 20.125 years (1 33, 1 23, 2 21, 2 20, 4 19 and 6 18 years), 4 female and 12 male.

50% of students said they never had any IT discipline in secondary education, and the other 50% said they had computer applications in 12th grade and only one said he was from technical and vocational education.

The average (1-5) of the answers to the question "do you like technology" was 4.75, Interest in technology? 4,875, technological dexterity? 3.9375 And motivation for learning IT 4.4375.

100% said they have account on Facebook, 87.5% Gmail, YouTube 93.75%, 75% Instagram, 81.25% Snapchat, 62.5% Twitter, only 12.5% LinkedIn, 68 75% Google + and 25% in Blogs / WordPress. 93.75% usually use the Internet for social networks, 93.75% Newspapers, 50% Digital Libraries, Games 87.50%, 68.75% Wikipedia, Google 93.75% and 100% for E-mail. 93.75% have 3G, 4G 62.50%, 75.00% PS4 or similar, 81.25% Laptop, Tablet 68.75% and 93.75% Smartphone.

In MsWord 50% say knowing how to use Sections, 100% chapter index, 75% figures Index, 56.25% Managing references, 31.25% Cross-reference and 87.50% Headers and Footers. In MsExcel 87.50% know how to use formulas and functions, 62.50% Using filters, 75% graphics and 43.75% sorts. In Power Point 93.75% can do Timings, 100% Animation, 68.75% Use Slide Master and 93.75% knows how to make transitions.

3.2 Second Group

The second group consisted of 37 students from three courses for unemployed people with an average age of 32 years (2 over 50s, 4 aged 40 and 50, 14 between 30 and 40 and 17 students aged 22 to 29). 13 students were female and 24 male.

29.72% have the 12th year as qualification, 59.46% 1st cycle and 10.81% have a Master degree. 21% had studied in the IT area, and the remaining belonged to areas as diverse as Architecture (8.1%), Design (18.91%), other Engineering (18.91%), but also Law, History, Journalism, Psychology and others. 48.65% have said to have computer skills: HTML, basic, Fortran, css, JavaScript, php, Basic, VB.NET, VBScript, C #, C, JavaScript, Java, ActionScript, Lisp, C ++, assembly, Pascal, ActionScript .

The mean (1-5) of the answers to question "do you like technology" was 4.27, Interest in technology? 4.24, technological dexterity? 3,51e Learning motivation to computer science 4.43.

86.49% said to have account on Facebook, 97.3% in Gmail, 83.78% in YouTube, 27.03% in Instagram, Snapchat 2.7%, 24.32% on Twitter, 67.57% in LinkedIn, 64.86% on Google+ and 24.32% in Blogs / WordPress. 83.78% say they usually use Internet for social networks, 83.78%

Newspapers, 70.27% Digital Libraries, 70.27% Games 75.68% Wikipedia, Google 100.00% and 100% for E-mail. 51.35% have 3G, 4G 16.22%, 18.92% PS4 or similar, 94.59% Laptop, Tablet 48.65% and 86.49% Smartphone.

In MsWord 75.68% said knowing how to use Sections 89.19% Index chapters, 83.78% Index figures, 56.76% Managing references, 29.73% Cross-reference and 97.3% Headers and Footers. In MsExcel 89.19% know how to use formulas and functions, 78.38% Using filters, 81% graphics and 78.38% Sorts. In Power Point 67.57% can do Timings, 78.38% Animations, 56.76% Use Slide Master and 75.68% knows how to make transitions.

3.3 Comparison between groups

While the average age of the first group stood at 20.125 years (with only 6.25% over the age of 30 years), in the second group the average age stood at 32 years (and 54% more than 30 years). In the first group there were 25% women, the second group had 35%.

Table 1. Comparison between the two groups regarding age.

Age	1st Group	2nd Group
<20	62,50%	
[20, 30][	31,25%	45,95%
[30, 40[	6,25%	37,84%
[40, 50[		10,81%
>=50		5,41%

Table 2. Comparison between the two groups regarding *gender.*

Gender	1st Group	2nd Group
Feminine	25%	35,14%
Masculine	75%	64,86%

The *average* (1-5) of the answers to the question taste for technology (4.75 and 4.27) Interest in technology? (4.875 *And* 4.24), technological Dexterity (3.9375 and 3.51) and motivation for learning Tis (4.4375 and 4.43) have to be very similar.

Table 3. Comparison between the two groups regarding taste and interest for technology, dexterity and motivation.

	1st Group	2st Group
Fondness for technology?	4.75	4.27
Interest for technology?	4.875	4.24
Technological dexterity?	3.9375	3.51
Motivation for learning Tis?	4.4375	4.43

Table 4. Comparison between the two groups regarding registration on some sites

Account	1st Group	2nd Group
Facebook	100%	86,49%
Gmail	87,5%	97,3%
YouTube	93,75%	83,78%
Instagram	75%	27,03%
Snap Chat	81,25%	2,7%
Twitter	62,5%	24,32%
LinkedIn	12,5%	67,57%

Google +	68,75%	64,86%
Blogs/WordPress	25%	24,32%

As for the use of applications, responses differed greatly between the two groups: the first group all had Facebook account while in the second group did not have 6.25%; 75% of the first group had Instagram while in the second only 27.03%, 81.25% and 2.7% respectively in Snapchat, 62.5% and 24.32% on Twitter, 12.5% and 67, 57% by *LinkedIn*. *This* is justified by the average age being higher in the second group, consisting of job seekers.

Table 5. Comparison between the two groups as the usual use of the Internet.

Usual use of the Internet	1st Group	2nd Group
Social networks	93,75%	83,78%
Newspapers	93,75%	83,78%
Digital libraries	50%	70,27%
Games	87,50%	70,27%
Wikipedia	68,75%	75,68%
Google	93,75%	100%
E-mail	100%	100%

The Internet use is not significantly di*fferent between the two groups.*

Table 6. Comparison between the two groups regarding the possession of computer equipment.

Do You have:	1st Group	2nd Group
3G	93,75%	51,35%
4G	62,50%	16,22%
PS4 or similar	75,00%	18,92%
Laptop	81,25%	94,59%
Tablet	68,75%	48,65%
Smartphone	93, 75%.	86,49%

The possession of technology, it is seen that the first group has more advanced mobile technologies, as well as devices for gaming.

There is no significant difference in the use of MsWord, MsExcel and MsPowerPoint for both groups.

Table 7. Comparison between the two groups regarding MsWord.

On MsWord knows how to do:	1st Group	2nd Group
Sections	50%	75.68%
Chapter index	100%	89.19%
Figures/Tables Index...	75%	83.78%
Managing bibliographical references	56.25%	56.76%
Different headers/footers	87.50%	97.3%
Cross-reference	31.25%	29.73%

Table 8. Comparison between the two groups regarding MsExcel.

On MsExcel knows how to do:	1st Group	2nd Group
Insert formulas/functions	87.50%	89.19%
Using filters	62.50%	78.38%

Creating graphics	75%	81%
Doing ordinations	43.75%	78.38%

Table 9. Comparison between the two groups regarding MsPowerPoint.

On MsPowerPoint knows how to do:	1st Group	2nd Group
Temporizations	93.75%	67.57%
Animations	100%	78.38%
Using slide master	68.75%	56.76%
Transitions	93.75%	75.68%

4. SYBALUS AND CLASSIFICATIONS

The course attended by the first group called "algorithms and initial programming" and is the first contact of students with the computer. It is a course of 1st year and 1st semester. In this document we are only studying the first part of the course so that they can make a comparison with the second group.

The syllabus of the two groups was the same: use of top-down and algorithms to solve simple problems of computing, using variables, conditional structures, cycles (FOR, DO WHILE and DO UNTIL), as well as arrays. The first group got a programming language (C), while the second group had contact with programming languages only after this module. In the first group there was a weekly schedule (six hours per week), the second module group has been given a little over one week (7 hours per day). In the first case it was made three small test and a final test, while in the second case were made four small test.

We consider only the students who completed the surveys. To be able to compare notes we use the average of the four tests although the average was not the final grade of the course of the first group or the second group module, since in both cases there were other elements of assessment less objective.

In the first group there was obtained an average of 12.18; the second gave an average of 11.8. In this group we can see that in terms of qualifications: average of 11.8 for student's 12th grade, 11.09 for graduate students and 9.5 for master degree. The under 30 group had a mean of 11.18; the group between 30 and 39 had 10.93; and the group older than 39 years was 11.33.

In the first group, men had an average of 13.95 and 6.67 women. 83.33% of men have had success, while women only 25% were able to have a score greater than 10 on these items. In the second group, men had an average of 11.5 and women 10.38. But while 66% of men had a score greater than 10 considered these items, 58.33% of women were successful.

5 FINAL INQUIRY

The answers to question in the future I see myself as a computer programmer? Were asked in the form of numbers 1 to 5. From the first group we obtained an average of 4.29 while in the second group we obtained an average of 3.54. My difficulty is in understanding the problems: 2.35 and 2.6, respectively; my difficulty is in writing the steps of Top-Down: 1.65 and 2.08; my difficulty is to decorate the organization of the algorithm: 2.47 and 2.73, respectively.

When we asked "Assuming that took 25 hours of Algorithmic, how many hours did you study outside of the classroom?" the first group responded about 12 hours while the second group only 5.43 hours (average). These numbers may be significant, however it is understood as the second course had a 7 hour time while undergraduate students have a less complete schedule.

When asked to assess themselves: how to read and write variables, If-Then-Else and cycles, was asked to do so within notes intervals up to 4 [4, 8 [[8, 12 [[12, 16 [, More than 16. to average effects will use the middle score of each interval. In the first case they accounted for an average 13.06; 13, 06 and 10, while in the second case answered 12.78; 12.56 and 10.89 respectively for Read / write variables, conditional structure and cycles. Also in this case the averages do not seem significant.

6 CONCLUSIONS

Who teaches the first steps of the computer science reasoning, using top-down and algorithms, have always a lot of doubts. There is always the idea that education should be differentiated according to the public, that women have less feel for the computer than men or that younger can learn more easily. It was on this basis that we start this study: the same syllabus, the same type of evaluation and two types of different students: the former consists of young people entering for

the first time at the university, a course that they intended that in future is their profession, while the second group was made up of people with an average much higher age, most of them have been professionally active but is currently unemployed, and that comes in computing an area of employability which will again have employment. Despite technological habits of a group and the other being a little different not found results that say that a group learns better than the other the introduction to algorithms.

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