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University course choice and the use of heuristics and biases as decision making mechanisms: a study in Brazil

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Artículo Original

Abstract

The choice of a higher education course is one of the most important decisions individuals make, as it usually directs the choice of career or profession. Therefore, it is a complex decision, and it is thus possible that young individuals rely on heuristics and biases to facilitate the decision-making process. Considering that, we explored whether and how heuristics and biases affected college students' judgments and decisions regarding courses. We developed a questionnaire and applied it to a sample of students in Brazil, and we analyzed the collected data using CATPCA and additional statistical methods. We found that students suffered from sunk-cost bias, in addition to the anchoring and representativeness heuristics. Additionally, we found no evidence of a framing effect. We conclude that heuristics and biases were relevant factors in students' judgments and decisions, but they did not dominate them, operating, instead, in conjunction with traditional aspects of analysis and choice.

Palabras clave:
higher education, decisión-making, heuristics, biases

Resumen

Elección del grado universitario y el uso de heurísticos y sesgos como mecanismos de toma de decisiones: un estudio en Brasil. La elección del grado universitario es una de las decisiones más importantes que las personas toman, ya que generalmente dirige la elección de carrera o profesión. Es una decisión compleja y entonces es posible que jóvenes usen heurísticos y sesgos para facilitar el proceso de decisión. Teniendo esto en cuenta, analizamos si, y de qué manera, heurísticos y sesgos afectaron los juicios y decisiones de estudiantes universitarios sobre sus cursos. Desarrollamos un cuestionario y lo aplicamos a una muestra de estudiantes en Brasil, y analizamos los datos utilizando CATPCA y métodos estadísticos adicionales. Encontramos que los estudiantes sufrieron del sesgo del costo hundido, y de los heurísticos de anclaje y representatividad. Además, no encontramos evidencia del efecto de encuadre. Concluimos que heurísticos y sesgos fueron factores relevantes en los juicios de los estudiantes, pero que no los dominaron, sino que operaron en conjunto con aspectos tradicionales de análisis y elección.

Keywords:
educación superior, toma de decisiones, heurísticos, sesgos

Tabla de Contenido

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Introduction

The choice of a higher education course is often a difficult decision for young individuals. To make matters worse, in many countries (such as Brazil), students must define their course — which usually directs their career path — before they start college studies. Therefore, it is a choice made very early in life, at a time when personality, preferences, and skills are developing, and labor market knowledge is often insufficient. When faced with such a complex choice, many students have trouble with their decision-making process (Kulcsár, Dobrean, & Gati, 2020), as they must engage in deep information research, which can be overwhelming.

In this sense, behavioral economics (BE) studies have shown that, in complex situations, cognitive limitations do not allow people to analyze every option and information all the time, causing them to use mental shortcuts — also called heuristics — in their decision processes to reduce

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mental effort and make decisions via intuitive judgments (DellaVigna, 2009). In this way, as young individuals often find themselves either undecided or anxious about a course and career choice (Nalbantoglu & Cetin, 2018), and considering that people often rely on mental shortcuts to facilitate complex decisions (Tversky & Kahneman, 1974) it is possible that students use mental shortcuts and biases to simplify course and career choices and judgments (Harrison, 2016; Redekopp, 2016).

Although heuristics facilitate decision making, they can also lead to systemic errors or non-optional choices (DellaVigna, 2009; Thaler, 2016). Recent research indicates that students have imperfect knowledge about their courses (Fricke, Grogger, & Steinmayr, 2018), as well as biased expectations regarding wages for different professions and the earnings from and costs of higher education (Baker, Bettinger, Jacob, & Marinescu, 2018; Ruder & Van Noy, 2017; Wiswall & Zafar, 2015). In addition, Hastings, Neilson, Ramirez, and Zimmerman (2016), in a large-scale study in Chile, find that students believe their earnings will be similar to those of past graduates (overestimating their own outcomes), and that most students rely on their families as sources of information.

In summary, despite being one of the most important decisions made by individuals, it is not rare that students make their career choices without proper knowledge (Hirschi, 2011; McGuigan, McNally, & Wyness, 2016), thus having a greater chance of making biased choices and becoming frustrated in the future. Therefore, our paper investigates whether and how students' judgments and decisions regarding their university courses are affected by heuristics and biases. With this aim, we developed a questionnaire and applied it to a sample of college students in Brazil, and we analyzed the collected data using Categorical Principal Components Analysis (CATPCA), in addition to further statistical methods.

Research Hypotheses

Following Redekopp (2016), we evaluated Brazilian college students and selected four behavioral effects to investigate: sunk-cost bias, framing effect, anchoring heuristic, and representativeness heuristic.

Hypothesis 1: Students' course choice is affected by sunk-cost bias, which grows throughout college time. Traditional microeconomic theory states that people should only base decisions on current and future costs and benefits, as past investments have already happened and, thus, should not influence new decisions (Roth, Robbert, & Straus, 2014). Yet, there is evidence from several fields of study related to decision making showing that individuals deviate from this principle, taking sunk-costs into account when making decisions (Guler, 2007; Haita-Falah, 2017; Roth et al., 2014; Thaler, 1999). Sunk-cost bias occurs when people continue to insist on a behavior because they have previously invested resources, such as money, time, or effort (Arkes & Blumer, 1985). In relation to this, it is common for students to feel that, even if they are unhappy with their course choice, they must complete it because of the time, money, or effort already invested (Redekopp, 2016). Therefore, if students choose a course and realize that they made a poor choice, but they decide neither to dropout nor to switch to another course because of the time already invested, then that could be an indication that students are affected by sunk-cost bias.

Hypothesis 2: Students are affected by the framing effect when processing course information. Kahneman and Tversky (1979) found that decision making depends on how options are presented. Generally, individuals tend to favor an option when it is framed positively, and reject it when it is framed negatively, even if the outcomes are the same (Levin, Schneider, & Gaeth, 1998; Stark, Baldwin, Hertel, & Rothman, 2016; Tversky & Kahneman, 1981). In relation to this, Tversky and Kahneman's (1981) classic experiment showed that small variations in the description of options could heavily influence decision making. Similar results have been observed in other studies [see Beratšová, Krchová, Gažová, & Jirásek (2016) for a recent review]. Among them, Redekopp (2016) highlights the reaction of a student to hearing that there is a 66.6% chance of rejection for a place in a training program, compared to a one in three chance of acceptance. Although the information is the same, the student who hears the former statistic would be more likely to give up than would the one who hears the latter. Thus, we expected students to change the way they process given information

depending on the context in which the information is framed (positive or negative).

Hypothesis 3: Students anchor their expectations in reference points related to social influences and the perceived earnings of acquaintances who graduated from the same courses they chose. Anchoring happens when individuals make a judgment based on a reference point and, from there, adjust their expectations to reach their answer or decision (Furnham & Boo, 2011; Tversky & Kahneman, 1974). Generally, the initial exposure to a number or value serves as a reference point, which influences subsequent judgments and decisions. However, recent studies suggest that peoples' behavior could also be anchored in perceptions of social norms, which lead to behavior change (Lewis & Neighbors, 2006; Schultz, 1999; Zimmerman, 2009), and also in perceptions of magnitude (Tomczak & Traczyk, 2017), communication (Hütter & Fiedler, 2019), and humor (Englich & Soder, 2009). This shows that the boundaries of anchoring effects may be much wider than previously thought (Oppenheimer, LeBoeuf, & Brewer, 2008). Redekopp (2016) argues that students often search for a career by considering wages as an initial filtering criterion, making it a reference point. Therefore, we expected that students, when choosing their course, could anchor their expectations both on social phenomena (e.g., the direct influence of family status) and on a numerical reference point (the monthly salaries they imagine that someone who graduated from their course receives).

Hypothesis 4: Students use the representativeness heuristic by relying on stereotypes and neglecting base-rate information when assessing social judgment. Representativeness occurs when individuals make a probability judgment between two instances based on the similarity between them. It involves judging the probability of an object "A" belonging to a class "B" based on how similar "A" is to "B". It arises from the use of similarities or stereotypes when making judgments or decisions (Smith, 1988; Tversky & Kahneman, 1974), and one of its consequences is an effect called base-rate neglect. Kahneman and Tversky (1973) describe base-rate neglect as the tendency of individuals to rely on representativeness to assess probability judgments, as they ignore or undervalue populational statistics and focus only on specific information. In other words, when facing a decision, while using the representativeness heuristic, people neglect base-rates and rely solely on specific evidence (Hoppe & Kusterer, 2011; Tversky & Kahneman, 1974).

An example of such specific evidence is stereotypes (Białek, 2017; Pennycook & Thompson, 2012). Following the dual-system theory, stereotypes usually lead to "System 1" intuitive judgments (based on representativeness), whereas the process of considering base-rate statistics requires more analytical reasoning, provided by "System 2." As it is common for people to favor less laborious judgments from "System 1," stereotypes would naturally be favored over base-rates (Pennycook & Thompson, 2016). Considering the literature review, we expected that students would be prone to the use of a stereotype and base-rate neglect when faced with a social judgment problem.

Method

Participants

The sample consisted of 470 college students — 247 (52.6%) female and 223 (47.4%) male — from two private universities in Southern Brazil. The age group was mainly 19–25 years old, with a median age of 24 years old. The distribution of students per course was Business Administration (19.1%), Accounting (10.9%), Economics (5.7%), Law (19.6%), Nursing (7.2%), Civil Engineering (27%), and Mechanical Engineering (10.4%).

Instrument

Data collection was made during October 2019 using a survey instrument. This instrument included 26 questions that allowed us to test our hypotheses (see Appendix A). The survey contained a list of questions aimed at characterizing the participants' personal and socioeconomic profile (sex, age, course, income, etc.). After that, we developed questions that helped us understand students' course choices: for instance, what were the main factors that motivated their decision, such as expected earnings, employment opportunities, family approval, and work enjoyment, among other factors. Finally, participants were also prompted to answer experimental questions based on the BE literature, such as Q14, Q19, Q20, and Q21.

Procedure

Before data collection, the questionnaire underwent a validation phase. First, we consulted a group of four judges, who analyzed the clarity and relevance of each question. Then, we carried out a pre-test with a pilot sample, aiming to confirm students' comprehension of each question. Subsequently, the survey was sent to the participants, who answered it online. Every student was informed about the goals of the survey and confirmed their consent to participate in the study. We also stressed that participants would not be identified in any way, ensuring the privacy and safety of all participants' personal information.

Data analysis

Data analysis was conducted using SPSS 22 *(Statistical Package for the Social Sciences).* We employed CATPCA, intending to create orthogonal components for analysis and interpretation. The instruments' internal consistency was measured by Cronbach's alpha, returning a measure of .695, which is fit for exploratory research (Hair, Black, Babin, & Anderson, 2014). The Kaiser-Meyer-Olkin measure of sample adequacy returned a value of 0.748, confirming the possibility of performing the analysis of the components. In addition, Bartlett's test of sphericity also had significant results, with an approximate chi-square of 5143.309 and 861 degrees of freedom. Therefore, we could proceed with the analysis.

The results from CATPCA were obtained through an optimal scaling process, and a total of 13 components, which explained 61.31% of data variance, was extracted. CATPCA also reevaluates the components' consistency and returns Cronbach's alpha based on the eigenvalues and total variance (Meulman, Van der Kooij, & Heiser, 2004). The adjusted alpha was 0.985, indicating high consistency of the components.

Results and Discussion

The 13 components extracted from CATPCA were interpreted and named based on the meaningful relationships revealed by their significant variables (see Appendix B). Then, we linked the components to each of the studied behavioral effects to answer our research hypotheses (not every component was used to investigate the selected effects, as only some of them were necessary to test this study's hypotheses). The results for each effect are described here.

Sunk-cost bias

To test for sunk-cost bias, we used the component "Propensity to switch course". The main variables in this component were those related to Q26 of the survey, which evaluated participants' chance of switching their course if faced with certain adverse scenarios, such as the student finding that the chosen career would be extinct in 15 years or that the levels of employment and wages for the chosen profession had fallen by 30%. In general, when faced with different adverse scenarios, students showed low chances of switching courses, even if they were to be either disappointed by or lose enjoyment in the chosen career.

Common sense tells us that individuals who plan for the long-term should consider current adversities and seek different career or course options as soon as possible to correct their choices and reduce losses. Naturally, there are many reasons why students could still remain in their courses — for instance, they may not see future risks clearly, and they could have either a low sense of urgency or a very strong vocation. However, it is plausible that factors such as course expenses, the knowledge acquired from, and the time already invested in the course, are all elements that could influence students' decisions — and if that is true, then we can infer the occurrence of sunk-cost bias.

Therefore, we regressed students' current semester (Q5.SEMESTER) against the component "Propensity to switch course," which was obtained by optimal scaling. We used an ordinary least squares regression to test if *Propensity to switch course= f(Q5. SEMESTER*). To identify sunk-cost bias, we expected that the relationship would be significant and negative, that is, that the more semesters students had spent in study, the less likely they would be to switch courses. The regression results can be seen in (1):

$$\text{Propensity to switch course} = .260\text{-}.043*Q5+ \in\_i \quad (1)$$

We can see that the estimated parameter for Q5.SEMESTER is negative, as expected to validate Hypothesis 1. In addition, we found that *p* = .013, which means that Q5.SEMESTER is significant and determinant to explain "Propensity to switch course." This way, our results confirm

Hypothesis 1 and are in line with other studies that identify sunk-cost bias on decision making, expanding the literature and providing evidence of this effect on educational choices. In particular, we mention Cunha Jr. and Caldieraro (2009), who argued for the need of more evidence that sunk-cost bias also happens for non-financial investments, such as time and effort — which are heavily invested in a college course.

Framing Effect

Two experimental questions were used to identify this effect. They were based on the example given by Redekopp (2016): the reaction of a student to hearing that there is a 66.6% chance of being rejected for a place in a training program, compared to a one in three chance that they will be accepted. The student who receives the first information (negative framing) should be more likely to give up their application than should the one who receives the second (positive framing), even though the information is the same. Therefore, our two questions were: Q19) "You find that 2 out of 3 students drop out of your course throughout the program. Does this influence your course decision?", and Q26) "[...] Indicate the % of chance that you would switch your course due to of each of these events [...]: Event 3) you discover that you have a 33% chance of completing your course successfully".

Following Redekopp's (2016) example, Q19 is presented in a negative context, emphasized by the information that most students *drop out* of the participants' course. Therefore, we expected students to answer "yes" to Q19 — indicating that their course decision *would* be affected by the negative information. As for Q26_3, it brings the same information, but framed in a positive context, emphasized by the chance that the student will *complete the course successfully*. We then expected that students would answer with low chances of switching their course.

For Q19, most students' (89.1%) course decision would not be affected if they discovered that two-thirds of their colleagues drop out of their course. Thus, this negative information did not affect the participants. As for Q26_3, we found that the average chance of switching course was low (19.8%), indicating that there was no reversal in the way participants processed the information. We also found a negative and significant correlation at the 1% level between the two questions, and an analysis of variance (ANOVA) confirmed that the percentage means answered in Q26_3 were statistically different ($F(1, 468) = 24{,}908$, $p = .000$) between the group that answered "yes" and the group that answered "no" to Q19. This confirms the consistency in responses, as those students who answered "yes" to Q19 are more likely (36.5% chance) to drop out than those who answered "no" (17.8% chance).

Therefore, even with a change in framing, we did not find an inversion in the way participants processed the course information, as is usually seen in studies that find framing effects (Stark et al., 2016; Tversky & Kahneman, 1981). Thus, Hypothesis 2 was not confirmed.

Anchoring

To understand if students were affected by anchoring when choosing their course, we used the components "Social influences," "Influences from colleagues or past graduates from the same course," "Importance of prestige," and "Importance of future earnings". Initially, we found that the courses with students most affected by family influence were Mechanical Engineering (42.9% of these students), Law (40.2%), and Civil Engineering (38.6%). Interestingly, students from these courses also stood out as those for who expected salaries had the greatest influence on course choice. We also found a significant and positive correlation among the importance of salaries, prestige, and family influence on course choice. This is expected, as social prestige is often linked to higher status or living conditions, elements that students may look forward to. Besides, it is common for parents to influence their children in choosing a career that guarantees high earnings.

Considering this, in Table 1 we show an analysis of correlations among the main questions regarding family influence and their socioeconomic characteristics. We also included question Q12, which asked students if any of their friends or family members either had the same degree or were engaged in the same course as the participant. This variable was computed in a way that higher values meant that the participants had, in their social circle, more people, with a closer relationship, that held a degree (or were engaged) in the same course that the participant pursued.

Table 1.
Correlations between family characteristics and questions related to family influence

Questions	Family income	Father's education	Mother's education	Q12 (Relationship degree with people who took the same course)	Q22_1 (Family influence)	Q23_5 (Choice based on having family members who took the same course)	Q23_7 (Choice based on family's wish)
- Family income	1	.313***	.252***	.134***	.126***	.072	.082*
- Father's education	.313***	1	.544***	.269***	.168***	.222***	.137***
- Mother's education	.252***	.544***	1	.223***	.179***	.173***	.140***
- Q12(Relationship degree with people who took the same course)	.134***	.269***	.223***	1	.243***	.432***	.134***
- Q22_1 (Family influence)	.126***	.168***	.179***	.243***	1	.425***	.608***
- Q23_5 (Choice based on having family members who took the same course)	.072	.222***	.173***	.432***	.425***	1	.415***
- Q23_7 (Choice based on family's wish)	.082*	.137***	.140***	.134***	.608***	.415***	1

Note. $*p < .1$, $**p < .05$, $***p < .01$

As can be seen, family income has a statistically significant, though weak, correlation with family influence. Parents' education, in turn, has a stronger correlation with family influence and, as expected, family income. These three elements seem to "go together": the higher a family's schooling and income, the greater the family influence on students' decisions. Having friends and family members on the same course (Q12) had significant and positive correlations with every variable related to family influence, but it was stronger for Q23_5. It appears that the more people students had in their social circle who pursued the same degree, and the closer these relationships were, the greater the influence on course choice. This evidence is in line with Xia's (2016) study, which shows that young students are more likely to choose a career associated with the profession of a family member.

These social influence factors seem to result in a type of anchoring based on desired lifestyle and perceptions about the earnings of other individuals who chose the same career. To deepen this analysis, we used Q13, in which participants had to disclose the average salary they imagined an acquaintance (colleague, friend, or family member) who graduated on the same course received monthly. The average "imagined" salary answered was R$5.420, an amount slightly above the Brazilian average for people with higher education, which was R$5.110 in 2017 (Almeida, 2018). Nevertheless, there was a significant disparity in participants' answers, with a standard deviation of R$4.956,74. Examining response frequencies, 51.1% of the sample disclosed an imagined salary up to R$4.000, but the other half answered with much higher amounts, reaching numbers like R$20.000 and R$35.000, figures that do not reflect the average of Brazilian reality. Thus, an important share of students overestimated the salaries received by individuals with higher education, a result similar to those of Baker et al. (2018), Hastings et al. (2016), and Wiswall and Zafar (2015).

Furthermore, our main idea was that aspects related to social influences and perceived earnings of individuals with similar goals could serve as reference points, by creating expectations among students about future living conditions and earnings. We used Table 2 to carry out the

following analysis.

Table 2.
Salaries imagined by students on Q13, per group of respondents

Question	Option	Q13) Imagined salary
Family income	Up to R$ 1000	**R$ 4.708,33**
	R$ 1001 to R$ 2000	**R$ 3.973,33**
	R$ 2001 a R$ 3000	**R$ 4.129,23**
	R$ 3001 to R$ 4000	**R$ 5.086,32**
	Higher than R$ 4.000	**R$ 6.168,38**
Q23_5) I chose this course because I had family members who were, are, or would be engaged in the same course;	No influence on my choice	**R$ 5.027,84**
	Little influence on my choice	**R$ 5.414,71**
	Medium influence on my choice	**R$ 7.710,53**
	A strong influence on my choice	**R$ 6.900,00**
Q23_2) I chose this course for the salary I will receive by graduating from this course;	No influence on my choice	**R$ 4.794,12**
	Little influence on my choice	**R$ 4.601,12**
	Medium influence on my choice	**R$ 5.337, 50**
	A strong influence on my choice	**R$ 6.130,32**
Q24_1) Which of the two courses would provide you with higher average earnings in the job market after your graduation?	Course A: YOUR COURSE	**R$ 5.840,29**
	Course B: YOUR SECOND OPTION	**R$ 4.321,54**

First, we found statistically significant correlations at the 1% level between the imagined salaries from Q13, family income, and family influence (Q23_5). That is, students who imagined higher salaries for their profession were also the ones who suffered greater family influence and came from more favored families — a result similar to that of Martins and Machado (2018), and one that indicates an anchoring effect based on family status. We also found significant correlations at the 1% level among Q13, Q23_2, and Q24_1, showing that students for whom future salaries were a determinant factor of course choice attributed earnings of 11%–28% higher to acquaintances who chose the same course, in relation to the estimates of participants for whom expected salaries were not so important.

Besides, students who believed that their course would provide higher earnings than their second option reported imagined salaries of 35% higher than those imagined by students who believed otherwise. The mean differences between the two groups were confirmed with an ANOVA ($F(1, 468) = 8{,}979$, $p = .001$). These results showed that students who make earnings-based choices also imagine higher salaries in the labor market, overestimating these amounts. The fact that their course choice is based on an overestimation of earnings may lead to future frustration.

In conclusion, this set of results attests that students: (i) suffer some degree of social influence when making course choices, especially from their family; (ii) have their earnings' expectations anchored on the socioeconomic status of their families, which influences their perceptions of future earnings; and (iii) anchor their earnings' expectations on the salaries they imagine that career colleagues receive, given that such expectations are a determinant factor of course choice. Therefore, Hypothesis 3 is confirmed.

Representativeness

One consequence of the representativeness

heuristic is base-rate neglect, in which people, when faced with a probability judgment, neglect populational statistics in favor of specific information, often considering stereotypes to assess judgment. Thus, to test this, we used the component "Propensity to rely on stereotypes." The main variable is Q21, which consists of a problem based on examples disseminated in the literature (Białek, 2017; Kahneman & Tversky, 1973; Pennycook & Thompson, 2012), and reads: *"You find that out of 1000 students enrolled in college this year, 900 chose Law as their course, while the rest chose Engineering. Roberto took the entrance exam and was among the best students. He is 19 years old, and his friends consider him an introvert. He also recently started an online programming course, and for the rest of his free time, he watches science fiction movies. What is the probability (%) that Roberto chose Law as his course?*". The description of the engineer stereotype followed Białek's (2017) example and, as explained by the author, a set of features, such as being an introvert with a sci-fi interest, is highly probable given that the person described is drawn from a population of engineers, fitting the stereotype well.

Due to the students' distribution, it is safe to say that it would be more likely that Roberto was a Law student than an Engineering student. However, the most likely thing to happen when people are faced with this problem is that they consider their knowledge about engineers and lawyers and then apply such stereotypes to their judgment (Białek, 2017; Pennycook & Thompson, 2016). The participants' mean response was that there was a 33.59% chance of Roberto being a Law student — which is far from the "correct" answer of 90% — with a large group (62.6% of the sample) indicating low chances (under 30%) of that. Besides, like the study of De Neys and Glumicic (2008), the base-rate (90%) was considered by less than 20% of the sample.

The result is also similar to Pennycook and Thompson (2012), who found a bimodal distribution on their participants' responses. The authors mention that when base-rates and stereotypes point to different responses, people tend to not integrate both aspects of information and choose either one or the other, giving an extreme response. This was also the case in our study, as we also found a bimodal distribution in response frequencies. We followed Schilling, Watkins and Watkins (2002), who argue that bimodality can be inferred if the means of two distributions differ by more than the sum of their standard deviations. Thus, we divided the responses into two distributions: the first with the estimates of 0% to 49% (*means* = 13.93%, *SD* = 12.14) and the second with the estimates of 50% to 100% (*means* = 74.73%, *SD* = 18.55). As we can see, the difference between means (60.8%) is almost double the sum of the standard deviations (30.69), confirming that our distribution is bimodal.

An ANOVA confirmed that there were no statistically significant differences for the mean estimates per course ($F(6, 463) = 1.566$, $p > .050$), with Tukey and Games–Howell tests ($p > .05$) confirming this for all courses. Therefore, students from all courses were affected by the stereotype and neglected base-rate information. This ruled out any possible extra effects caused by describing an Engineering student in the problem, given that there were Engineering students in our sample. These results allowed us to confirm Hypothesis 4. Thus, our research expands the knowledge related to the use of representativeness by college students in their decision making, adding to the work of Smith (1988), who finds that higher education students also use this heuristic when choosing a university.

Finally, further analysis of the component revealed that the students who are less likely to rely on stereotypes were also less likely to be influenced by seeing peers drop out of the course. This seems logical, as the students least influenced by stereotypes should also be less affected by seeing representatives of these stereotypes — their colleagues — dropping out. Besides, the students most likely to rely on stereotypes were those who did not have acquaintances engaged on the same course when the course decision was made. Thus, being close to someone who has solid information about the pursued course appears to reduce students' tendency of relying on stereotypes when making an assessment.

Conclusions

This study explored the decision-making process of higher education students for their university courses, focusing on whether and how students' choices and judgments were affected by heuristics and biases. To conduct this analysis, we developed a survey and applied it to 470 students

in Brazil; the collected data were analyzed mainly by CATPCA. We found evidence that heuristics and biases were elements that influenced the decisions and judgments of higher education students. However, not all the explored effects were identified in the sample.

First, our results showed that sunk-cost bias affected students' decision-making processes regarding their permanence on the chosen course throughout college. The implications of this early evidence can be related to the future satisfaction and well-being of students. If students do not revise their course choice even when facing incentives to do so — such as either disliking the activities of the chosen profession or discovering that it will be extinct in some years — then what are the consequences in their lives for continuing to invest time and resources in a path with low prospects of future satisfaction? How can the influence of sunk-cost bias on such important decisions be reduced? Universities should find ways of identifying these individuals and perhaps make the process of correcting course choices less punishing for students.

We also found that students anchored their earnings' expectations on social influences, including the socioeconomic status of their family and the earnings they imagine that acquaintances who took the same university course received in their occupations. A point that must be highlighted is that as course choice was mostly anchored on overestimated expectations (with students adjusting their expectations upwards), then mechanisms for information and correction of beliefs must be developed by institutions to diminish this problem. Furthermore, we extend Xia's (2016) argument that if the socioeconomic condition of the family influences a student's earnings expectations, then students from less favored families might not have the opportunity to know the returns from higher education. Thus, facilitating information about the possibilities of different schooling paths must also be included in the agenda of universities.

The third set of evidence we found is that students used the representativeness heuristic, relying on stereotypes and neglecting base-rates, to make a social judgment. This evidence raises a question: because, within a social judgment context, students neglect base-rates, giving more weight to specific cases that represent a group of people (students from a course), how can institutions use this fact in their campaigns to attract new students? The answer is ambiguous: universities can reinforce stereotypes to increase the effect of representativeness and attract students from specific groups of interest, or, conversely, this knowledge can be used by institutions in ways that reduce this effect (debiasing students), to prevent young individuals from being incorrectly influenced by stereotypes.

Additionally, we did not identify a framing effect on students' information processing. It appears that students followed a more rational procedure when processing the given course information; however, as it is also possible that the instrument was not able to capture the effect, this should be further investigated by future studies.

It is also important to mention that not all components from the CAPTCA were used in our analysis of behavioral effects; some components were specifically related to labor market and vocational aspects, which accounted for 25% of the data variance. These important and expected elements of course decision are not necessarily affected by heuristics or biases. Therefore, we conclude that heuristics and biases were relevant factors in students' decision making, but they did not dominate it, operating, instead, in conjunction with more traditional factors involved in career decisions. This result is in line with one of the main pillars of behavioral economics: that people operate under bounded rationality — not irrationality — making choices that are sufficient and satisfactory but not always optimal.

Some limitations of our study must be mentioned. First, we explored a limited number of behavioral effects, and other heuristics and biases, such as loss aversion and availability, could also be investigated in future research. Another limitation is of a geographic nature, as the cultural and socioeconomic characteristics of the sample make it difficult to generalize our results. Therefore, we encourage similar studies with students from different regions, cultures and backgrounds.

Finally, it would also be important for future works to explore how to mitigate the influence of heuristics and biases on students' decisions and judgments (i.e., debiasing). Studies along this line, focusing on course and career choices, may contribute to the development of methods that assist students in such important decisions.

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Appendix A

Survey instrument

When accessing the survey instrument, students were firstly presented with the questionnaire title, followed by a short notice regarding the survey's goals and details. The notice (translated from Portuguese to English) was the following:

> ***How did you choose your course?***
>
> *Hello! Thank you for opening this link!*
> *This questionnaire is part of a master's dissertation research in the Economics graduate program at UNISINOS University. The goal of this research is to evaluate the decision-making process of higher education students for their courses. Therefore, we would like to count on your collaboration in answering these questions about your actions and reflections regarding your course choice.*
> *The survey is anonymous, and you will not be identified. Besides, you will be able to obtain information regarding the progress of the research and its results, as well as a copy of this document, through the e-mails "mateusfeld@outlook.com" or "mateusfeld@edu.unisinos.br".*
> *We emphasize that if you feel uncomfortable in answering these questions or decide to give up at any time, just indicate the option* "I do not agree to participate in the survey" *and send it.*

Directly after this message, students were faced with Question 1, which was the consent confirmation:

Q1) To continue this survey, please identify the desired option:
1. ( ) I have read, understood and agree to participate in the survey;
2. ( ) I do not agree to participate in the survey.

The students who answered the 2nd option on Q1 were led to an acknowledgment page and then exited the survey. Those who confirmed their consent, by answering option 1 on Q1, were led to the survey, which, after being translated from Portuguese to English, is fully transcribed below:

Q2) How old are you?
Q3) Sex:
( )Male
( ) Female
( ) I would rather not inform
Q4) What is your course?
( ) Business Administration
( ) Accounting
( ) Economics
( ) Law
( ) Nursing
( ) Civil Engineering
( ) Mechanical Engineering
Q5) What semester are you currently in?
Q6) Who do you currently live with?
( ) Alone
( ) Parents
( ) Spouse/partner
Q7) Regarding your occupation, currently you:
( ) Only study and is not looking for a job;
( ) Study and work;
( ) Only study, but is looking for a job.

After Q7, participants who indicated that they worked were directed to Q8 and Q9. Those who only studied were directed to Q10.

Q8) What is your employment status?

( ) Internship
( ) Salaried employee
( ) Self-employed/entrepreneur

Q9) What is your monthly income?

Q10) What is your family's monthly income?

Q11) Indicate below the highest level of education of your family members (check the appropriate option (1 per column). If you have more than one sibling, check the option for the highest degree of education, and if you do not have siblings, check "not applicable"):

	Elementaryschoolorless	Incomplete high school	Complete high school	Incompleteh igher education	Complete higher education	Graduate school/post higher education	I don't know / Not applicable
Sibling(s)							
Father / Stepfather							
Mother / Stepmother							

Q12) Were any of your family members or friends (that you already had before entering your course) past graduates or engaged in the same higher education course as yours when you made your course choice?

Q13) Consider someone you know, who is a past graduate in the same course as you and is currently working in a related occupation. Based on that person, what is the AVERAGE salary you imagine they receive monthly? (If you do not know anyone who fits this description, please answer with "0").

Q14) Imagine that you can only work after you graduate and that you need to choose between a Course "A" and a Course "B", as shown below. Based on this information alone, which course would you choose?

Course A ( )
Startingsalary: R$ 3000
Courselength: 2 years

Course B ( )
Startingsalary: R$ 3200
Courselength: 2.5 years

Q15) Which of the options below most accurately describes your situation as a university student?
( ) I am taking my first higher education course;
( ) I dropped out of another higher education course and switched to this one;
( ) I already graduated from another course and now I am doing this one;
( ) I am taking two courses at the same time;
( ) I started this same course at another institution but decided to switch to this institution (same course).

Q16) Before choosing your current course, how many others did you consider among your options?
( ) 1 (only my current course)
( ) 2
( ) 3 or more

Q17) Do you still question your course choice? (That is, do you still wonder if you chose the right course for you?).

Q18) Before you made your course choice, what were the main SOURCES OF INFORMATION that you used to research the courses/careers you were interested in? (You can select more than one alternative).
( ) I talked to friends who took the same course, to ask for information;
( ) I consulted with counselors / psychologists / vocation specialists;
( ) I visited career conferences, fairs, exhibitions and events held in universities;
( ) I talked to my family members;
( ) I visited a university on my own and spoke with a member of the course (professor, coordinator, etc.);
( ) Government websites (such as MEC – Ministry of Education);
( ) University websites;
( ) Career information websites (career guides, student guides, etc.);
( ) I talked to co-workers;
( ) I did not seek any information before choosing my course.

Q19) You find that 2 out of 3 students drop out of your course throughout the program. Does this influence your course decision?

Q20) Imagine that you can only work after graduating and that you need to choose between a Course "1" and a Course "2", as shown below. Based on this information alone, which course would you choose?

Course 1 ( )	*Course 2 ( )*
Startingsalary: R$ 3200	*Startingsalary: R$ 3000*
Courselength: 6.5 years	*Courselength: 6 years*

Q21) You find that out of 1000 students enrolled in college this year, 900 chose Law as their course, while the rest chose Engineering. Roberto took the entrance exam and was among the best students. He is 19 years old, and his friends consider him an introvert. He also recently started an online programming course, and for the rest of his free time, he watches science fiction movies. What is the probability (%) that Roberto chose Law as his course?

Q22) For the following questions, read the statements in the first column and then select how much you agree with them in the following columns. **(Participants were prompted with a Likert-type agreement scale with the options "Strongly disagree", "Partially disagree", "I do not agree nor disagree", "Partially agree" and "Strongly agree" for each statement).**

Q22_1) Your family influenced your course choice;
Q22_2) Your friends influenced your course choice;
Q22_3) You currently know what professional activities are performed by someone who graduated in your course;
Q22_4) Your family/parents agree with the course/career you chose;
Q22_5) Your friends respect the course/career you chose;
Q22_6) Before choosing your course, you knew what professional activities are performed by someone who graduated in your course;
Q22_7) For personal reasons, you need to cut the number of classes you take in each semester by half, doubling the time it would take you to graduate. This would discourage you from continuing in your course;

Q23) What factors most influenced your course choice? Check below how much each factor weighed in your decision. **(Participants were prompted with a Likert-type weight scale with the options "No influence on my choice", "Little influence on my choice", "Medium influence on my choice", and "Strong influence on my choice" for each statement).**

Q23_1) I chose this course for the possibility of getting a job by graduating from this course;
Q23_2) I chose this course for the salary I will receive by graduating from this course;
Q23_3) I chose this course because I would find people like me in this course;
Q23_4) I chose this course because I had friends who were, are, or would be engaged in the same course;
Q23_5) I chose this course because I had family members who were, are, or would be engaged in the same course;
Q23_6) I chose this course because I like the type of work that people who graduate in this course do;
Q23_7) I chose this course because my family wanted me to graduate in it;
Q23_8) I chose this course because the classes are easy;
Q23_9) I chose this course because of the prestige that the professionals graduated in this course have in society;

Q24) In the next questions we ask you to compare YOUR COURSE (A) with a course that was your SECOND OPTION (B), one that perhaps you thought about taking but ended up not taking. **(Students had to check the box that represented their answer, in a table like the one below).**

Questions	**Course A: YOUR COURSE**	**Course B: YOUR SECOND OPTION**
Q24_1) Which of the two courses would provide you with higher average earnings in the job market after your graduation?		
Q24_2) Considering the challenges and difficulties of each course, which one do you believe is easier?		

Q24_3) In which course do you see more chances of having a stable job?		
Q24_4) Which of the courses would make you most happy or satisfied with your life, after a few years of work?		
Q24_5) Which of the courses would please your parents the most?		
Q24_6) Which of the courses would take the longest to finish?		
Q24_7) Which of the two courses do you think is the most expensive, considering tuition, necessary materials, etc.?		

Q25) Imagine that the course that was your second option is being reformulated, and now the time it would take you to graduate in it is halved. Would you switch your course?

Q26) Some events may motivate us to switch courses or career paths. Based on the events described below, please indicate the % chance of you switching your course due to each of the events. Remember to consider how long will it still take you to graduate.
Q26_1) You discover that this is NOT the work you would like to do;
Q26_2) You find that the wages for your future profession have dropped by 30%;
Q26_3) You discover that you have a 33% chance of completing your course successfully;
Q26_4) You win millions of dollars in a lottery;
Q26_5) You find that the profession related to your course will be extinguished in 15 years;
Q26_6) You discover that the employability for the profession related to your course has dropped by 30%;
Q26_7) You find that the people who graduated from the course that was your second option are receiving wages 30% higher than the people who graduated in your course.

Appendix B

Principal components identification and extraction matrix

B1 - Principal components, survey items and correlation sign within the component

Principal component	Survey items	Variable sign
1. Propensity to switch course	Q16) Before choosing your current course, how many others did you consider among your options?	Positive
	Q17) Do you still question your course choice? (That is, do you still wonder if you chose the right course for you?);	Negative
	Q22_7) For personal reasons, you need to cut the number of classes you take in each semester by half, doubling the time it would take you to graduate. This would discourage you from continuing in your course;	Positive
	Q24_4) Which of the courses would make you most happy or satisfied with your life, after a few years of work?	Negative
	Q25) Imagine that the course that was your second option is being reformulated, and now the time it would take you to graduate in it is halved. Would you switch your course?	Negative
	Q26_1) You discover that this is NOT the work you would like to do;	Positive
	Q26_2) You find that the wages for your future profession have dropped by 30%;	Positive
	Q26_3) You discover that you have a 33% chance of completing your course successfully;	Positive
	Q26_4) You win millions of dollars in a lottery;	Positive
	Q26_5) You find that the profession related to your course will be extinguished in 15 years;	Positive
	Q26_6) You discover that the employability for the profession related to your course has dropped by 30%;	Positive
	Q26_7) You find that the people who graduated from the course that was your second option are receiving wages 30% higher than the people who graduated in your course.	Positive
2. Social influences	Q22_1) Your family influenced your course choice;	Positive
	Q22_2) Your friends influenced your course choice;	Positive
	Q22_4) Your family/parents agree with the course/career you chose;	Positive
	Q22_5) Your friends respect the course/career you chose;	Positive
	Q23_2) I chose this course for the salary I will receive by graduating from this course;	Positive

	Q23_7) I chose this course because my family wanted me to graduate in it;	Positive
	Q23_9) I chose this course because of the prestige that the professionals graduated in this course have in society;	Positive
	Q24_1) Which of the two courses would provide you with higher average earnings in the job market after you graduate?	Positive
	Q24_5) Which of the courses would please your parents the most?	Positive
	Q24_7) Which of the two courses do you think is the most expensive, considering tuition, necessary materials, etc.?	Positive
3. Vocation	Q23_3) I chose this course because I would find people like me in this course;	Negative
	Q23_4) I chose this course because I had friends who were, are, or would be engaged in the same course;	Negative
	Q23_5) I chose this course because I had family members who were, are, or would be engaged in the same course;	Negative
	Q24_2) Considering the challenges and difficulties of each course, which one do you believe is easier?	Negative
	Q24_6) Which of the courses would take the longest to finish?	Positive
	Q24_7) Which of the two courses do you think is the most expensive, considering tuition, necessary materials, etc.?	Positive
4. Personal fulfillment	Q18) Before you made your course choice, what were the main SOURCES OF INFORMATION that you used to research the courses/careers you were interested in? (You can select more than one alternative).	Positive
	Q23_3) I chose this course because I would find people like me in this course;	Positive
	Q23_6) I chose this course because I like the type of work that people who graduate in this course do;	Positive
	Q23_7) I chose this course because my family wanted me to graduate in it;	Negative
	Q24_4) Which of the courses would make you most happy or satisfied with your life, after a few years of work?	Positive
	Q26_1) You discover that this is NOT the work you would like to do;	Positive
5. Independent decision	Q2) How old are you?	Negative
	Q12) Were any of your family members or friends (that you already had before entering your course) past graduates or engaged in the same higher education course as yours when you made your course choice?	Negative

	Q16) Before choosing your current course, how many others did you consider among your options?	Positive
	Q23_4) I chose this course because I had friends who were, are, or would be engaged in the same course;	Negative
6. Intertemporal consistency	Q14) Imagine that you can only work after you graduate and that you need to choose between a Course “A” and a Course “B”, as shown below. Based on this information alone, which course would you choose? Course A ( ) Course B ( ) Starting salary: R$ 3000 Sarting salary: R$ 3200 Course length: 2 years Course length: 2.5 years	Positive
	Q20) Imagine that you can only work after graduating and that you need to choose between a Course “1” and a Course “2”, as shown below. Based on this information alone, which course would you choose? Course 1 ( ) Course 2 ( ) Starting salary: R$ 3200 Starting salary: R$3000 Course length: 6.5 years Course length: 6 years	Positive
7. Knowledge about the course-related profession	Q22_3) You currently know what professional activities are performed by someone who graduated in your course;	Positive
	Q22_6) Before choosing your course, you knew what professional activities are performed by someone who graduated in your course;	Positive
8. Labor market	Q2) What is your age?	Positive
	Q5) What semester are you currently in?	Positive
	Q18) Before you made your course choice, what were the main SOURCES OF INFORMATION that you used to research the courses/careers you were interested in? (You can select more than one alternative).	Negative
	Q23_1) I chose this course for the possibility of getting a job by graduating from this course;	Positive
	Q23_2) I chose this course for the salary I will receive by graduating from this course;	Positive
9. Experience and learning about the chosen profession	Q5) What semester are you currently in?	Positive
	Q24_3) In which course do you see more chances of having a stable job?	Negative
10. The propensity to rely on stereotypes	Q12) Were any of your family members or friends (that you already had before entering your course) past graduates or engaged in the same higher education course as yours when you made your course choice?	Positive

	Q19) You find that 2 out of 3 students in your course drop out throughout the program. Does this influence your course decision?	Positive
	Q21) You find that out of 1000 students enrolled in college this year, 900 chose Law as their course, while the rest chose Engineering. Roberto took the entrance exam and was among the best students. He is 19 years old, and his friends consider him an introvert. He also recently started an online programming course, and for the rest of his free time, he watches science fiction movies. What is the probability (%) that Roberto chose Law as his course?	Positive
11. Importance of prestige	Q23_8) I chose this course because the course classes are easy;	Positive
	Q23_9) I chose this course because of the prestige that the professionals graduated in this course have in society;	Positive
12. Influence from colleagues or past graduates from the same course	Q13) Consider someone you know, who is a past graduate in the same course as your own and is currently working in a related occupation. Based on that person, what is the AVERAGE salary you imagine they receive monthly? (If you do not know anyone who fits this description, please answer with “0”).	Positive
	Q19) You find that 2 out of 3 students in your course drop out throughout the program. Does this influence your course decision?	Negative
13. Importance of future earnings	Q13) Consider someone you know, who is a past graduate in the same course as your own and is currently working in a related occupation. Based on that person, what is the AVERAGE salary you imagine they receive monthly? (If you do not know anyone who fits this description, please answer with “0”).	Positive
	Q22_2) Your friends influenced your course choice;	Negative
	Q22_7) For personal reasons, you need to cut the number of classes you take in each semester by half, doubling the time it would take you to graduate. This would discourage you from continuing in your course;	Negative

B2 - Principal components extraction matrix

Variable	Components												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Q2	-.234	-.332	.072	-.229	**-.393**	.116	-.151	**.412**	.131	-.077	.035	.110	.112
Q5	-.114	.157	.074	-.330	.042	.014	-.170	**.373**	**.434**	.021	.087	.131	-.089
Q12	.168	.214	-.356	-.044	**-.429**	.216	.093	-.022	.086	**.382**	-.094	-.045	-.010
Q13	-.008	.222	-.034	-.022	-.098	.160	.112	-.095	.283	.180	-.262	**.377**	**.393**
Q14	-.153	.037	-.193	.224	.393	**.693**	-.160	.147	-.151	.056	.066	-.016	-.122
Q16	**.419**	.065	-.129	-.112	**.376**	-.181	.026	-.152	.060	.032	-.169	.249	-.057
Q17	**-.551**	.000	-.113	.363	-.243	-.013	-.085	.003	.116	-.075	.123	.078	-.004
Q18	.248	.259	-.236	**.338**	.206	-.066	.017	**-.335**	.033	-.096	-.276	.180	-.068
Q19	-.349	.103	-.053	.161	-.051	-.021	.079	-.008	-.040	**.304**	-.227	**-.455**	.285
Q20	-.073	.068	-.180	.246	.386	**.690**	-.165	.169	-.173	.123	-.058	.005	-.099
Q21	.044	.117	.062	-.074	.106	.027	-.122	-.012	.273	**.478**	.303	.253	-.061
Q22_1	.368	**.478**	-.344	-.287	.009	.192	.153	-.179	.068	-.220	.076	.008	.042
Q22_2	.250	**.331**	-.268	-.096	-.195	-.069	-.269	.003	-.126	.039	-.292	.039	**-.344**
Q22_3	-.331	.164	-.013	.115	-.184	.158	**.515**	.113	.087	-.046	-.176	.197	-.121
Q22_4	.039	**.529**	-.081	.123	.172	-.125	.297	.071	.177	.024	.176	-.162	-.055
Q22_5	-.072	**.478**	.006	.164	.072	-.143	.300	.190	.061	.218	.102	-.319	-.160
Q22_6	-.202	-.079	-.128	.169	-.337	.098	**,586**	.203	-.250	-.048	-.006	.084	-.014
Q22_7	**.306**	.022	.082	-.115	.197	-.242	.131	.067	-,019	.282	.123	.197	**-.357**
Q23_1	.278	.236	.022	.153	.226	-.245	.018	**.496**	-.188	-.022	-.131	.267	.254
Q23_2	.279	**.431**	.064	.197	.231	-.139	-.052	**.439**	-.129	.000	-.027	.062	.384
Q23_3	.160	.161	**-.345**	**.346**	-.105	-,248	-.318	.095	-.082	-.085	-.060	.008	-.092
Q23_4	.247	.249	**-.342**	-.049	**-.443**	-.180	-.214	.210	-.198	.116	-.225	-.032	-.223
Q23_5	.300	.343	**-.431**	-.234	-.230	.164	-.049	.012	.236	.000	-.044	-.088	.123
Q23_6	-.319	.118	-.051	**.515**	-.042	-.045	.177	.102	.161	-.202	.075	.210	-.268
Q23_7	.398	**.411**	-.285	**-.331**	-.019	.169	.120	-.153	-.037	-.224	.243	-.070	.109
Q23_8	.291	.023	-.292	-.068	-.223	.070	-.062	.015	-.285	-.282	**.300**	.233	.082
Q23_9	.233	**.370**	-.131	.170	.116	-.181	-.067	.062	.024	-.119	**.322**	-.207	.043
Q24_1	-.145	**.489**	.368	-.006	-.221	.137	-.081	-.166	-.197	.067	.157	.174	.087
Q24_2	-.057	-.370	**-.495**	.081	-.146	.004	.015	.048	-.068	.246	.266	.060	.078
Q24_3	-.217	.141	.151	.154	-.135	-.106	.022	-.366	**-.432**	.294	.161	.225	.085
Q24_4	**-.446**	.175	-.010	**.442**	-.217	-.037	-.246	-.024	.200	-.097	.156	.046	.028
Q24_5	-.031	**.512**	.377	-.078	-.134	.043	-.021	-.006	-.081	.042	.248	.015	-.069
Q24_6	-.146	.472	**.609**	-.116	-.096	.132	-.087	.009	-.054	-.156	-.193	-.080	-.049

Variable	Components												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Q24_7	-,216	**.458**	**.458**	-,163	-.156	.169	-.108	.047	-.058	-.026	-.125	.041	-.154
Q25	**-.431**	.297	-.103	.118	.007	-.136	-.330	-.136	.017	.139	.017	-.020	.136
Q26_1	**.434**	-.028	.153	**.450**	-.117	.107	.000	-.232	.307	-.047	-.070	.027	.009
Q26_2	**.720**	-.122	.161	.248	-.180	.074	-.070	.016	.064	.101	.075	-.058	.065
Q26_3	**.566**	-.207	.215	.195	-.212	.116	-.053	.057	.081	-.046	.063	-.090	-.157
Q26_4	**.603**	-.161	.128	-.125	.037	.047	.131	.099	-.068	.157	.026	.057	-.068
Q26_5	**.646**	.026	.206	.327	-.026	.135	.009	-.063	.115	-.046	-.025	-.016	.095
Q26_6	**.755**	-.171	.188	.240	-.184	.045	-.059	.065	.044	.038	.046	-.018	.013
Q26_7	**.724**	-.083	.317	.100	-.160	.080	.069	.042	-.136	.070	-.004	-.082	.036