Empowering to code a diverse population of future digital designers

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Abstract

The Amsterdam School for Communication and Multimedia Design (CMD) offers a bachelor's program, where computing is taught in the context of digital design. Some of the graduates will be employed as visual designers, others as front-end developers. They all have something in common, though: they will be professionally involved with the digital world. For that reason, introductory coding courses are considered fundamental in the curriculum. But designing these coding courses is not obvious at all. The diversity in skills and background of students is challenging. Some students already were skilled developers before enrolling, while others have never written a line of code before. Addressing all these students' educational needs at the same time is a challenge.

One fortunate side-effect of the pandemics has been the focus on blended learning. A blended approach seems to support our ambition to design a version of the first coding course of the CMD curriculum that fits our diverse student population. Taking an action research approach, we share our experiences with a blended setup of the course "introduction to HTML and CSS". In this course, the program, the exercises, and the assessments are the same for everybody, but students are free to choose the learning approach they are most comfortable with.

1 A challenge for teachers

The School for Communication and Multimedia Design (CMD) of the University of Applied Sciences in Amsterdam offers an undergraduate degree in digital design. It is a Bachelors' degree, or in terms of the European Qualification System or EQF (European Union, sd), a level 6 degree. The school's program is a hybrid computing curriculum, i.e.: a program in higher (tertiary) education "devoting a substantial part of its curriculum to computing, but less than 50%" (Benvenuti, 2019, p. 174). Other examples of hybrid computing curricula are Health Information Science (University of Victoria, Canada, sd) and Digital Humanities and Digital Knowledge (University of Bologna, Italy, sd). In these programs, knowledge and understanding of specific fields of computing is considered

fundamental. But, unlike in computing programs, many students enroll with little or no experience with computing or coding.

Teaching methods for coding often aim to trigger the students' enthusiasm by challenging them to solve puzzles. This might work very well in computing programs, where students supposedly are eager to learn how to code. But students in hybrid computing curricula might not be enthusiastic at all about coding, they might prefer other topics as designing. By addressing "enthusiasm" for coding in hybrid computing curricula, teachers might risk losing a considerable part of their audience. On the other hand, courses written for novices might bore those students who already were enthusiastic about coding, students who enrolled in the hybrid computing program because of its computing content. Writing introductory coding courses for hybrid computing curricula is a challenge.

In this paper, we will discuss an approach we have developed for blended setting. Our aim was to challenge all our students. We wanted to enable novices to discover their enthusiasm for coding (if applicable), to stimulate students who are eager to learn it, but also to design a course that is achievable for these students who consider coding as a necessary evil. By analogy with the (European) classification of ski slopes, we developed three tracks through the course: a gentle blue track, a more adventurous red track and an Olympic black track. The blue track and the red track were presented as equivalent in terms of content, the black track mainly consisted of follow-up materials. Students were free to choose the track they wanted to follow. We asked our students every week to record the track they had followed. In this paper, we will evaluate the following two questions: (1) Is there a *raison d'être* for both the blue and the red track, or should we conclude that on one of them is most suitable for this audience? (2) Is it possible to predict which track students will choose by demographic information or by previous education?

2 Motivation for educational design

In Dutch Universities of Applied Sciences, the first year is meant to assess if there is a match between student and program. Students should be enabled to choose (1) if completing the program is interesting for them and (2) which direction to specialize. Schools assess the probability that the student will graduate within a reasonable time. That assessment leads to advice to the student (stay or go) that is mandatory. For these reasons, it is important to design coding courses that are achievable for all the students. Learning how to code can be hard. We demand that our novices actively explore coding, but do not want the first coding course to be a mission impossible for them. At the same time, we want to trigger those students who embrace coding.

2.1 Different backgrounds, learning goals and job expectations

CMD's program focuses on digital design and on the application of new technologies. An investigative attitude towards technology is considered an asset, in particular for these students who will specialize in new technologies. However, like most of the programs of Dutch Universities of Applied Sciences, admission requirements for CMD are forgiving. Students can enroll if they have graduated from: (1) nearly any upper secondary school for general education, level 4 of the EQF (European Union, sd), or (2) any school for secondary vocational education, level 4 of the EQF (European Union, sd). Qualified developers do enroll, and graduates from new media programs in vocational education, but also high-school graduates, qualified nurses, professional dancers and students who have discovered that a computing program (ICT) is not for them. Students of CMD have a very varied background,

Due to the varied educational background, there is also a great diversity in coding experience. Some of the freshmen are fluent in more than one programming language, others may have been

experimenting because they are interested in coding, but most of them are novices. Those who already are experienced coders sometimes struggle with the theoretical approach required in higher education. Students of CMD have very different learning goals when they enroll in coding courses.

Finally, students of CMD have varied job expectations. Some students will specialize in Front-End Development, most of them will not. The future jobs for CMD-students differ in the amount coding that is involved. The relevance of coding for their future may be not always be clear for the students.

2.2 Gender

Much has been written about the position of female students in computing classes. The dominant stereotype for a "developer" is still a male and geeky (Winter, Blair, & Thomas, 2021) (Voelkel, Wilkowska, & Ziefle, 2018). Many authors indicate "not belonging" as an important cause for the he "leaking pipeline" (Mishkin, 2019), (Winter, Blair, & Thomas, 2021) – a metaphor indicating young women dropping out of computing programs and subsequent careers. Finally, many authors point at perceived self-efficacy of students about computing, that is rated lower by female students (Beyer, 2014) (Mishkin, 2019) (Winter, Blair, & Thomas, 2021).

We were inspired by these themes, but are cautious to reduce our teaching question to a gender problem. First of all, CMD Amsterdam is not a computing program. It is a hybrid program. Unlike most computing programs, CMD has no female minority. Female student rate has been oscillating round 50% in the past few years (48-52%). Although female students tend to choose electives in UX/UI or Visual Design (rather than Front-End Development), the participation of women in Front-End courses seems to be increasing. We suspect that some students might experience feelings of "not belonging" in coding classes. Gender however needs not be the sole cause of these feelings.

2.3 Collaborating in groups

The school's educational approach is a combination of learner-centered and sociocultural (Faraon, Ronkko, Wilberg, & Ramberg, 2020), page 1767. CMD is a learning community. It facilitates collaboration and active engagement by dedicating a large well-equipped "lounge" to students, whose presence is warmly recommended. Although learning to code is an individual effort, the act of leaning, sometimes of accepting, coding conventions also supports community forming.

One of the possible choices in collaborative, active learning classrooms is which ways of grouping to support. Briggs (Briggs, 2020) conducted a targeted experiment. He found that in groups where high-performing students worked together with low-performing students, the low-performing students tended to become passive observers, rather than active participants. His conclusion was that low- and middle performing students benefit the most from homogeneous groups.

2.4 Supporting intrinsic motivation

Many authors refer to lower perceived self-efficacy (of female students) as a problem in computing classes. We recognize this problem in our student population, where experienced developers work side by side with novices. We sought a way to scaffold our students' learning, regardless their experience, and decided to support intrinsic motivation. According to Niemiec and Ryan, satisfaction of competence and autonomy needs is required to maintain intrinsic motivation (Niemiec & Ryan, 2009). If students are encouraged to make their own educational choices, instead of following a pre-designed path, if they experience that they are competent for the tasks they are asked to perform, and if they are able to develop their relation to the professional environment (content and colleagues), they will be more motivated to learn. This was the starting point for the educational design of the course, that was translated in the design plan for the course's Electronic Learning Environment.

3 The “Introduction to HTML and CSS” course in 2021

The “Introduction to HTML and CSS” spans 6 weeks in Semester 1 of the first year of CMD. It is an intensive course, with two classes of 2 hours each in the first 5 weeks, and a hands-on assignment that is assessed in the last week. The course is structured as a flipped classroom. Students are asked to read theory and do some exercises before attending classes. The assessment consists of a Multiple-Choice quiz about global theoretical topics as vocabulary at the end of week 3, and a 15-minute discussion in week 6 about a 4-page, original Website students are required to code about the topic of their choice.

During the pandemic, at least one lesson every week was online, in MS Teams. Besides MS Teams, the course’s Electronic Learning Environment consisted of a course site in Brightspace. All the course materials were published through the course site. This allowed us to offer students more than one way to approach the learning materials. We developed one set of exercises for students who want to approach coding through instruction (the blue track), one for students who prefer discovery and experimentation (the red track) and one for those students who consider the exercises too obvious (the black track).

The course was – and still is - structured in weeks. Every week, the main topic is stated, followed by the literature students should explore and 3 to 4 exercises illustrating the main topic. Exercises are offered in three versions. The blue version consists of an introduction with the aim of the exercise, a global explanation and an action plan. The red version states the exercise first; it provides no explanation at all, but it offers literature pointers to support execution. The black track consists of follow-up materials, and in-depth questions. The track color is visible on the course site. See figure 1 for an example.

Figure 1: One exercise, three versions

The exercises of the blue track and the red track are almost identical, but they are presented in different ways. We also take particularly care in the language that is adopted. In the blue track, the use of technical terminology is minimal in the first week. Terms are introduced in the exercises before using them, they are explained and increasingly used through the course. In the red track, technical terms that were introduced in the literature are used without further explanation. The black track has a different status: it is meant for experienced developers. Technical jargon is considered well-known in the black track.

The course is assessed in the same way for all the students. Everybody makes a Multiple-Choice test in week 3 and discusses their Web site in week 6. But students are free to choose the path through

the course materials. Students also are encouraged to explore more than one track, in order to discover which fits their own learning preference.

Experienced developers may schedule the discussion of their Web site in week 3, after the Multiple-Choice test, and skip the last weeks of the course if they succeed for the test.

3.1 Design rationale

Our aim was to support students' intrinsic motivation in learning how to code. We allow students to choose which approach fits their own learning preference and also to change their preference. This way, students have some autonomy in the choice of learning materials.

Students are encouraged to help each other. We advise them to collaborate with colleagues who do the same version of the exercise, in order to sustain their experienced competency, or at least not to put them in a situation that might undermine it. During the pandemic, we created channels in MS-Teams for students to collaborate: three "blue" channels, three "red" channels and a "black" channel. We noticed that students' collaboration online worked best if students had had the opportunity to meet physically in advance.

The relevance of coding may not be clear to all our students at the start of the course. We expect that talking about code, exploring coding and collaborating with colleagues increases students' relatedness with the schools' learning community and with the professional group they will belong to, and helps them to decide whether or not to choose electives where coding is necessary.

3.2 Course efficiency

Comparing the 2021 course efficiency with the previous runs of the course is almost impossible, for several reasons. First of all, examination has changed. Due to the pandemic, the 2020 course was only examined through the discussion of the Web site. In 50% of the cases, these discussions took place online. Also, the way theory was examined changed in 2021. Moreover, we already were differentiating since 2019, although not consistently for every exercise, and without adopting the ski slopes metaphor. But although we can not prove that improvement is completely caused by the introduction of the different tracks, we found that the course's success rate increased in the past years. The success rate, that had been oscillating around 65% until 2018, has grown to 73% in 2021.

4 Data collection and analysis

Data collection was limited by the University's privacy policy and by our fear of jeopardizing the relationship with our students. For these reasons, data was collected in anonymous form. We asked students to fill 5 surveys in total, that were published on the course page. The University adopted their user id's to link together the answers of every single student, and provided us an anonymized overview of all the answers per student. One of the students turned out to have had two user id's for the electronic learning environment. The questions were not answered the same way by both user id's. We did not include these answers in our sample.

At onboarding, we asked students to complete the following sentence: "At the start of this course, I…"

- am not able to code yet, and feel somehow anxious about learning it
- am not able to code yet, but I look forward to learn it
- got acquainted with HTML and CSS in high school
- have learned to write HTML and CSS as autodidact

- have learned to write HTML and CSS code in a vocational track where coding is considered important
- am working as a Web developer
- would rather not tell

In weeks 1 to 4, we asked: "which track did you mainly follow this week?"

- Blue track
- Red track
- Black track
- I'd rather not tell.

4.1 Data collection

324 students enrolled for the course. 171 of them filled at least one of the 5 surveys mentioned above. But, as we can see in Figure 2, few of them filled all the surveys. Many answers were left blank. For that reason, it is difficult to draw sound conclusions. But we still can underpin some observations about the questions stated in section 1: "Is there a *raison d'être* for both the blue and the red track?" and "Is it possible to predict which track students will choose by demographic information of by previous education?".
We examined the following overviews:

(a) 23 respondents who answered all the questions about their track choice
(b) 49 respondents who skipped maximum one answer about their track choice out of 4
(c) 67 respondents who skipped maximum two answers about their track choice out of 4
(d) 116 respondents who have answered the onboarding question and/or the question about the track choice in Week1.

The option "I'd rather not tell" was chosen three times and was equated with "no answer provided".
Overviews (a), (b) and (c) are cumulative. You will find overview (c) in Figure 2, as an example.

4.2 Onboarding and track choice

We were interested in the path respondents have followed through the course, where the "path" is the sequence of the tracks chosen by the respondent. We classified their path as "mix" if the chosen tracks were mixed, by color otherwise. We observed that, although they were free to choose, respondents following a mixed path seem to be the exception. We have registered mixed paths:

- 2x out of 23 respondents in overview (a),
- 5x out of 48 respondents in overview (b)
- 8x out of 67 respondents in overview (c)

We compared the respondents' path choice with the answer to the onboarding question, if provided. In overview (c), 51 respondents out of 67 also answered the onboarding question. You will find the elaboration of those data (as an example of the elaborations we made) in Figure 3.

In the following paragraphs, we will discuss the findings that apply to all the overviews we have examined: the patterns that seem to be invariant through the overviews. We will illustrate them by pointing at Figure 3.

A full black path seems to have rarely been followed. But we did not find Web developers choosing other tracks than the black track. Besides the only respondent who qualifies herself as "autodidact" (line

nr. 54) and followed a full black path, the black track was incidentally chosen by respondents taking a mixed path.

	Onboarding	week1	week2	week3	week4	Pati	SIS: gend
2		the Blue track	the Blue track	the Blue track		Blue	Female
3	acquainted in high school	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
4	no experience, looks forward	the Blue track	the Blue track	the Blue track		Blue	Female
5		the Blue track	the Blue track			Blue	Female
6	no experience, looks forward	the Blue track	the Blue track			Blue	Female
7	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Male
8		the Blue track	the Blue track	the Blue track	the Blue track	Blue	Male
9	no experience, looks forward	the Blue track	the Blue track			Blue	Female
10	acquainted in high school	the Red track	the Red track	the Red track		Red	Female
11		the Blue track	the Blue track		the Blue track	Blue	Female
12	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
13	webdeveloper	the Black track	the Black track	the Black track	the Black track	Black	Male
14	no experience, looks forward	the Blue track	the Blue track	the Blue track		Blue	Male
15		the Black track		the Black track	the Black track	Black	Male
16	no experience, looks forward	the Blue track		the Blue track	the Blue track	Blue	Female
17	no experience, looks forward	the Blue track	the Red track	the Blue track		Mix	Female
18		the Blue track	the Blue track	the Blue track	the Black track	Mix	Female
19		the Blue track	the Blue track			Blue	Female
20	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
21		the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
22	learned in vocational education	the Red track	the Red track			Red	Male
23	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
24		the Blue track	the Blue track			Blue	Female
25	no experience, looks forward	the Blue track	the Red track	the Blue track		Mix	Male
26	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
27	no experience, anxious	the Blue track			the Blue track	Blue	Female
28	no experience, looks forward	the Blue track	the Blue track	the Blue track		Blue	Male
29	no experience, anxious	the Blue track	the Blue track	the Blue track		Blue	Female
30	no experience, looks forward	the Blue track	the Blue track			Blue	Male
31	learned in vocational education	the Red track	the Red track	the Blue track		Mix	Male
32	no experience, looks forward	the Blue track		the Blue track	the Blue track	Blue	Female
33	no experience, looks forward	the Blue track	the Blue track			Blue	Female
34	acquainted in high school	the Red track	the Red track	the Red track	the Red track	Red	Male
35		the Black track	the Red track			Mix	Female
36	no experience, looks forward	the Blue track	the Blue track		the Blue track	Blue	Female
37	no experience, anxious	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Male
38		the Blue track	the Blue track		the Blue track	Blue	Female
39	no experience, anxious	the Blue track	the Blue track			Blue	Male
40	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
41		the Blue track	the Blue track	the Blue track	the Blue track	Blue	Male
42	no experience, looks forward	the Blue track	the Blue track	the Blue track		Blue	Female
43		the Blue track	the Blue track			Blue	Male
44	learned in vocational education	the Red track	the Red track	the Red track	the Red track	Red	Female
45	no experience, looks forward	the Blue track	the Blue track			Blue	Male
46	no experience, looks forward	the Red track	the Red track	the Red track	the Blue track	Mix	Male
47	learned in vocational education	the Blue track	the Blue track	the Blue track		Blue	Male
48	no experience, looks forward	the Blue track	the Blue track	the Blue track		Blue	Female
49	learned in vocational education	the Red track	the Red track	the Red track	the Red track	Red	Female
50		the Red track	the Red track	the Red track	the Red track	Red	Female
51		the Blue track	the Blue track			Blue	Female
52	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
53	acquainted in high school		the Blue track	the Red track	the Red track	Mix	Female
54	autodidact	the Black track	the Black track	the Black track	the Black track	Black	Female
55	no experience, anxious	the Blue track	the Blue track	the Blue track		Blue	Female
56	learned in vocational education		the Blue track		the Blue track	Blue	Female
57	no experience, looks forward	the Blue track	the Blue track	the Blue track		Blue	Female
58	webdeveloper	the Black track	the Black track			Black	Male
59	acquainted in high school	the Red track	the Red track	the Red track		Red	Male
60	no experience, looks forward	the Red track	the Red track	the Red track	the Red track	Red	Male
61		the Blue track	the Blue track	the Blue track		Blue	Male
62	learned in vocational education	the Black track	the Red track			Mix	Male
63	no experience, looks forward	the Blue track	the Blue track	the Blue track		Blue	Male
64	acquainted in high school	the Red track	the Red track	the Red track	Ik zeg liever niet	Red	Male
65	no experience, anxious	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Male
66	no experience, anxious	the Blue track	the Blue track			Blue	Female
67	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Male
68	no experience, looks forward	the Blue track	the Blue track			Blue	Female

Figure 2: Overview, missing maximum 2 track choices

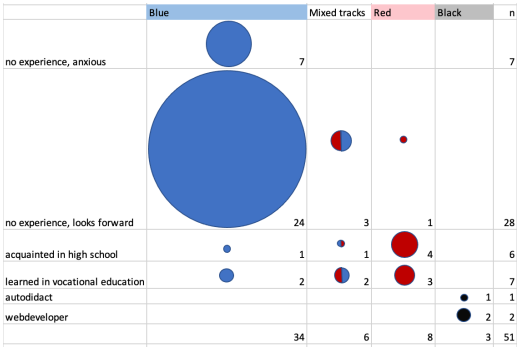

Figure 3: Track choice vs. onboarding (if known), respondents missing maximum 2 track choices

The large majority of the other respondents chose blue. In particular, we did not find any of the novices who are somehow anxious about coding, choosing other tracks than blue. Most of the novices who look forward to learning how to code also seem to have chosen blue. There are exceptions, though. We see at least one respondent in this group (line 60 in Figure 2) taking a full red path, and a small minority who took a mixed path.

The red track seems to mainly have been chosen by students who already were acquainted with coding, either because they had learned it in vocational education or in high school. Although the sample size is smaller than that of novices, we carefully argue that this group seems to show more diversity in path choices. We find at least 3 respondents who followed a full red path (lines 34, 44, 49 in Figure 2), at least 1 respondent who followed a full blue path (line 3 in Figure 2) and at least 3 respondents who took a mixed path.

We finally point at information that could have been scoped out in this analysis. First of all, only 116 out of the 324 students who enrolled in the course are represented in our overviews. 54 of them only answered the onboarding question. They provided us no answers at all about their track choice.

The opposite applies as well: we see a full black track in line 15 of Figure 2, and a blue-blue-blue-black path in line 18, but these respondents did not answer the onboarding question. They were not included in the overviews as Figure 3. Secondly, in we assume that most incomplete single-color paths can be extrapolated to full single-color paths in our elaborations like Figure 3. We do so, because mixed paths seemed to not to be the rule but the exception, but there is no certainty. Finally, we saw many interesting patterns that puzzled us. If we had not promised anonymity to our respondents, we would have interviewed some of them in order to better understand their track choices, but we have excluded this possibility when we committed us to respect our respondents' anonymity.

4.3 Gender and track choice

Table 1: track choice by gender, Week 1

	Blue	Red	Black	n
Female	52	8	2	62
Male	37	7	6	50
	89	15	8	112

In the first week, 116 respondents answered the onboarding question and/or the question about the track they choose in week1. We called this data "overview (d)" in section 4.2. 112 respondents gave us information about their track choice. In Table 1, we compared the respondents' track choice in week 1 with their gender. We found no significant differences between the track choices in week 1 of male and female students (p=0,21211271, Fisher's exact test 3x2, (Soper D. , 2022))

If we limit our analysis to the choice Blue track/Red track, we will find that all the cell values approximate the expected values in this distribution. We found no significant differences. (Chi-sqr(1,104) = 0,14; p=0,71).

We repeated both tests for the respondents who gave us all the information about the path they followed ("overview (a) N=23" in section 4.2). You will find the data in Table 2. We found no significant differences between path choices of male and female students (p=1,0; Fishers' exact test 4x2)

Table 2: path choice by gender

	Blue	Mix	Red	Black	n
Female	8	1	3	1	13
Male	6	1	2	1	10
	14	2	5	2	23

Also the distribution of Blue path / Mixed path / Red path in overview (a) approximates a random distribution (p = 1,0; Fisher's exact test 3x2)

We also performed these tests for the overviews (b) and (c) and found no significant differences between path choices of male and female students. But we have to be cautious here. Our interpretation of "path" as stated in section 4.2 (i.e. "the sequence of the tracks chosen by the respondent, classified as "mix" if the chosen tracks were mixed, by color otherwise") leads to a classification that is far less certain in overviews (b) and (c) than in overview (a). Unlike overview (a), sequences in overviews (b) and (c) can be incomplete.

5 Evaluation

We offered our students 3 tracks through the course “Introduction to HTML and CSS” and asked them to register every week which track they chose. With the black track, we targeted a small group of experienced Web developers. Its continuation was not questioned. Our aim here was to evaluate two questions concerning the blue and the red track, two tracks that were presented to our students as equivalent: (1) Is there a *raison d’être* for both the blue and the red track, or should we conclude that on one of them is most suitable for this audience? (2) Is it possible to predict which track students will choose by demographic information or by previous education?

5.1 Is there a raison d’être for both the blue and the red track?

75% of the choices we have registered, were choices for the blue track. Although very few students provided us all the information about their choice, we noticed that the blue track was chosen by the large majority of students who had no previous experience with coding (and provided us information). In particular, all the students who confessed to be reluctant to engage with coding chose blue. Our conclusion is: we see enough reasons to offer a blue track in this hybrid computing curriculum, where some computing is considered fundamental, but the focus lies on digital design.

Should we keep the red track? 25% of the choices we are aware of were for the red or the black track, often in mixed paths. Most choices for the red track we saw, were made by students who had previous knowledge of coding. But that group also seems to show the biggest variation in path choices. The students who did not choose the blue path (excluding the Web developers) challenged themselves by choosing a red path, or by exploring a mix of tracks, or, in case of the autodidact, a full black path. We do not want to discourage these investigative students. Furthermore, these might be the students who enroll in the CMD program because of its computing related content.

Within the limits of our sample and of the interpretations we have made, our answer to the first question stated in section 5 tends to “yes”. Based on the data we collected in the 2021 run of the course, we think we see enough reasons to keep both a blue and a red track in the future.

5.2 Is it possible to predict which track students will choose?

We looked at the combinations of track choice and entry knowledge at onboarding, and the combination of track choice and gender. We need to be careful: although approximately 50% of the population is female, female students were overrepresented between the respondents. This might have biased our results.

Within the limits of our sample, we think we could say that the blue track seems be most interesting for novices, and the red track for more experienced developers. But we also saw important exceptions: a novice completing the red path, big differences in track choices of graduates in vocational education and students who had explored coding in high school. Although approximately 1/3 of our students already had some knowledge of coding and approximately 1/3 of our students will choose electives where coding is essential, it might not be the same 1/3. This is a question that asks for future research.

As for gender, we did not find significant differences between track or path choices of male and female students. Even if we take the overrepresentation of female students into account, our conclusion is that it does not seem possible to predict the track choice by gender.

6 Future work

In the long term, we want to evaluate if the choice for a track predicts other choices, as electives where coding is required, or a minor Front End Design and Development. We plan to follow this cohort

in the next two years and will perform a longitudinal study in order to collect more information about our students' future choices.

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