Behavioural Effects of Providing Labour Market Information to Students Evidence from an Eye-tracking Pilot Study

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Didier Fouarge
Sanne Steens
Martin Wetzels

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Research Centre for Education and the Labour Market
Maastricht University
P.O. Box 616, 6200 MD Maastricht, The Netherlands
T +31 43 3883647

secretary-roa-sbe@maastrichtuniversity.nl
www.roa.nl

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Abstract

In this paper, we evaluate students' responses to labour market information by using eye-tracking technology to measure the visual attention students pay to labour market indicators of study programmes they are interested in. We relate these measures of visual attention to their recall of information and the likelihood that they re-rank their preferred study choice. In a sample of 63 students in the pre-academic track of a Dutch secondary school, we find that the dwell time (i.e., the time students spend looking at the labour market information we provide) is positively correlated with finding future changes of work and earnings prospects important. Students who report they find our information useful correct their expectations more often. However, we do not find a correlation between dwell time and informational recall on measures of unemployment, working hours and wages in their preferred study programme. The evaluation of the information by students suggests a generally positive response to the information, with a high level of interest and perceived ease of understanding. Despite that, only a small percentage of students plan to use the information in their programme choice, indicating a potential gap between interest and practical application for some students.

1. Introduction

Labour market tightness has reached record-high levels in the last couple of years in many European countries, including the Netherlands (Kiss et al, 2022). Since 2014, the number of vacancies has increased, while the number of unemployed job seekers has decreased, with numbers of vacancies exceeding the number of job seekers in 2022-2023. If human capital theory is right in predicting that youngsters make informed education choices in parts based on their abilities and preferences, and future expected net pay-offs of education investments, than such shortages in the labour market and the broad coverage is gets in the media could work as a disincentive for youngsters to invest in education (Fouarge, 2023). Not investing in education because of today's large availability of jobs would be a suboptimal outcome because the documented large variation in wages and career outcomes across educational degrees and occupations today and the near future (ROA 2021) and because high vacancy rates tell little about the about the quality of jobs. In fact, evidence shows that the vacancy rates by occupation correlates negatively with wages and hours worked in those occupations, suggesting job quality might be low, and positively with the routineness of jobs, suggesting job tasks might not be challenging and prone to automation in the medium to long term (Bakens & Fouarge, 2022).

In this paper, we investigate the extent to which youngsters pay attention to labour market characteristics of their preferred study programmes, and their behavioural response to such information. We do this in the context of the Netherlands.[1] The Netherlands is an interesting case with a long tradition of Career Orientation and Guidance (COG) in schools, but high levels of teenage uncertainty in occupational expectations (Mann et al., 2020). COG is mandatory in Dutch schools, but how they organize it – themselves with dedicated staff or though specialized companies – is free for schools to choose.

[1] This study was funded by NRO, the Netherlands Initiative for Education Research (grant number 405.20400.021). We thank Bart de Koning for his contribution to this project during his appointment at Maastricht University.

The standard material for COG in schools mainly focuses on informing students about the characteristics of study programmes and occupations, and how they match their preferences, personality traits and abilities. COG materials usually do not include information on the labour market opportunities of study programmes and occupations. This is peculiar for several reasons. First, apart from a cognitive and socialization function, education also has a labour market function, namely to prepare students with the current and future demand for skills (Van de Werfhorst et al., 2015). Second, there is growing policy attention to the efficiency of education supply and on the labour market relevance of educational choices made by students.[2] Third, there is a large body of evidence that differences in pay and job opportunities vary strongly by level and types of education (e.g., Altonji et al., 2016), but that prospective students have noisy beliefs about returns to education (Hastings et al., 2016, Conlon, 2019).

Despite evidence for the US that the enrollment of students weakly responds to short-term changes in wages, and somewhat more strongly to medium-term changes in employment (Bardhan et al., 2013), a recent Dutch study shows no such relations between labour market characteristics of study programmes and enrollment rates (Non et al., 2024). In a behavioural intervention performed earlier as part of a COG tool used by more than 23,000 students in prevocational schools in the Netherlands, the authors do find that prospective students indeed are misinformed about the expected wages and job prospects in the occupation of their choice (de Koning, 2022). They generally overestimate wages and job prospects. In a field-experimental setting, the authors further find that showing students information leads them to correct their beliefs and to make different rankings of preferred occupation, in a way that they give preference to occupations with better prospects with than without information. Other behavioural interventions in economics and sociology aimed at actually informing young people about the labour market opportunities of study programmes and occupations sometimes report large effects but sometimes no effects (e.g., Barone et al, 2019; Bonilla et al, 2017; Finger et al, 2019; McGuigan et al, 2016; Oreopoulos & Dunn, 2013). A possible cause is that the behavioural interventions implemented in these various studies differ widely in 1) the type of information shared with young people (e.g., wages, job opportunities or other characteristics), 2) the way this information is presented to them (e.g., in number, percentage), or 3) the context in which this information is presented (e.g., in text, using illustrations). In the Netherlands, several websites do present labour market information, some publically accessible (e.g., KiesMBO.nl for information on intermediate vocational tracks and Studiekeuze123.nl for information on programmes in higher education) and some after paid registration (e.g., Keuzegids.nl for intermediate and higher vocational tracks and for masters degrees). These websites use a variety of indicators and presentation formats but provide little guidance about the attention prospective students pay to these indicators.

[2] This shows in the attention for macro efficiency of new education programs in intermediate vocational education (https://www.cmmbo.nl/) and higher education (https://www.cdho.nl/), the so-called Van Rijn Commission report of 15-5-2019 pleading for additional funding of education fields that are in shortage, and the former Minister of Education Bussemaker's letter of 28-9-2016 to the Second Chamber on strengthening the labour market component of COG in schools.

In this paper, we implement eye-tracking technology to investigate young people's behavioural responses to labour market information presented to them about study programmes they have interest for. Eye-tracking technology is a relatively new research technique in marketing that is applied, e.g., in brand recognition. This eye-tracking technology aims at measuring the intensity of subjects' visual attention (Khushaba et al., 2013). As a tool, it potentially fits well in young people's world of experience since the technology itself could be appealing to them. The eye-tracking technology is implemented as part of a survey we field in a pre-academic secondary school track (vwo-school). As part of that survey, we ask students about their preferred field of study, show them wage information and other relevant labour market indicators and measure the level of visual attention they pay to that information. We then assess if they recall the information we gave them and whether the information affects their ranking of preferred study programme. We find that important factors in the study choice include the programme being fun or enjoyable to follow, but that youngsters also value the professions they can access with that profession, the job opportunities that open to them and the money they can make. We find that the eye-tracking technology we used, a web-based technology running on school laptops, is less precise than expected and crucially depends on the quality of instructions given to students. The dwell time, i.e., the time students spend paying attention to the labour market information we give them, is positively correlated with them reporting caring for future changes of work and the money they will make later. Students who report our information to be useful more often correct their expectation based on our information. This suggests that our information has an impact. However, we do not find that the dwell time is related to smaller mistakes in recalling labour market information of study programmes of their liking.

The rest of the paper is structured as follows. In Section 2, we describe data collection. In Section 3, we describe our main findings. Section 4 concludes and draws a number of lessons learning from our research.

2. Data collection[3]

Our study involves a small-scale eye-tracking experiment that aims at measuring youngsters' attention for labour market information for study programmes of their choosing and their recall of that information. We conducted our data gathering activities on November 14, 2022, at a school located in the North of the Netherlands. The study involved four classes of vwo5 students and was integrated into the regular COG hour at the school. Two of the prime investigators were present in the classroom for instructions during the data collection, together with the teacher involved with COG. Prior to the commencement of the data collection, informed consent was obtained from the participants, with additional parental consent secured for students under the age of 16. Only one student did not give consent. Students younger than 16 for whom we could not track the parental consent were taken apart for a talk on study choice with one of the primary investigators, while the other students went through the assignment. A total of 63 students participated in the study. This number of participants is large, considering most eye-tracking studies

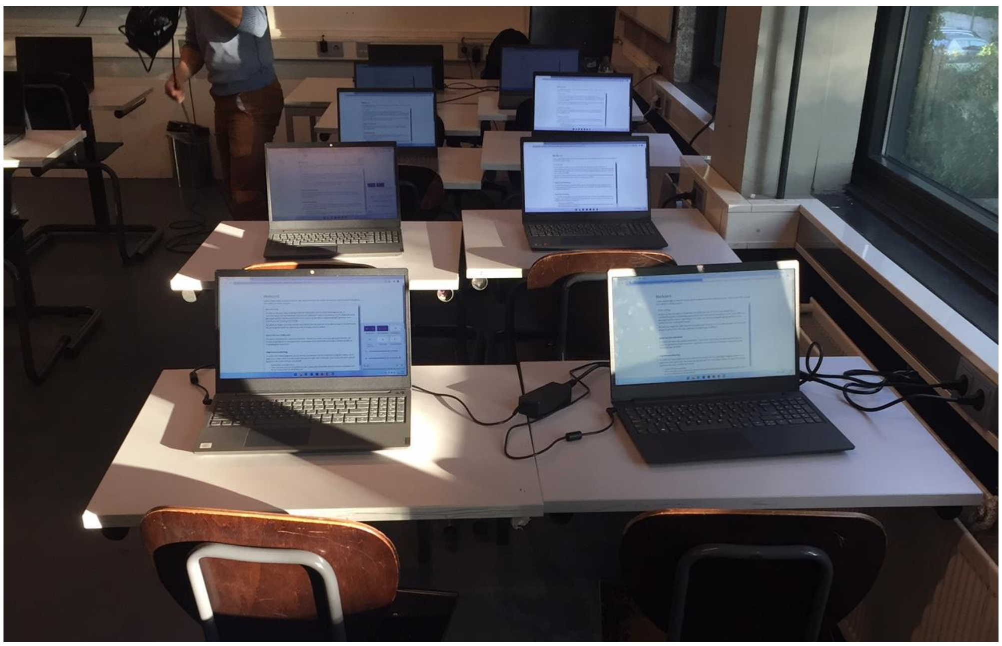
[3] Parts of Section 2 and 4 were generated using generative AI software (ChatGPT, version 3.5), and then edited by the investigators.

assume 20 to 40 participants (Wills et al., 2007). The assignments were programmed by us in Qualtrics. For the eye-tracking, we made use of iMotions.[4]

2.1 Eye-tracking set up

For the data gathering, students sat in a classroom, in front of a school laptop on which they could access our web-based survey. The session began with an introductory instruction outlining the tasks expected of the students. We explained to them they would have to answer a number of questions about their study choice, and that we would monitor their eye-movement. For this, we made use of the webcam installed on the school's laptop. Figure 1 shows the setting in the classroom.

Figure 1: Classroom set up for data gathering

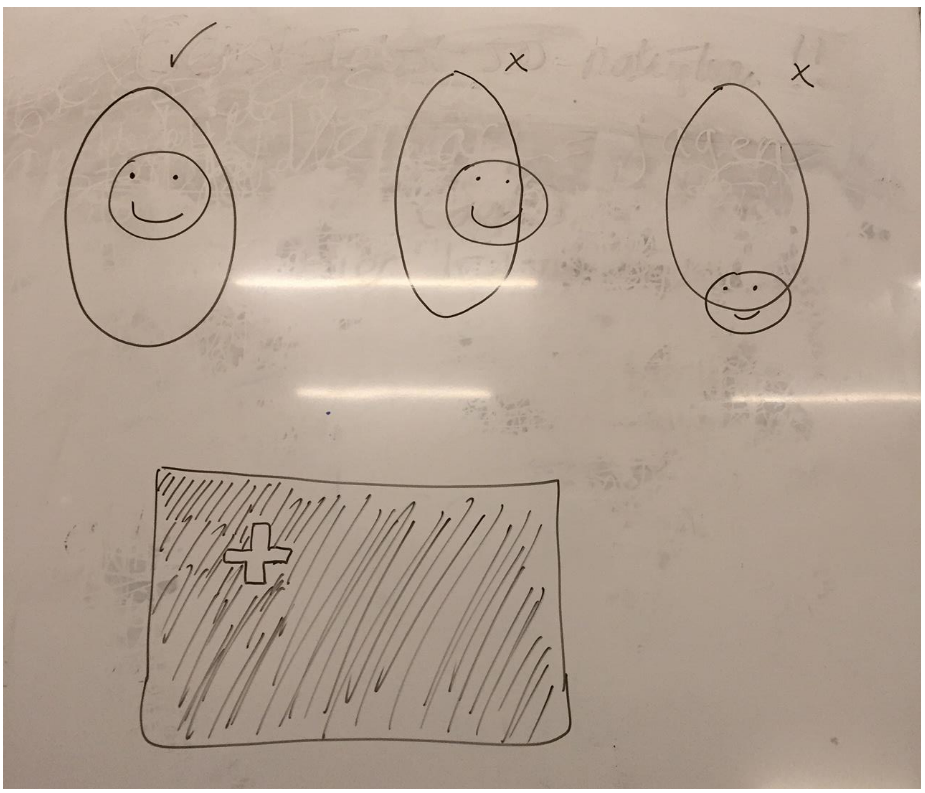


Eye-tracking technology monitors and records the movement and focus of a person's gaze, providing valuable insights into visual attention and cognitive processes. In our case, we employ the built-in webcam of the school's laptops to track the movements of the student's eyes, mapping where and how long they look at specific points of interest. This technology is widely used in marketing research (e.g., Duerrschmid & Danner, 2018), and usability studies to understand user behavior, optimize website designs, evaluate advertisements, and analyze cognitive responses. The webcam-based eye-tracking technology we use offers a non-intrusive and relatively cheap method for studying student's visual attention, in fact less intrusive and expansive then eye-tracking glasses.

[4] For this research, we obtained ethical approval from Maastricht University Ethical Review Committee Inner City Faculties (reference: ERCIC_337_23_03_2022).

The initial step involved calibrating the eye-tracking software to ensure accurate measurements of student's eye-movement. For this, students first had to sit straight in front of their screen, with their head at the center of an oval that shows in the middle of the screen. Second, they had to follow with their eyes the movement of a white cross that shows on a black screen. Only after that did we begin with our measurements. Specifically for this eye-tracking component, two types of instructions were provided by us to facilitate a successful calibration process: a concise verbal explanation with visual aids (group 1, that consists of two of the classes we approached), and a more comprehensive version accompanied by gestures of one of the primary investigators (group 2, that consists of the other two classes we approached).[5] Figure 2 shows the visual aids we had drawn on the schools' white board and that we used for verbal explanation.

Figure 2: Drawing to help students understand the calibration task



After giving their consent and the calibration of the software, the participants engaged in a series of assignments, including answering questions related to crucial aspects of their preferred study, such as

[5] The personal observation of the two principal investigators who were present is the classes in that the overall attention of students in group 1, who were approached in the afternoon, was less than that of students in group 2.

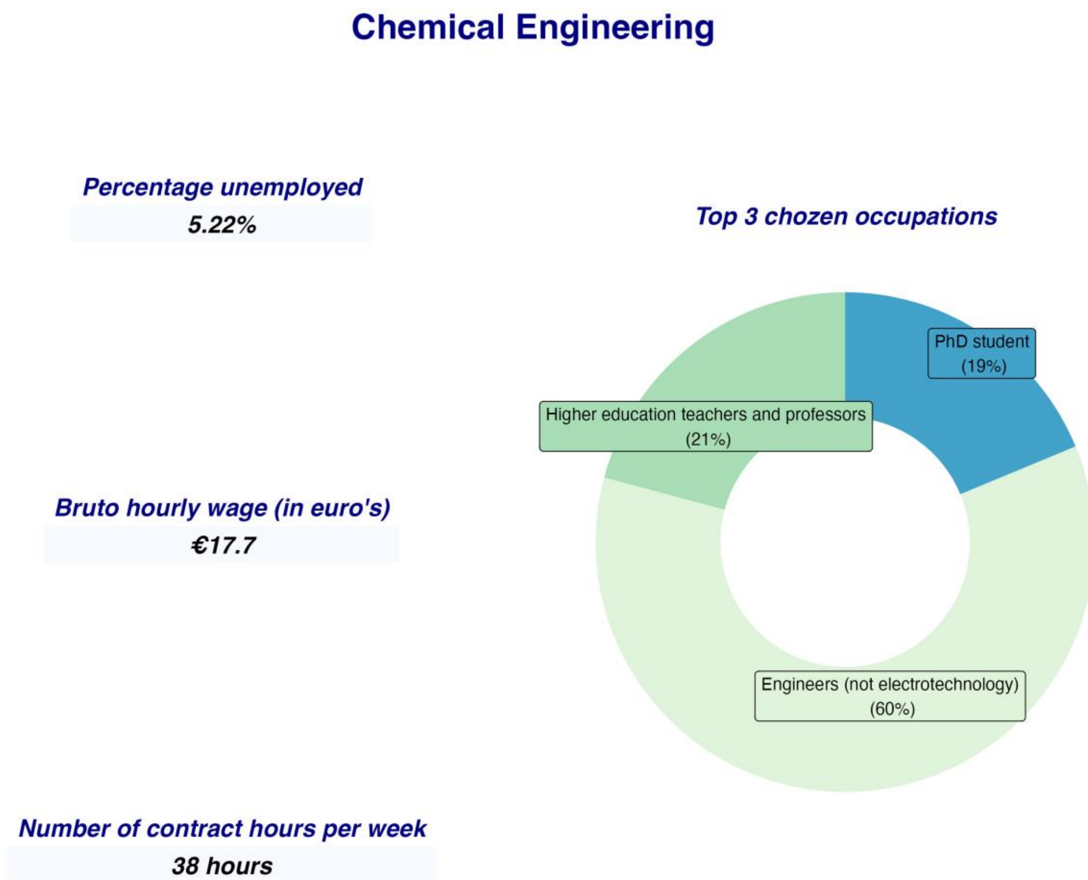
interest, difficulty, and financial considerations. They were then tasked with selecting their top three preferred study programs and to rank them in order of preference, as depicted in Figure 3.

Figure 3: Choosing and ranking three preferred study programmes

We then presented a visual stimulus that included labor market information for the top three study programmes. For each study programme, we presented true information about the percentage of graduates who are unemployed shortly after graduation, gross hourly wages in euros, average hours worked, and the three most frequent occupations recent graduates entered.[6] This information was shown in three different screens for the three preferred study programmes. The order in which we displayed information was randomized to avoid bias based on the students' study programme preferences. Figure 4 provides an example of the information provision screen for chemical engineering.

[6] The information we displayed comes ROA's Project Onderwijs-Arbeidsmarkt (https://roa.nl/research/research-projects/project-onderwijs-arbeidsmarkt-poa; funded by NRO grant number 405-17-900) and Nationale Alumni Enquête 2017-2019, a biennial national survey among graduated master's students at Dutch universities who are approached 1.5 years after graduation.

Figure 4: Information screen for chemical engineering



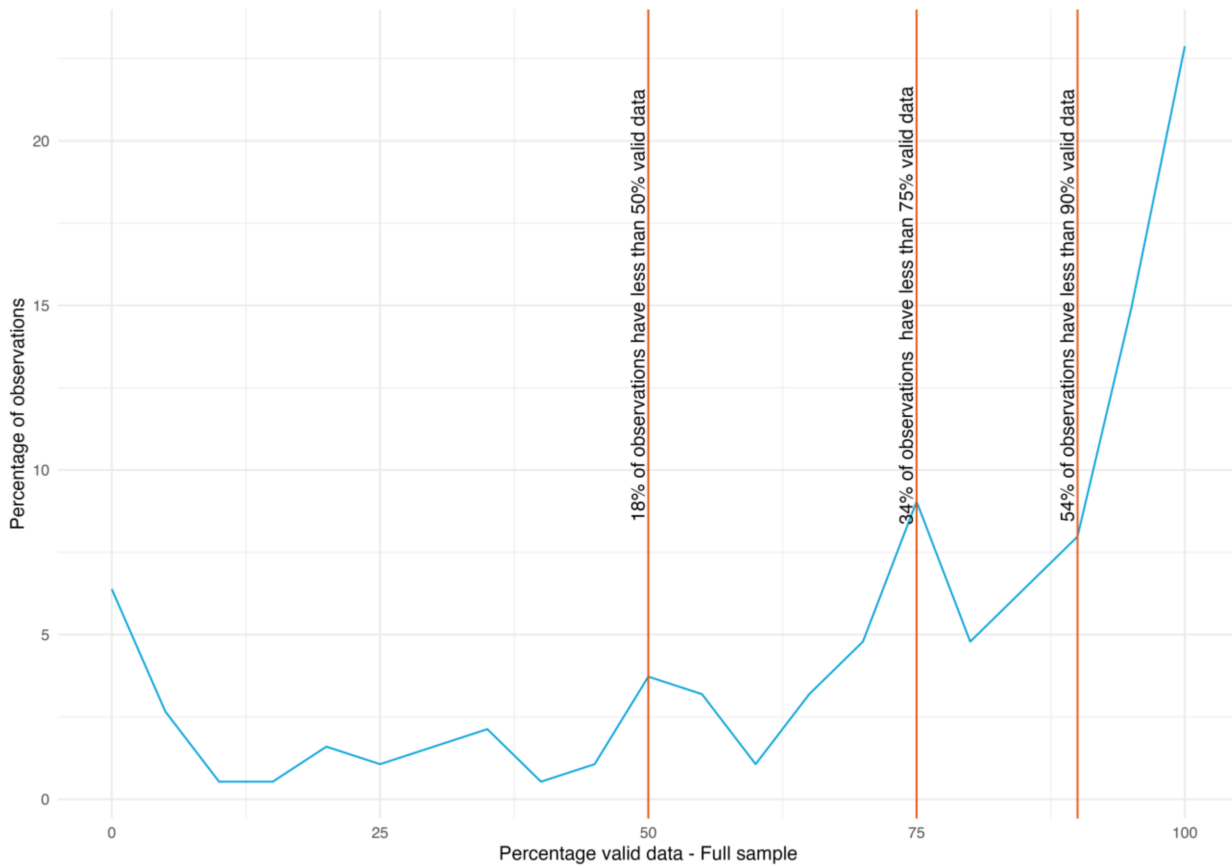
To assess changes in preferences, students were asked to re-rank their top three study programs after we gave them information. We also ask recall questions about the average gross hourly wage of the selected study programs. Following this, a post-calibration of the eye-tracking tool was conducted. The session concluded by thanking students for their participation in the study.

2.2 Measurements from eye-tracking

Eye-tracking technology captures various dimensions of visual attention, allowing us to study how students interact with the visual stimuli we provide them with. First, recognition of eye movement involves tracking the gaze point, pinpointing precisely what the eyes focus on. Second, dwell time quantifies the duration spent on a particular area of interest, reflecting the intensity of attention. Third, heatmaps offer a visual representation of the spatial distribution of gaze points, providing insights into areas of heightened interest. Fourth, time to fixation measures the duration it takes for the eyes to reach a specific area of interest, offering valuable information about the immediacy of attention. Fifth, fixation sequences trace the path of eye movements from one area to another, detailing the sequential order of visual exploration. Sixth, saccades represent the rapid, voluntary eye movements between fixations, crucial for understanding how the eyes transition from one point of interest to another.

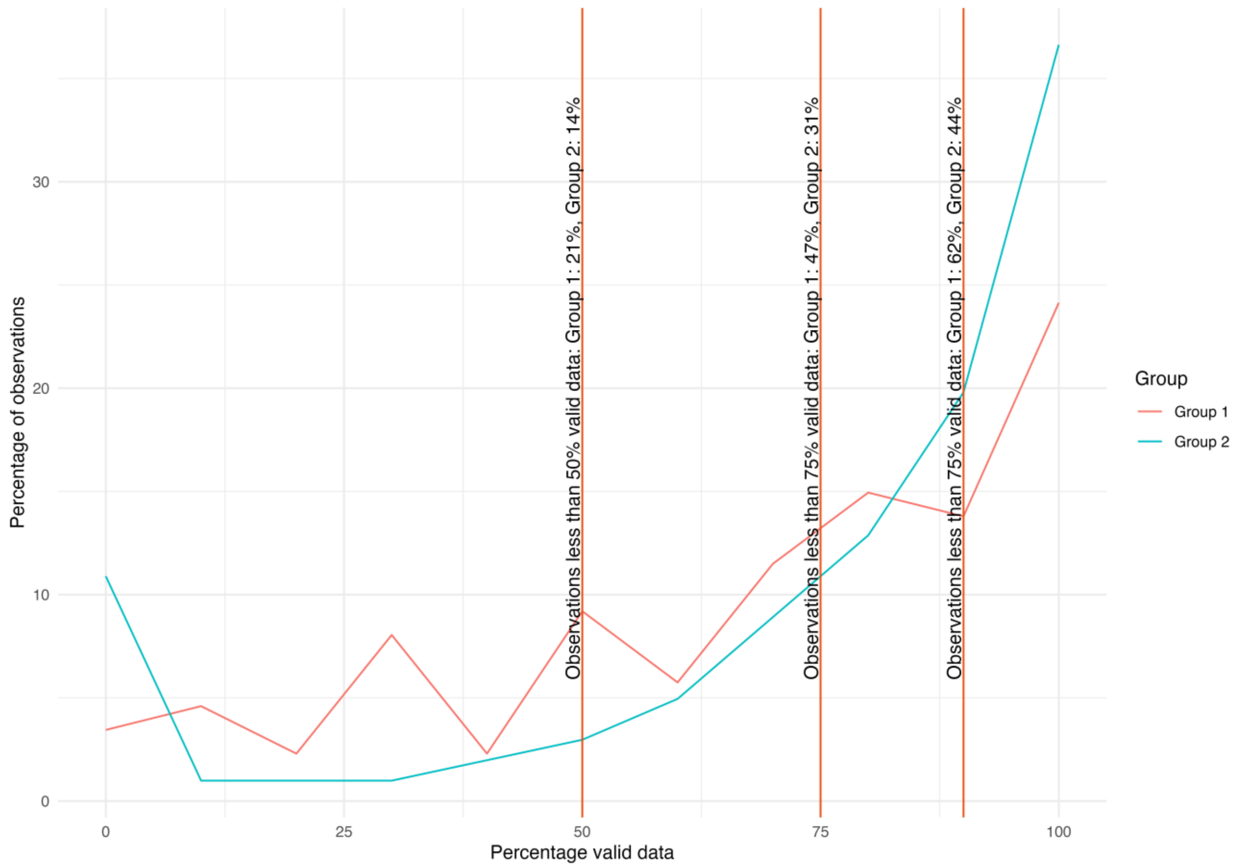
We experienced that eye movements are recognized by the webcam-based eye-tracking technology but that the technology is not sufficiently accurate to generate heatmaps, time to fixation data or fixation sequences. Figure 5 displays the histogram of the eye-movement recognition. It shows that for 66% of the respondents, the eye movement was recognized at high level of accuracy (75% or more), but that the variation is large, and for 18% of all cases have less than 50% valid eye-movement recognition.

Figure 5: Eye-movement recognition (percentage of eye-movement detected)



The type of instruction given to students seems to matter for the extent to which the eye-tracking technology is able to detect eye movements. Suggestive evidence for this is presented in Figure 6 that shows the distribution of detected eye-movements for the group of students that received the standard instructions (group 1) and the group that received more extensive instructions (group 2). The figures show that the group who received more extensive instructions also a higher share of valid data, i.e., they more often looked at the information on the screen. For example, 69% of the cases in group 2 have 75% or more valid data, while this percentage is 53 in group 1.

Figure 6: Eye-movement recognition (percentage of eye-movement detected) for two instruction groups



3. Main findings

3.1 Important aspects of study choice

In the survey, we asked students to report what they find important when considering their study programme. Table 1 shows students' perceptions of the importance of various aspects related to their choice of study. The data indicates that a vast majority, 97%, consider the level of enjoyment ('fun') associated with the study to be a highly important factor. Understanding the potential professions available after college is deemed significant by 86% of the respondents. Job opportunities following college, a key consideration for career prospects, are viewed as important by 76% of participants. The financial aspect of post-college life, including earning potential, is significant for 67% of respondents. On the other hand, factors such as the number of working hours post-college are considered less critical, with only 16% of respondents attributing high importance to this aspect of their decision-making process.

Table 1: Aspects of study choice that students consider to be important

Questions:	**Percentage of students who find aspect important**
How **fun** the study is	97
How **difficult** the study is	27
The **professions** you can do after college	86
How much **job opportunity** you have after college	76
How much **money** you make after college	67
How many **hours** you will work after college	16

3.2 Dwell time

Figure 7 reports the dwell time on the three information screens (see Figure 4), that correspond to student's three preferred education programmes. Students spend 19.1 seconds reading information of the first screen, and less time on the other two information screens (13.4 seconds on screen 2 and 12.0 seconds on screen 3). Because we do not follow students' ordering of preferred programmes in the sequence in which we show the information screens, the sequence is randomized. This finding suggests that students learn how to process the information we are providing them with. We find that the dwell time is shorter for the third preferred education programme compared to the first choice education programme. Further, we find that the dwell time for students in group 2 is shorter than in group 1 (see Table 2). This could be because instructions help find information more effectively, but also because overall attention in group 1 classes was lower than in group 2.

Figure 7: Dwell time on three information screens

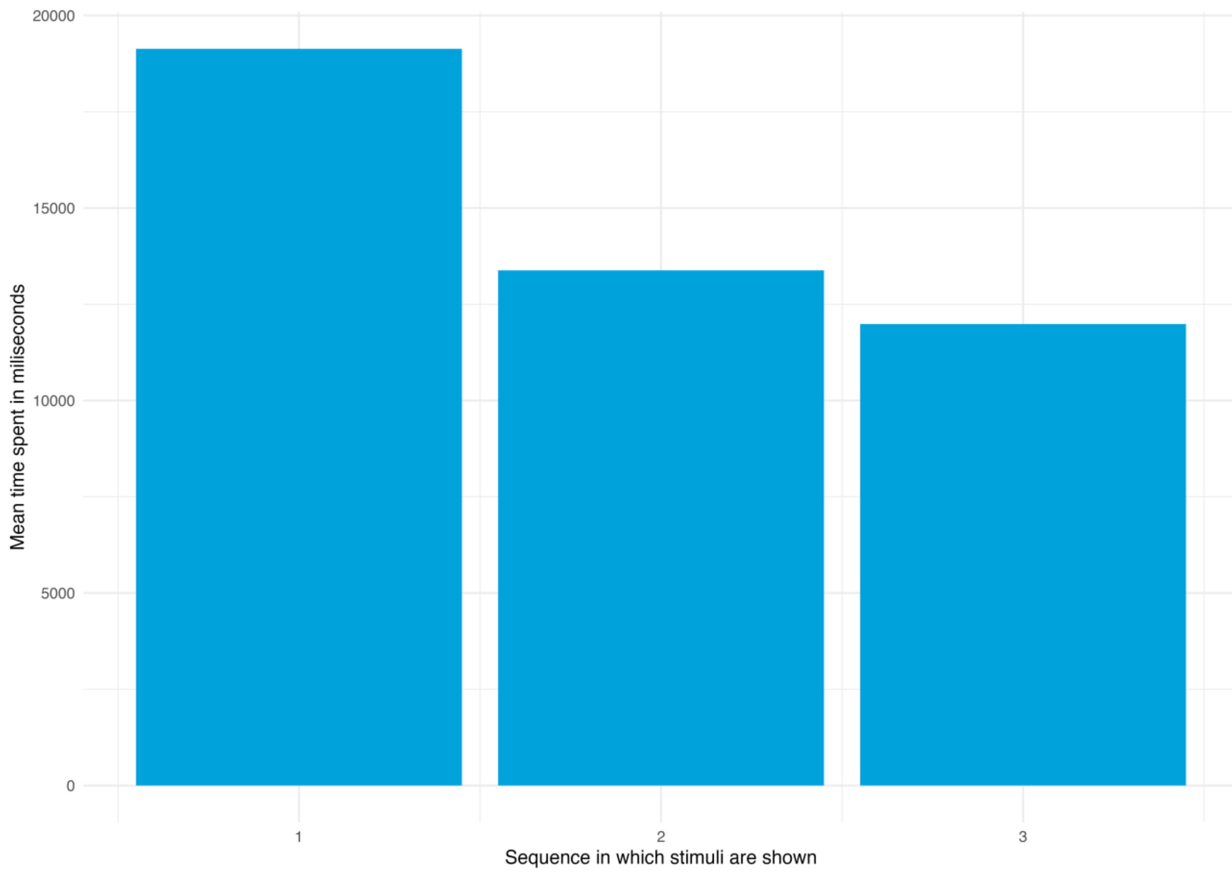
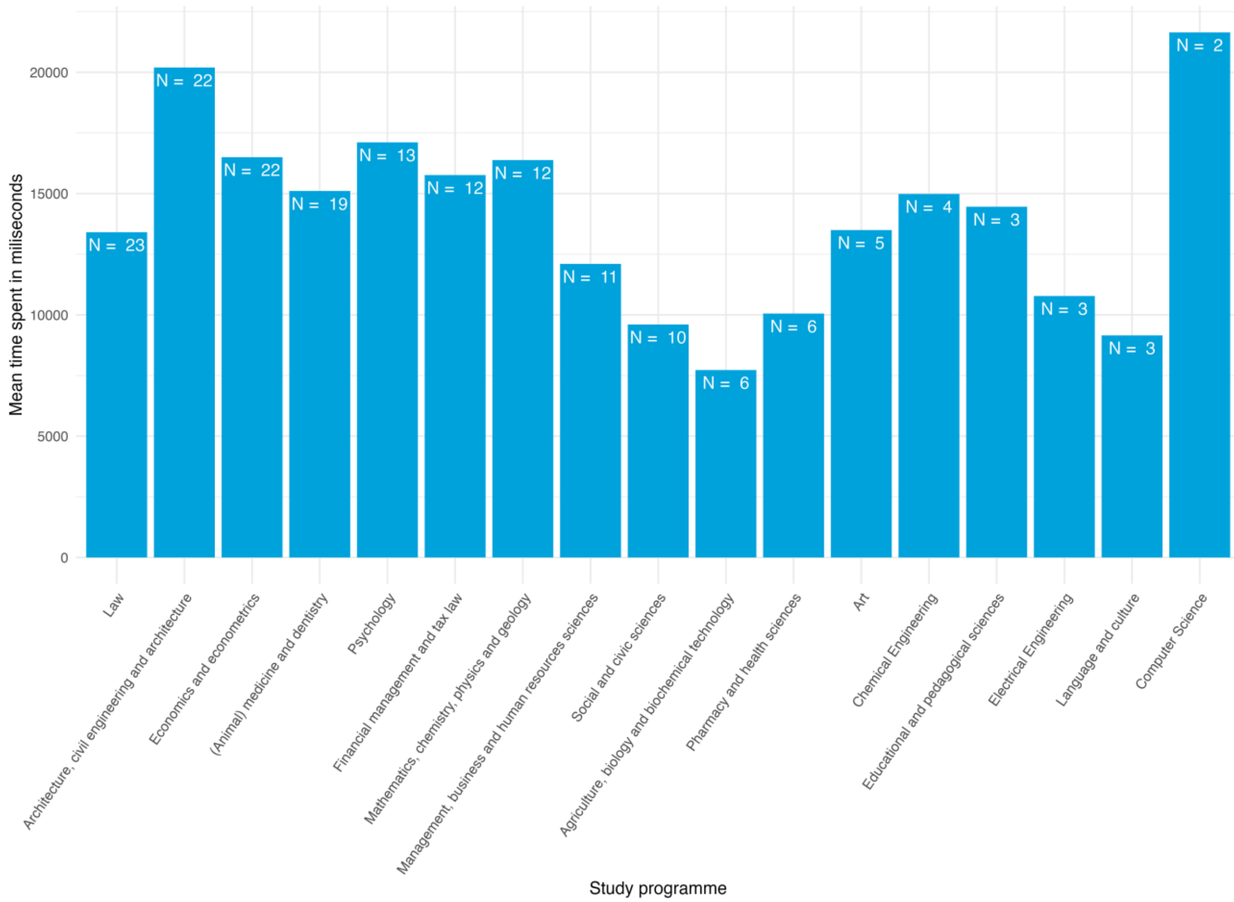


Table 2: Dwell time on three information screens

Group	Information screen (hit sequence)	Mean dwell time in ms
1	1	20067.26
1	2	13662.09
1	3	13777.76
2	1	18261.62
2	2	13109.86
2	3	10374.47

Figure 8 reports the dwell time for the various study programmes chosen by the students. The dwell time is longest for students with a preference for programmes such as construction, civil engineering, architecture, psychology, and informatics, although the latter has a low number of observations. We see relatively short dwell times for study programmes in agriculture and biology, language and culture, social sciences and pharmacy, and health sciences.

Figure 8: Dwell time for the various study programmes



Note: the N is the total number of observations, i.e., number of students times three (although a few students selected only two programmes).

3.3 Dwell time and preferences

We find that the dwell time, i.e., total dwell time across all three screens, is correlated with a number of aspects students consider important in their choice (see Table 3). First, the extent to which students care about the fact that the study programme should be fun to engage in correlates negatively with the dwell time on the information sheets. Second, we find a positive and significant correlation between dwell time and students reporting they consider how much money they will make and job opportunities after college. However, we are not able to track the extent to which students spent time looking at these specific indicators in our information screens.

Table 3: Correlation between dwell time and aspects of study choice that students consider to be important (N = 176)

	Dwell time (gaze in ms)
Dwell time (gaze in ms)	1.00
How fun	-0.18**
How difficult	-0.12
Chance at work	0.16**
How much money	0.19**
How many working hours	0.03
Occupation selection	0.01

** Significant at the 5% level

One may expect that the decrease in dwell time across the three information screens that we report in Figure 7 is less for students who indicate they care about wage and job prospects after college since this is the information we provide them with. However, in our analyses, we also cannot confirm that the dwell time indeed decreases less for those who care more wages and job prospects.

3.4 Dwell time, recall and ranking of programmes

Because we ask students about their wage expectations after we provide them with information, we can assess the extent to which they correctly recall the information we have provided to them. To this end, we regress the absolute difference between the true information and student's recall of unemployment, hours and wage information on the dwell time (see Table 4). If dwell time relates to the attention students pay to the information we provide them with, then we would expect that a longer dwell time results in more accurate recall. Although the signs in our regression are negative and suggest that longer dwell time is related to smaller recall error, we do not find that this relation is statistically significant but cannot exclude that this is due to our small sample size. However, we do find that students with a higher dwell time re-rank their preferred study programme more often (significant at the 10%-level). 23 students out of 63 re-rank their preferred programme, and for 11 of them to a study programme with better wage prospects come higher up in their list.

Table 4: Dwell time, recall of information and ranking

	Absolute difference between unemployment shown and unemployment reported	**Absolute difference between hours shown and hours reported**	**Absolute difference between wage shown and wage reported**	**Re-ranking of preferred education programmes after information (1=yes, 0=no)**
Dwell time	-0.104	-0.093	-0.164	0.075*
Dummy for group 2	yes	yes	yes	yes

* Significant at the 10% level

3.5 Evaluation of information by students

After the information experiment, we asked students to evaluate the information we had provide them with. The results are displayed in Table 4. 83% of students found the information interesting and 92% of students found the information easy to understand. This suggests that a significant majority of students were engaged and intrigued by the content. Although 68% of students found the information useful, only 22% of students expressed an intention to use the information when making their study choice. Further analyses reveal that students who report our information to be useful more often correct their expectation based on our information, herby suggesting that our information is potentially impactful.

Table 4: Post experimental evaluation

Question	**Percentage of student who agree**
I found the information interesting	83
I found the information useful	68
I found the information easy to understand	92
I will use the information when making my study choice	22

4. Conclusions and lessons learned

In this paper, we evaluate students' responses to labour market information presented to them about study programmes they are interested in. We use eye-tracking technology to measure visual attention (i.e., dwell time) and relate this visual attention to their recall of key labour market information (such as unemployment, hours worked and wage), and ranking of study choice. In a sample of 63 students in a pre-academic secondary school (vwo), we find that the dwell time (i.e., the time students spend visualizing the labour market information we give them) is positively correlated with them reporting caring for future changes of work and the money they will make later. Students who report our information to be useful more often correct their expectation based on our information. This suggests that our information has an impact. When relating dwell time to student's recall of unemployment, hours and wage information of the study programmes of their liking, we find a negative relation suggesting that a longer dwell time is related to smaller recall error. However, we do not find that this relation is statistically significant. This could be because we do not show the information in a way that is sufficiently salient to students, but we also cannot exclude that this lack of significance is due to our small sample size.

The evaluation of the information by students suggests a generally positive response to the information, with a high level of interest and perceived ease of understanding. However, there is a lower percentage of students who explicitly plan to use the information in their study choice, indicating a potential gap between interest and practical application for some students.

The eye-tracking technology we used, a web-based technology running on school laptops, is less precise than expected and seems to depend on the quality of instructions given to students. There are number of lessons we learned from this research project that can help other in future endeavors. First, obtaining ethical approval and navigating GDPR compliance proved time-consuming, especially because the webcam-based eye-tracking technology we used records more than just eye-movements. In such cases, a careful explanation of how the data is stored and processed is of key importance. Second, securing consent, especially from parents of students under 16, posed challenges, with forms occasionally getting lost in school processes. Third, collaborative involvement of both mentors and researchers yielded higher levels of student involvement in the study. Moreover, extensive instructions appeared to be important for a successful implementation of eye-tracking in the classroom. Fourth, we chose for a technology (webcam-based eye-tracking) that is less intrusive to students than eye-tracking glasses, but this comes at the cost of more noisy measurements. This, in combination with the importance of having researchers involved is delivering extensive instructions to students, made it impossible to upscale the experimental design to more schools and pupils.

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