

Factors that determine the persistence and dropout of university students

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Abstract

Background: The increase of students in higher education means a more heterogeneous student body, complicating the identification of the variables that influence students' decisions to stay in or drop out of university. The objective of this study is to analyze the influence of these variables on students' decisions by establishing specific groups of students based on performance. **Method:** A study was carried out with 2,970 first-year university students from Portugal, using the decision tree technique. **Results:** Academic performance is confirmed as a determining variable in the decision to remain or drop out, allowing us to establish three groups (high, medium and low achievement), in which different types of variables act as mediators: sex, type of course (licenciatura [BA] or mestrado integrado), the fact of studying at the students' first-choice university or the mother's educational level. **Conclusions:** Without neglecting the weight of academic achievement as a priority variable, we must consider these secondary variables in the configuration of student groups in order to plan support policies to avoid higher-risk students dropping out.

Keywords: permanence, dropout, Higher Education, first-year, decision trees.

Resumen

Factores determinantes de la permanencia y abandono de los estudiantes universitarios. **Antecedentes:** el aumento de estudiantes en la educación superior supuso una mayor heterogeneidad del alumnado, complicando la identificación de las variables que influyen en la decisión de los estudiantes de permanecer o abandonar los estudios. El objetivo de este estudio es analizar la influencia de algunas variables en tal decisión estableciendo grupos específicos de estudiantes en función del rendimiento. **Método:** se ha realizado un estudio con 2.970 alumnos universitarios de primer año de Portugal recurriendo a la técnica de los árboles de decisión. **Resultados:** el rendimiento académico se corrobora como variable determinante en la decisión de permanencia o abandono, permitiendo establecer tres grupos (alto, medio y bajo rendimiento), en los cuales actúan como mediadoras de forma diferencial otro tipo de variables como: el sexo, el tipo de estudios realizados (licenciatura o mestrado integrado), el hecho de cursar estudios en la universidad elegida como primera opción o el nivel de estudios de la madre. **Conclusiones:** sin restar peso al rendimiento académico como variable prioritaria, debemos de considerar estas variables secundarias en la configuración de grupos de estudiantes de cara a planificar políticas de apoyo para evitar el abandono de los estudiantes en situación de mayor riesgo.

Palabras clave: permanencia, abandono, enseñanza superior, primer año, árboles de decisión.

The democratization of access to Higher Education (HE) has increased the diversity of students at this educational level. It has given access to students from poorer socio-cultural and academic groups, and groups of students with different capacities, motivations, and vocational projects. This new situation requires a deeper understanding of the students' paths leading to them dropping out or completing their courses (Amado-Tavares, Marinho-Araújo, Almeida, & Amaral, 2011; Esteban, Bernardo, & Rodríguez-Muñoz, 2016).

When examining the concepts of permanence and dropout, there is more consensus about the former, which refers to the

situation of students who remain in the system until they complete their course of study and gain their qualification. The definition of dropping out is more complex, as there are different definitions, perhaps the most common being its consideration as transferring to a different course and/or university (Aina, 2013; Heublein, 2014), or alternatively definitively dropping out of university, identified as non-enrolment on the original courses in the two years after the last enrolment (Gury, 2011). In this study, taking our lead from those authors, we will consider permanence as referring to students who are enrolled in the next academic year in the same university (regardless of having passed or repeating the course, or having transferred their degree) and dropout as all the students who cancelled their enrolment during the first year or who did not enroll in the same university the next year. In addition, the diverse definitions of dropout or permanence are not only needed for conceptual clarification of the object of study, but also to clarify different profiles within the framework of each category leading to the identification of the variables that influence the decision. In

the case of dropout in particular, this allows specific interventions to be proposed to minimize risk factors (Bernardo, Esteban, Gonzalez-Pienda, Núñez, & Dobarro, 2017; Bernardo, Cervero et al., 2017).

Several researchers have indicated academic achievement as the determinant of students' decisions to remain on their original university degree courses (Cerezo, Bernardo, Esteban, Sánchez, & Tuero, 2015; Oriol, Mendonza, Covarrubias, & Molina, 2017). Likewise, low academic achievement in their early evaluations is a source of stress and dissatisfaction (Belloc, Maruotti, & Petrella, 2011), which increases students' disconnection from their classmates, university degree courses, and institutions (Gairín et al., 2014; Kinser & Deitchman, 2007).

Students' prior academic histories are also important. Older students who had not entered HE upon completing secondary education are subsequently more likely to fail or drop out (Tinto, 2010), as are those with a school history marked by situations of risk, such as repeating years or low grades (Crosling, Heagney, & Thomas, 2009; Páramo, Araújo, Vacas, Almeida, & González, 2017). At the opposite extreme, students with higher grades have higher rates of permanence, especially if they start their first-choice degree or a socially prestigious degree, and are more likely to complete their courses; their previously acquired knowledge and academic competences constituting a protective factor against failure and dropout (Diseth, 2011; Hailikari, Nevgi, & Komulainen, 2008).

Some personal variables like sex or age may also have some relationship to dropout or permanence. For example, male students spend less time on academic activities, which seems to increase their dropout rate, whereas female students who drop out tend to exhibit more difficulties with social integration (Rosário et al., 2014; Tinto, 2010). The men who drop out tend to be older, but age does not appear to be determinant for female dropout (Stratton, O'Toole, & Wetzel, 2008). Women demonstrate better study skills and value HE more than men, which contrasts in our study with their peak of dropout in the case of negative results, and which seems to be more closely related to issues like balancing family and academic activities (Aina, 2013), or difficulties adapting to different assessment methods (McNabb, Pal, & Sloane, 2002).

Socio-economic variables are also related to dropout, as it is more frequent in students from more disadvantaged socio-cultural background. Students whose parents have lower educational qualifications are more likely to drop out, mainly when they are first generation students, and therefore coming from families without a tradition of studying in HE (Araque, Roldán, & Salguero, 2009). In fact, the impact of the mother's educational attainment may be greater as often it is the mother who is more present in a child's cognitive development and academic life (Alves, Lemos, Brito, Martins, & Almeida, 2016; Gutman, Sameroff, & Cole, 2003; Hernandez et al., 2017). Consequently, when students come from more disadvantaged socio-economic backgrounds, they may have poorer skills, poor study habits and a lack of critical thinking, all of which could negatively affect their motivation and academic achievement, increasing the risk of dropout (Aina, 2013; Stinebrickner & Stinebrickner, 2014).

Permanence is better in students with sufficient economic resources to absorb daily expenses (Alon, 2011; Chen, 2012; Finkel & Barañano, 2014) and in students whose parents are better qualified, who provide more cognitively and academically stimulating family environments, and who invest more in their children's academic future, promoting their self-esteem, encouraging effort and

enhancing teaching-learning methods (Alonso & Román, 2005; Davis-Kean, 2005; Umek, Podlesek, & Fekonja, 2005).

Vocational issues are also a determinant for students' permanence and dropout, in particular vocational motivation and the goals students establish. Students who enroll in their first-choice universities or university degrees have more positive perceptions of efficacy and more positive expectations of overcoming difficulties (Vries, León, Romero, & Hernández, 2011). If students fail to find a place on their first-choice degree course, they will have less well defined vocational projects or less commitment to academic activities, and they will resume vocational exploration behaviours and seek clarification of their academic and life project (Okun, Goegan, & Mitric, 2009). All of these situations lead to academic dissatisfaction and amotivation, which can result in failure and dropout. This is particularly true when admission to the university requires students to leave the parental home, as living with their family is a protector factor against dropout, especially if they did not get a place on their first-choice university and degree courses (Heublein, 2014; Porto & Soares, 2017).

The goal of our research is to examine university students' decisions to remain or drop out of their studies, creating different predictive groups as a function of academic achievement, which is the primary variable according to the literature. We analyzed the following variables: the subject area of the degree, age, sex, grade point average to get into university, whether the degree or the university were the student's first choice, parents' academic qualifications, number of ECTS credits (European Credit Transfer System) registered, number of ECTS credits passed, and mean grade in the first year. We started with two hypotheses: (a) academic achievement will be the main discriminatory variable in the decision to remain or drop out of the course, and (b) some of the variables analyzed will differentially influence the decision to remain or drop out as a function of students' achievement. Thus, the creation of different groups will reveal the need to establish specific measures of dropout prevention appropriate to the characteristics of each group of students.

Method

Participants

The sample comprised 2,970 first-year students at a public university in the north of Portugal, a predominantly socio-economically disadvantaged region, in which the vast majority of parents have basic or secondary school qualifications.

The majority of the students were women (56.1%), with a mean age of 18.93 years ($SD = 3.81$). The students were enrolled in different degree courses: 13.4% were studying Health Sciences, 22.9% Law-Social Sciences, 17.4% Humanities, 17.9% Exact Sciences, and 28.3% Engineering. In this respect, it should be noted that the university degrees in the areas of Health and Engineering tend to be a "*mestrado integrado*" (integrated masters' that includes both bachelor's and master's degrees from the beginning) lasting 5 or 6 years, whereas in other areas, students usually study for a *Licentiate degree* (BA), which lasts 3 years.

Instruments

We examined the following student data, collected when students enrolled in their courses (September 2016): (a) *student*

information: sex, age, parents' educational qualifications (*basic educational level* or 9 school years; *secondary educational level* or 12 school years; or *tertiary educational level*), and change of residence to study HE; (b) *information on academic history and vocational options*: grade point average of access to HE, degree in which the student enrolled, type of degree (*bachelor's degree* or *integrated master's degree*; in the latter case, *students started a course lasting 5-6 years*) and whether the degree or university in which the student enrolled was their first choice.

In addition, at the end of the school year, we collected more data provided by university Academic Services (September 2017): *information about academic achievement and permanence*: these data refer to the number of ECTS gained during students' first-years, their average grades in the subjects passed in the first year (values between 10 and 20), and whether the student dropped out during the school year. We should note that students take on 5 or 6 subjects per semester, totaling 30 ECTS credits (60 ECTS per year), and that the grades follow a scale from 0 to 20, although Academic Services only have the grades of the subjects students passed (minimum score of 10). Therefore, the average grade at the end of the first year only considers passed subjects (with a score equal to or greater than 10 points).

Procedure

At the time of enrolment, the students were informed of the objectives of the study and gave their free and informed written consent. We also requested their authorization to have access to their grades via Academic Services and to their status (dropped out or remained) at the beginning of the following school year. In addition, we ensured the confidentiality of the data, as well as making participants aware that they did not have to participate and could leave the study subsequently simply by communicating their wishes.

Data analysis

We analyzed the data using the IBM SPSS Statistics v.24 program, and created classification trees. The classification tree or decision tree is a data mining technique that allows us to visualize in an easily interpretable way the set of rules or conditions that study participants must meet to be placed in a certain category. By applying this analysis, we can determine the group of predictive variables related to the criterion variable. This analysis produces a tree with a network of nodes that shows how the dependent

variable behaves in relation to the other variables being studied (Berlanga, Rubio, & Vilà, 2013; Vera, Morales, & Soto, 2012; Yasmin, 2013).

The tree establishes an initial node (Node 0) in which the subjects of the total sample are classified as a function of the values of the criterion variable (permanence/transfer of degree or dropout). Subsequently, through chi square tests, we establish which of the tested variables among the predictor variables—provided that it is significant—has the most influence on the classification of the original node, establishing different groups in which the participants of the sample studied will be categorized. Finally, this procedure is repeated in each of the new categories obtained, displaying different child nodes depending on the variables that influence the previous node until there are no more discriminant variables.

Results

In this study, our selected criterion variable was remaining at university, classifying subjects in the condition of permanence/transfer of degree or dropout. Subjects were classified in these two categories, validating a model that, through decision tree analysis, determined the predictive variables that most influenced students' decisions about their academic futures. Bearing this in mind, we see that the categorization of the decision to remain or drop out of the institution is highly predictive, with a higher percentage of success in the case of permanence (95.8%) than in the case of dropout (65.6%), which was significantly lower. These values consistently support the validity of the predictor variables that determine the decision-making process, seen in the classification tree, the results of which we shall detail in several sections due to their length.

As shown in the 0 node or root node, the sample is mainly made up of students who remain (87.9%) versus students who drop out (12.1%), and the variable which best predicts this decision is the number of ECTS credits passed ($\chi^2 = 1193.567, p = .000$). This variable leads to four defined groups, although we will not consider the group made up of missing values, as it does not include added discriminating factors. Individuals gaining less than six credits produces a first group showing a clear tendency to drop out (71.5%); if the number of passed credits is between 6 and 33 (second group), the tendency is to remain; and if the number is greater than 33 ECTS credits passed (third group), permanence peaks, with 97% of the students in this category.

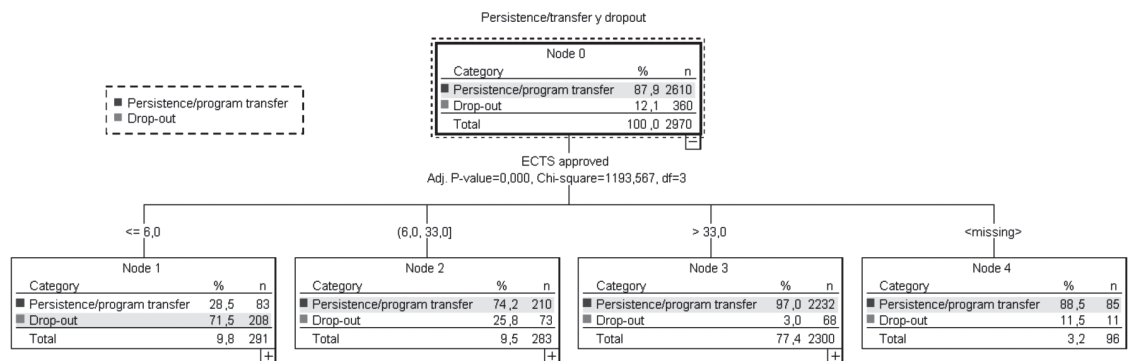


Figure 1. Levels 1 and 2 of the decision tree

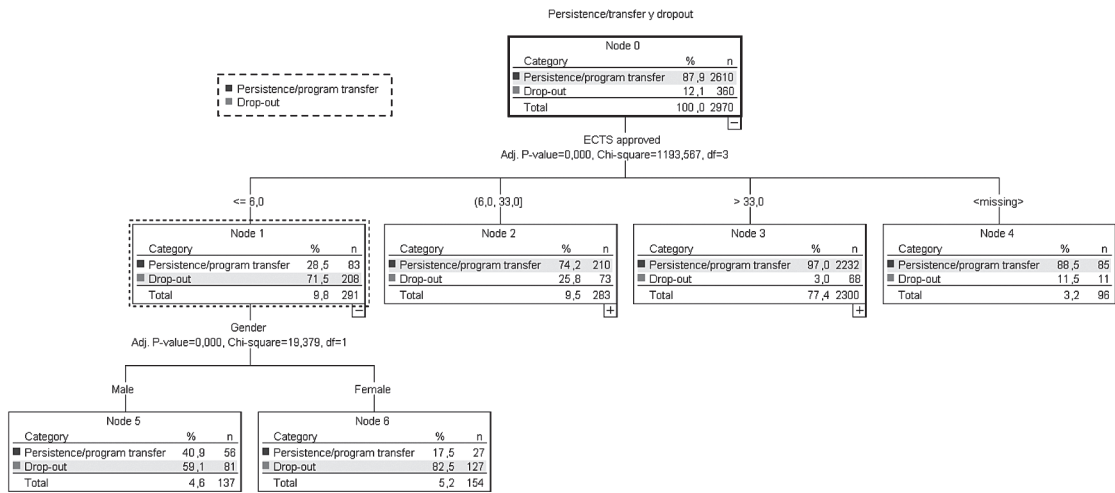


Figure 2. Branch of Node 1 of the decision tree

Despite the primary influence of ECTS credits gained, we can see that each group has its own characteristics, defined by secondary variables that affect performance and, therefore, the decision to remain or drop out. At a third level, within the branch corresponding to the group of students who gained less than 6 credits and therefore tended to dropout, sex seemed to function as a modulator ($\chi^2 = 19.379, p = .000$), because 82.5% of the women with less than 6 credits dropped out, which decreased to 59.1% in the case of the men, with statistically significant differences between the two groups.

In the second group, with between 6 and 33 ECTS credits, the third level predicts the importance of average grade in the first year ($\chi^2 = 18.801, p = .001$); if it is lower than or equal to 12.18,

the percentage of permanence is 84%, decreasing to 61.2% if the average grade is higher. To analyze the average grade in the first year in this range of credits gained we should also consider the differences by degree type ($\chi^2 = 4.003, p = .045$) if the average grade is lower than 12.18, and the differences as a function of sex ($\chi^2 = 6.947, p = .008$) if the average grade is higher. The percentage of students who remain is greater in the *integrated master's degree* (90.9%) than in the students doing the *Licentiate degree* (79.2%) if the average grade is lower than the indicated limit, and it is higher in men (71.6%) than in women (48.1%) if the average grade is higher.

Finally, in Node 3, relative to the third group, which includes those who passed more than 33 ECTS credits, there are differences between those who chose this university as a first choice and those

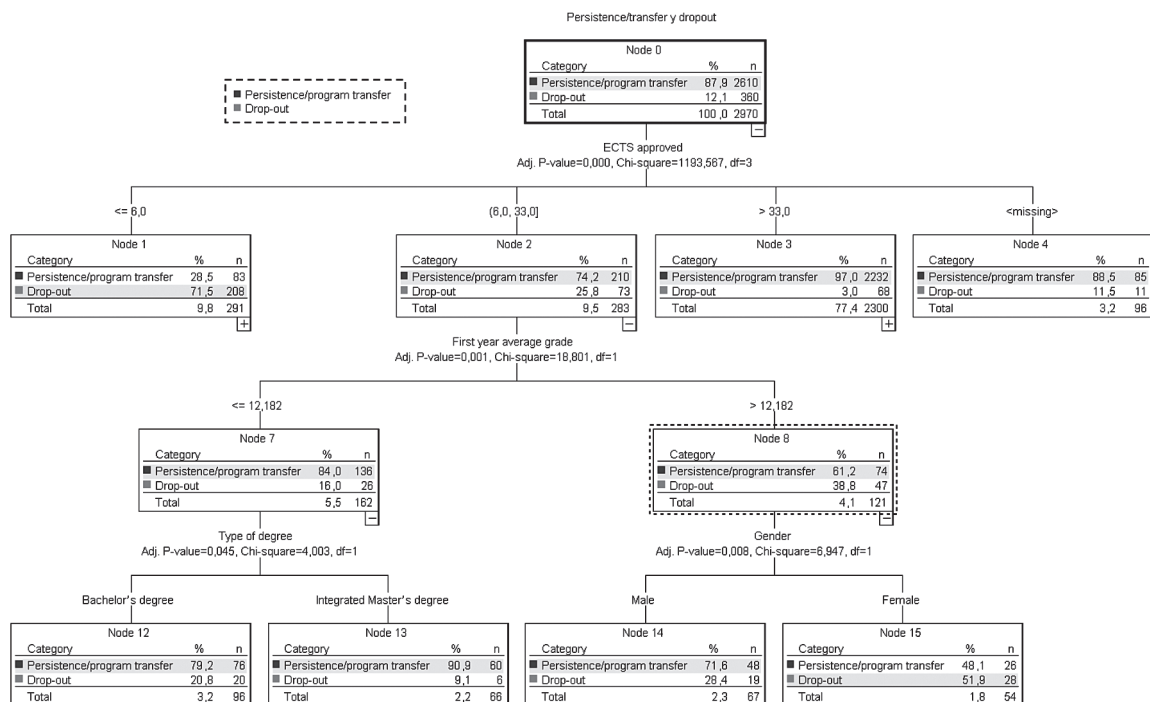


Figure 3. Branch of Node 2 of the decision tree

who did not ($\chi^2 = 6.947, p = .008$), with a higher tendency to remain or to transfer university degrees in the former (98.3%). However, at this level there are also significant differences because, among the students who were able to study at their preferred university, we can distinguish between those who gained 44 credits or less and those with more than 44 credits, as the highest number of credits passed is an indicator of permanence or transfer of degree (99%) versus dropout. Differences were found among those who could not pursue their degree at their originally selected university depending on the mother's educational level; if the mother had a university qualification, the student was more likely to drop out (14.8%) than if she had basic or secondary education (3%).

Discussion

Our results allow us to accept the working hypotheses. Academic achievement measured as ECTS credits gained during the first year was shown to be the most critical variable. The results suggest that the decision to remain or drop out is particularly dependent on academic achievement, which is in line with other research (Cerezo et al., 2015; Diseth, 2011; Hailikari et al., 2008). Academic achievement during the first year reflects the academic competencies students have when they start HE or develop during their first year, their levels of participation and their learning strategies, which might suggest that less successful students have a less well-defined vocational or educational project that has led them to higher education (Belloc et al., 2011; Vries et al., 2011).

With respect to the second hypothesis, we can say that there are three differentiated groups of students in which different influential variables that determine the decision to remain or drop out are verified. These groups are associated with the impact of the number of ECTS credits passed: students with less than 6 ECTS credits (low performance), those who pass between 6 and 33 ECTS credits (intermediate performance), and those with more than 33 ECTS credits (high performance).

In the low achievement group (less than 6 ECTS credits) sex is a key variable, and most of the students who decide to drop out are female. This situation, which seems to contradict the research reporting women's better study skills and better academic achievement (Aina, 2013), may mean that female students who are faced with failure are in a situation of increased vulnerability. For female students, reduced performance may mean a lower tolerance of academic failure, which deserves further study in future work. In fact, female students' low academic achievement may indicate a greater impact of the transition to HE due to changes in evaluation methods, because one of the difficulties that is usually mentioned is teaching staff having a more distant relationship and the need to do more independent academic tasks (McNabb et al., 2002). The impact of the transition might force an adjustment of academic expectations, which may be low due to the mismatch between what they expected to find and what they actually find at university, with this fact contributing to their decision to drop out (Diniz et al., 2018).

In the case of students with between 6 and 33 ECTS credits, which we called intermediate academic achievement, the decision to remain or drop out was also influenced by their average grades in the subjects passed in the first year. In this case, students with lower grades (average grade between 10 and 12.18) had a greater tendency to remain in university (90.9%) if they were studying for an *Integrated master's course* (total of 300-360 ECTS credits) than if they were studying for a *Licentiate degree* (BA) (180-240 ECTS credits), where 20.8% of them drop out. We saw a higher percentage of drop outs in women in this group, as well as in students who had an average grade higher than 12.18 in the subjects passed. This paradoxical situation could be concealing a trend of students with good results who are not pursuing their studies in their first-choice degree or university, who decide to study only certain relevant subjects in order to be in a position be able to transfer to the university or course of their choice in the future. At that time, the students would focus their learning during

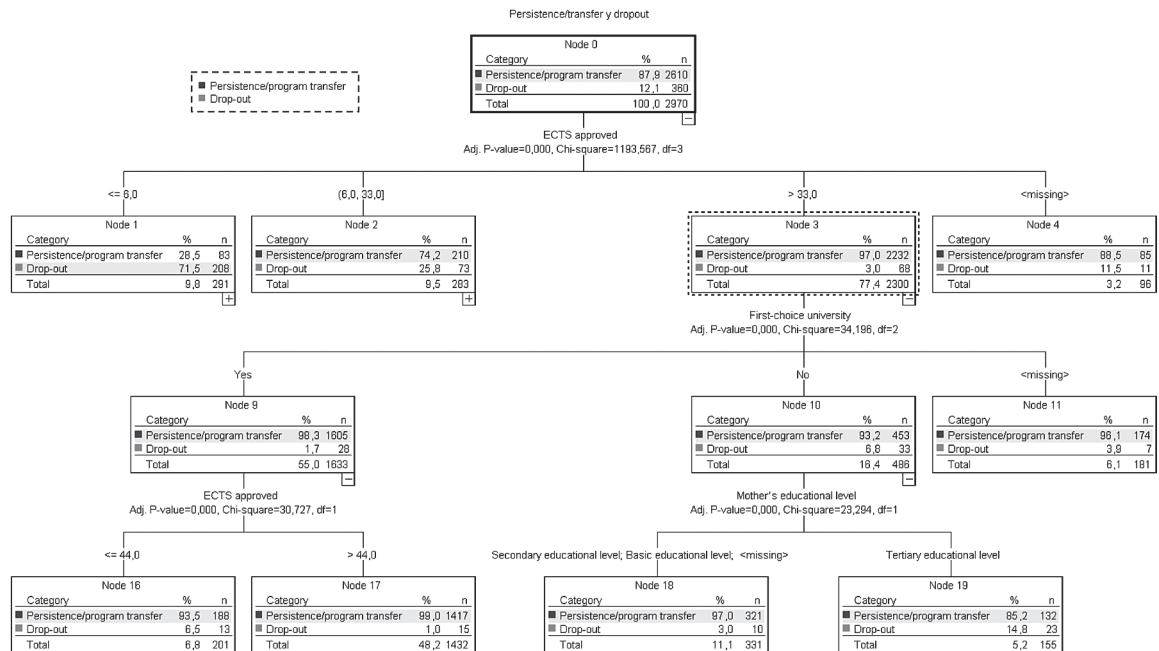


Figure 4. Branch of Node 3 of the decision tree

the first year on subjects that might be equivalent in the course they want to attend subsequently.

Finally, looking at the high performance group (students with more than 33 ECTS credits), whether or not they were in their first-choice university was also relevant to the decision to remain or drop out, with a greater possibility of students dropping out who were not in their preferred university (6.8% versus 1.7% in students attending their first-choice university) (Crosling et al., 2009; Vries et al., 2011). But in this context the dropping out of students whose mothers had HE qualifications (14.8%) was noticeable, a percentage that decreased to 3.0% for those whose mothers had basic or secondary education qualifications (Aina, 2013; Araque et al., 2009). This result again suggests that high performing students, who are not in their first-choice institution, may try to switch universities during the academic year or at the end of the first year. As we have seen, this situation is more frequent in students whose mothers have higher academic qualifications, which are usually associated with better socio-economic backgrounds and also with greater family support for students' vocational projects. Finally, students who attended their first-choice institution and successfully passed a higher number of ECTS credits (above 44 ECTS) were less likely to drop out. This suggests that students who achieve their first-choice options adapt better and engage more in curricular tasks, and perform better which reinforces their link with the degree course and the university (Crosling et al., 2009; Okun et al., 2009). In conclusion, the results support the importance of interventions to promote the permanence of first-year students and, in view of the difficulty

of changing the system of student selection (*numerus clausus*), it seems obvious that institutions must address other variables, which should be included in drop-out prevention programs.

In this sense, it is important to improve reception for students entering university and to identify their learning difficulties. This, together with measures to diagnose and bring students' knowledge up to the appropriate levels, may be important to protect against failure, considering that prior skills and academic achievement are decisive for success and permanence. In addition, students who cannot get onto to their desired degree could get help from teaching staff in terms of specific study techniques and explorations of the vocational projects and employment possibilities open to them thanks to the degree they are starting, improving motivation in students who have to adapt to second choices.

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