

# Does an adventurous approach to the first coding course predict a career in tech?

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## Abstract

The Amsterdam School for Communication and Multimedia Design (CMD) offers a bachelor's program in digital design. Due to the nature of the program, that is partially devoted to computing but mainly focuses on design, graduates have very different job expectations. Some of them will be employed as visual designers, others as UX designers or front-end developers. Introductory coding courses are considered fundamental in the curriculum. But students enroll in the program with very different background knowledge about computing. Some of them already were skilled developers before enrolling, while others had never written a line of code before. Addressing all these students' educational needs at the same time is a challenge for teachers.

In 2021, we designed a version of the first coding course of the CMD curriculum to fit our varied student population (Benvenuti & Stam, Empowering to code a diverse population of future digital designers, 2022). We developed two versions of the course, one based on instructions and one based on explorative learning. Students were free to choose the learning approach they were most comfortable with. We followed the 2021 cohort and kept track of the electives they chose. In this paper, we will explore the question: what do students' choices for learning approaches in their first tech course tell us about their learning journeys after the first year at CMD?

## 1 Designing an introduction to coding for a varied population

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, Computing Education in a Hybrid World, 2019, p. 174). In these programs, knowledge and understanding of specific fields of computing is considered fundamental. But, in contrast with 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 about coding at all; they might prefer other topics as designing. By addressing "enthusiasm" for coding in hybrid computing curricula, teachers could risk losing a considerable part of their audience. But courses written for novices might bore students who were already enthusiastic about coding: students who enrolled in the hybrid computing program because of its computing content. Teaching introductory coding courses in hybrid computing curricula is a challenge.

## 2 Previous work

In 2021, three sets of exercises were developed for the first course in which coding is taught, a fundamental of Semester 1 named *Introduction to HTML and CSS*. By analogy with the (European) classification of ski slopes, the sets of exercises were respectively named "blue", "red" and "black" track through the course. The blue version of the exercise consisted of an introduction with the aim of the exercise a global explanation and an action plan. The red version stated the exercise first; it provided no explanation at all, but offered literature pointers to support execution. The black track consisted of follow-up materials, and in-depth questions. The track color was visible on the course site. The (gentle) blue track was meant for students who wanted to approach coding through instruction, the (more adventurous) red track was for those, who preferred discovery and experimentation, and the (Olympic) black track for those, who considered the exercises too obvious because they were already skilled developers. The blue and red track were designed to be equivalent in terms of content. Assessment consisted for all students of a multiple-choice quiz on global theoretical topics as vocabulary, and a 15-minute discussion about a 4-page, original website about the topic of their choice they were required to code.

Students were free to choose the track they wanted to follow, and were also free to switch between tracks. They were asked to record (1) their previous experience with coding and (2) every week, the track they had chosen. Students who had completed two or more weekly surveys, and reported to have chosen the same track every time, were classified according to the learning "path" they had indicated: a blue, red or black path. A minority of students had switched between tracks. These paths were classified as "mix". See Figure 1 for the data about previous experience, track choices and path classification. Figure 1 also shows that only a few students completed all the surveys. In fact, the survey's response rate was lower than we had expected. Of the 324 students who enrolled in the course in 2021, 67 provided useful data. More detailed information about course design and data collection can be found in our previous paper (Benvenuti & Stam, Empowering to code a diverse population of future digital designers, 2022).

Taking an action research approach, we evaluated the question: *Is there a "raison d'être" for both the blue and the red track, or should we conclude that one of them is most suitable for this audience?* In Figure 2, path choices of students are compared with their previous knowledge about coding. Our conclusion was that yes, we saw enough reason to offer both tracks. We saw reasons to preserve the blue track to support novices. We saw reasons to preserve the red track to challenge more skilled developers. But we also found important exceptions to this scheme. Students who already had some experience with HTML and CSS because they had learned it in vocational education, choose almost randomly between a blue, a red or a mixed path. We recorded at least one novice coder who completed a full red path. Our conclusion was that in this hybrid computing curriculum, where the focus lies on digital design, but some knowledge of computing is considered fundamental, there is a "raison d'être" for both a blue and a red track in the first coding course.

1	Onboarding	week1	week2	week3	week4	Pat	Sis: gende
2		the Blue track	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	the Blue track	Blue	Female
5		the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
6	no experience, looks forward	the Blue track	the Blue track	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	the Blue track	the Blue track	Blue	Female
10	acquainted in high school	the Red track	the Red track	the Red track	the Red track	Red	Female
11		the Blue track	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	the Blue track	Blue	Male
15		the Black track	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	the Blue track	Blue	Female
17	no experience, looks forward	the Blue track	the Red track	the Blue track	the Blue track	Mix	Female
18		the Blue track	the Blue track	the Blue track	the Blue track	Mix	Female
19		the Blue track	the Blue track	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	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	the Blue track	the Blue track	Blue	Female
25	no experience, looks forward	the Blue track	the Red track	the Blue 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		the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
28	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Male
29	no experience, anxious	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
30	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Male
31	learned in vocational education	the Red track	the Red track	the Blue track	the Blue track	Mix	Male
32	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
33	no experience, looks forward	the Blue track	the Blue track	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	the Red track	the Red track	Mix	Female
36	no experience, looks forward	the Blue track	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	the Blue track	Blue	Female
39	no experience, anxious	the Blue track	the Blue track	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	the Blue track	Blue	Female
43		the Blue track	the Blue track	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	the Blue track	the Blue track	Blue	Male
46	no experience, looks forward	the Red track	the Red track	the Red track	the Red track	Mix	Male
47	learned in vocational education	the Blue track	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	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	the Red track	the Red 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 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	the Blue track	Blue	Female
56	learned in vocational education	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
57	no experience, looks forward	the Blue track	the Blue track	the Blue track	the Blue track	Blue	Female
58	webdeveloper	the Black track	the Black track	the Black track	the Black track	Black	Male
59	acquainted in high school	the Red track	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	the Blue track	Blue	Male
62	learned in vocational education	the Black track	the Red track	the Red track	the Red track	Mix	Male
63	no experience, looks forward	the Blue track	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 lever nie	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	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	the Blue track	the Blue track	Blue	Female

Figure 1: Overview, missing maximum 2 track choices

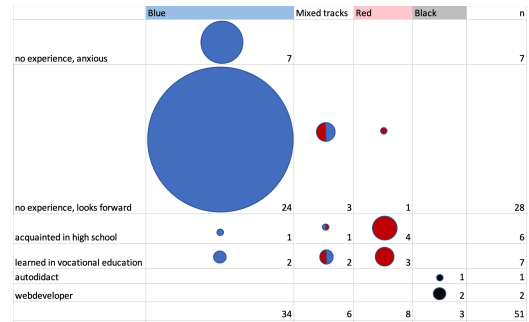


Figure 2: Track choice vs. onboarding (if known), respondents missing maximum 2 track choices

### 3 Research question

The research plan associated by the 2021 data collection, included a longitudinal study of the 2021 cohort's choices of electives. In this paper, we will explore what students' path choices in the first coding course tell us about their future learning journey. We are especially interested in their choices for courses following up the first coding course, that is for electives where coding is required.

CMD considers an investigative attitude towards technology as an asset, in particular for these students specializing in emerging technologies. We discussed our findings on this project with colleagues. A recurring question while discussing figure 2 was: were we sure we were not just helping the lazy by offering all our students, including these who already had some knowledge of coding, a blue track based on instruction? There is an assumption behind this question. The choice for a red path in the first coding course is assumed to correlate with an active, explorative attitude towards technology. Red path students were assumed to be the students CMD wants to hold. Would these students, who had shown a preference for the red path, choose electives where coding is required, showing intrinsic

motivation to pursue a career in tech? In that case, there might be reasons to favor the adventurous approach of the red track in coding classes, above the gentle approach of the blue track.

Approximately 2/3 of the students of the 2021 cohort took a blue path. We know that approximately 2/3 of the students does not choose electives where coding is required. But it might not be the same 2/3. The question we will address in this paper is: did students of the 2021 cohort, who had chosen a red path in the first coding course, choose electives where coding is required more often than students who had chosen a blue path?

## 4 Data collection and analysis

Our aim was to analyze choices for electives of students of the 2021 cohort. CMD is a program in a Dutch University of Applied Sciences. By law, the first year (2 semesters) is meant to assess if there is a match between student and program. Students who do not pass the first year seldom enroll in the 2<sup>nd</sup> year. The pass rate of the 2021 cohort of CMD was 76% (Hogeschool van Amsterdam, Communication and Multimedia Design, 2024)).

The first 3 semesters of CMD's program consist of fundamentals. That part of the program applies to all students. Semester 4, semester 5 and semester 6 consist of electives. Thus far, we have access to cohort 2021's choices in semester 4 (2<sup>nd</sup> year). We do have data about choices in semester 5 (3<sup>rd</sup> year), but these data only concern students who have completed their exams within set time period. We do not have data about semester 6 (3<sup>rd</sup> year) yet. We will limit our present investigation to the choices we have registered about semester 4 (2<sup>nd</sup> year), because we expect to gather more data about the 3<sup>rd</sup> year in the future.

324 students enrolled in CMD in 2021. 67 of them provided useful data about their path choices in the first coding course in semester 1. We see these data in Figure 1. 4 respondents of that sample followed a black path (see line 13, 14, 54 and 58 of Figure 1). For the scope of this analysis, we are not interested in respondents who followed a black path. That is why we did not include these 4 respondents in the sample we will discuss in this article, that therefore consists of 63 respondents.

47 respondents of that sample passed to the 2<sup>nd</sup> year. This is 76% of 63, in conformity with the pass rate of cohort 2021. In Table 1, we see the numbers of respondents who passed to the 2<sup>nd</sup> year and of those who failed to pass, classified by path choice. The pass rate of cohort 2021(76%) is respected in line 1, showing respondents who followed the blue path. In line 2 (respondents who had followed the red path), respondents who failed to pass to the 2<sup>nd</sup> year are overrepresented. All respondents in line 3 (who followed a Mixed path) passed to the 2<sup>nd</sup> year. These differences of pass/fail rates between groups of respondents that had followed different paths are significant ( $p=0.02359365$ , Fisher's exact test 3x2, (Soper D. , 2022))

**Table 1:** Students who passed to year 2 by path

	Passed	Failed	n
Blue	35	11	46
Red	4	5	9
Mix	8	0	8
	47	16	63

What does the choice for a red path in the first coding course indicate? It does not seem to indicate a match with the CMD program. On the contrary. In Dutch Universities of Applied Sciences, the first year is meant to assess if there is a match between student and program. The failure rate of the group that followed a red path significantly exceeds the failure rate of the cohort.

Did students, who had followed the red path, opt for electives where coding is required, and show intrinsic motivation to pursue a career in tech? We have to be careful here. We know the semester 4-electives these 47 students choose, and the semester 5-electives of some of them. But we also are aware of the challenges related to the size of the sample we are working with. Nevertheless, we must mention that none of the 4 students of cohort 2021 who reported having followed a red path in semester 1 and had passed to the 2<sup>nd</sup> year, opted for electives where coding was required. Not in the 2<sup>nd</sup> year, nor – as far as we know today - in the 3<sup>rd</sup> year. The students of the 2021 cohort who have showed intrinsic motivation to pursue a career in tech so far, did not belong to the group that had chosen a red path in the first coding course.

## 5 Conclusion

Our careful conclusion is that we did not help the lazy by allowing students with some experience in coding to choose the blue track. On the contrary, students who followed a mixed path (most of which include choices for the blue track), form the group with the highest pass rate to the 2<sup>nd</sup> year.

Who are the students who followed a red path in the first coding course of the program? Today, we think that these could be the students who are more interested making websites than in learning about coding. They might be these students who rather focus on know-how than on know-why, an attitude that does not match a tertiary program where coding is fundamental. That might be the reason for a lower pass rate to the 2<sup>nd</sup> year. It could also explain why we have not found yet representants of this group who have opted for electives where coding is required.

### 5.1 Future work

We will continue to follow the 2021 cohort in the next years and will collect more information about these students' future choices. We will gather data about semester 6, and will keep following students who have study delays, in order to better evaluate what path choices in the first coding course tell us about our students' approach to tech.

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