Eğitimde Kuram ve Uygulama (EKU)
Journal of Theory and Practice in Education
ISSN: 1304-9496

2024, 20(1), 107-121

Dropout and Graduation in Higher Education: CHAID Analysis

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Article Type: Research Article

To Cite This Article: Hark Söylemez, N. (2024). Dropout and graduation in higher education. *Eğitimde Kuram ve Uygulama, 20*(1), 107-121. https://www.doi.org/10.17244/eku.1287393

Ethical Note: Research and publication ethics were followed. For this research, the ethical approval was obtained from the Dicle University Social Sciences Ethics Committee (Date: 30.12.2022, Number: 349).

Yükseköğretimde Okul Terki ve Mezuniyet: CHAID Analizi

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Sorumlu Yazar: Nesrin Hark Söylemez

Makale Türü: Araştırma Makalesi

Kaynak Gösterimi: Hark Söylemez, N. (2024). Dropout and graduation in higher education. *Eğitimde Kuram ve Uygulama, 20*(1), 107-121. https://www.doi.org/10.17244/eku.1287393

Etik Not: Araştırma ve yayın etiğine uyulmuştur. Bu araştırma için Dicle Üniversitesi Sosyal ve Beşeri Bilimler Etik Kurulu'ndan etik onay alınmıştır (Tarih: 30.12.2022, Sayı: 349).

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Abstract

This study aims to investigate the socioeconomic variables and their order of importance that have a significant effect on the dropout and graduation of higher education students. Relational survey model was used in the study. In the study, the "Students Dropout and Academic Success Dataset," was utilized. The dataset, created by the Polytechnic Institute of Portalegre, consists of 4424 records. CHAID decision tree algorithm was used to analyze the data. With this method, the independent variables that demonstrate the maximum variation in the dependent variable have been identified hierarchically. It is found that, 49.93% of the students are “graduate”, 32.12% are “dropout”, and 17.948% are “enrolled”. Obtained findings show that the graduation rates of the students are not at the desired level. “Tuition fees up to date” was found as the best variable that explains the students’ school completion. 86.55% of students with not up to date tuition fees were found as dropout and 55.95% of students with up-to-date tuition fees were found as graduate. “Scholarship holder” was found as the variable that best explains the clusters formed by variable “tuition fees up to date”. 89.00% of the students that don’t have their tuition fees up to date and don’t hold a scholarship dropout the school, while 78.44% of students that have their tuition fees up to date and holding a scholarship are graduate. Building on the results obtained from the study, several suggestions were proposed for coping with dropout problem and further guiding research on dropout.

Article Info

Keywords: Higher education, dropout, graduation, decision trees, CHAID analysis

Article History:
Received: 25 April 2023
Revised: 10 February 2024
Accepted: 11 February 2024

Article Type: Research Article

Yükseköğretimde Okul Terki ve Mezuniyet: CHAID Analizi

Öz

Bu araştırmada, yükseköğretim öğrencilerinin okul terki ve mezuniyet durumları üzerinde anlamlı etkisi olan sosyoekonomik değişkenlerin tespit edilmesi ve önem sırasının belirlenmesi amaçlanmıştır. Araştırmada ilişkisel tarama modeli kullanılmıştır. Çalışmada “Students Dropout and Academic Success Dataset” veri seti kullanılmıştır. Polytechnic Institute of Portalegre tarafından oluşturulan veri seti, 4424 kayıt içermektedir. Verilerin analiz edilmesinde CHAID karar ağacı algoritması kullanılmıştır. Bu sayede bağımlı değişkende en fazla farklılaşmayı gösteren bağımsız değişkenler hiyerarşik olarak tespit edilmiştir. Araştırmada öğrencilerin %49.93’ünün okulu tamamlama durumlarının “mezun”, %32.12’sinin “terk”, %17.94’ünün “devam eden” olduğu görülmektedir. Elde edilen bulgular öğrencilerin mezuniyet oranlarının istenilen düzeyde olmadığını göstermektedir. Öğrencilerin okul bitirme durumlarını en iyi açıklayan değişkenin “üniversite harç borcu” olduğu bulunmuştur. Harç borcu olan öğrencilerin %86.55'i okulu terk etmiş, harç borcu olmayan öğrencilerin %55.95'i mezun olmuştur. “Üniversite harç borcu” değişkeninin oluşturduğu kümeyi en iyi açıklayan değişken “burs sahibi” olarak bulunmuştur. Üniversite harç borcu olan ve burslu olmayan öğrencilerin %89.00’u okulu terk ederken, harç borcu olmayan ve burslu öğrencilerin %78.44'ü mezun olmuştur. Araştırmadan elde edilen sonuçlardan yola çıkılarak, okul terki sorunuyla başa çıkmak ve okul terkiyle ilgili daha fazla araştırmayı yönlendirmek için çeşitli önerilerde bulunulmuştur.

Makale Bilgisi

Anahtar Kelimeler:
Yükseköğretim, okul terki, mezuniyet, karar ağaçları, CHAID analizi

Makale Geçmişi:
Geliş: 25 Nisan 2023
Düzeltme: 10 Şubat 2024
Kabul: 11 Şubat 2024

Makale Türü: Araştırma Makalesi

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DOI: https://www.doi.org/10.17244/eku.1287393

Geniş Özet

Giriş

Okul terki, birçok ülke yükseköğretim sisteminin paylaştığı ortak bir sorundur. Yükseköğretime başlayan her bireyin şartları farklıdır ve süreçte izledikleri yolda farklı olabilmektedir. Bazı bireyler süreci başarıyla tamamlarken bazıları tamamlanması gereken sürede tamamlayamamakta bazıları ise süreci tamamlamadan sistemden ayrılabilmektedirler. Öğrencilerin yükseköğretim sürecini tamamlayabilmeleri ve okulu terk durumlarının önüne geçilebilmesi için öğrencilerin okul terki ve mezuniyet durumlarını yordayan sosyoekonomik değişenlerin ve bunların önem sırasının incelenmesi önem arz etmektedir. Hangi öğrencilerin okul terki yaşayabileceğinin tespit edilmesi, muhtemel yaşanacak bir okul terkini önlemek için gerekli önlemlerin alınması ve yaşanabilecek okul terki oranlarının azaltılması için oldukça gereklidir. Bu nedenle, çalışma kapsamında, öğrencilerin okul terkini ya da mezuniyet durumlarını yordayan sosyoekonomik değişkenlerin tespit edilmesi ve önem sırasının belirlenmesi amaçlanmıştır. Yapılan alanyazın taramasında yükseköğretim öğrencilerinin okul terki ve mezuniyet durumlarını yordayan değişkenlerin, CHAID analizi ile incelendiği herhangi bir araştırmaya rastlanmamıştır. Bu sayede yükseköğretim öğrencilerinin okulu terk durumlarının azaltılması ve yükseköğretim kurumlarından mezun oranlarının artırılması için dikkat edilmesi gerekenlere ilişkin farkındalık oluşturulacaktır. Elde edilen sonuçlar aracılığıyla farklı imkanlara sahip olan öğrencilerin yükseköğretimi tamamlayabilmelerini sağlayan farklı stratejiler geliştirilebilecektir. Okul terkini ya da mezuniyet durumlarını yordayan sosyoekonomik değişkenler hakkında bilgi sahip olmak, eğitime aktarılan kaynakların daha verimli kullanılması açısından da önem taşımaktadır. Bu nedenle yapılan çalışma mevcut literatüre katkı sağlayacaktır. Ayrıca çalışmanın gerçekleştirildiği veri tabanının geniş bir yelpazeye yayılması çalışmanın genellenebilirliğini artırmaktadır.

Yöntem

Araştırma ilişkisel tarama modeli kullanılarak gerçekleştirilmiştir. Çalışmada "Students Dropout and Academic Success Dataset" veri seti kullanılmıştır. Polytechnic Institute of Portalegre tarafından oluşturulan veri seti, 4424 kayıt içermektedir. Veri seti, her bir kaydın bireysel bir öğrenciyi temsil ettiği 4424 kayıt içermektedir. Bu çalışma kapsamında veri setinde yer alan sosyoekonomik özellikler bağımsız değişkenler olarak kullanılmıştır. Öncelikle çalışmanın veri seti üzerinde gerekli düzenlemeler ve analizler yapılmıştır. Sonrasında mevcut verilerin analiz edilmesinde IBM SPSS Modeler programı kullanılmıştır. Araştırma verilerine CHAID karar ağacı algoritması uygulanmıştır. Bu çalışmada CHAID karar ağacı algoritmasının tercih edilmesinin nedeni, karmaşık ilişkilerin ve etkileşimlerin hızlı ve açık bir şekilde anlaşılmasına olanak tanıyan bu algoritmanın avantajlarından yararlanmaktır. Ayrıca, CHAID otomatik bir şekilde etkili bölünmeleri belirleyerek modelin anlaşılabilirliğini artırır ve sonuçları yorumlamayı kolaylaştırır. Bu nedenle, CHAID karar ağacı algoritması, veri setini analiz etme amacını iyi bir şekilde karşılayan bir seçenek olarak tercih edilmiştir. Bu araştırma için Dicle Üniversitesi Sosyal ve Beşeri Bilimler Etik Kurulu'ndan etik onay alınmıştır (Tarih: 30.12.2022, Sayı: 349). Araştırma ve yayın etiğine uyulmuştur.

Sonuç

Yükseköğretim kurumlarında karşılaşılan en önemli sorunlardan biri öğrencilerin okulu terk durumlarını azaltarak başarılı akademik performanslarla mezun olmalarını sağlamaktır. Bu nedenle öğrencilerin okul terki ve mezuniyet durumlarını yordayan değişkenlerin belirlenmesi gerekmektedir. Bu araştırmada, öğrencilerin okul terki ve mezuniyet durumları üzerinde anlamlı etkisi olan sosyoekonomik değişkenlerin tespit edilmesi ve önem sırasının belirlenmesi amaçlanmıştır. Araştırmada öğrencilerin %49,932 sinin okulu tamamlama durumlarının "mezun", %32,120'sinin "terk", %17,948'inin "devam eden" olduğu görülmektedir. Elde edilen sonuçlar öğrencilerin önemli bir kısmının okulu bıraktığını ya da uzattığını göstermektedir. Dolayısıyla öğrencilerin okulu tamamlama durumları üzerinde olumlu etkisi olan değişkenlerin incelenmesi ve elde edilen sonuçlar doğrultusunda öğrencilerin yükseköğretimi zamanında tamamlamalarını sağlayacak düzenlemelerin yapılması gerekmektedir. Yapılan araştırmada öğrencilerin okulu tamamlama durumlarını en iyi açıklayan değişkenin "üniversite harç borcu" olduğu ortaya çıkmıştır. Harç borcu olan öğrencilerin büyük çoğunluğunun okul terk ettiği ancak harç borcu olmayan öğrencilerin büyük çoğunluğunun okuldan mezun olduğu tespit edilmiştir. Çalışmada üniversite harç borcunu "Hayır" veya "Evet" olarak belirten öğrencilerin oluşturduğu kümeyi en iyi açıklayan değişkenin ise "burs sahibi" olduğu ortaya çıkmıştır. Üniversite harç borcunu "Hayır" ve burs sahibi olma durumunu "Hayır" olarak belirten öğrencilerin %89,004'ünün okulu tamamlama durumunun "terk" olduğu tespit edilmiştir. Üniversite harç borcunu "Hayır" ve burs sahibi olma durumunu "Evet" olarak belirten öğrencilerin ise %60,870'inin ise okulu tamamlama durumu "terk" olarak bulunmuştur. Aynı zamanda üniversite harç borcunu "Evet" ve burs sahibi olma durumunu "Hayır" olarak belirten öğrencilerin %47,626'sının okulu tamamlama durumunun "mezun" olduğu tespit edilmiştir. Üniversite harç borcunu "Evet" ve burs sahibi olma durumu "Evet" olan öğrencilerin ise %78,443'ünün okulu tamamlama durumu "mezun" olarak bulunmuştur. Elde edilen bir diğer önemli sonuç ise ailenin sosyokültürel durumunun, öğrencilerin okul terki durumları üzerinde etkili bir değişken

olduğunu göstermektedir. Yapılan çalışma sosyoekonomik durumun öğrencilerin okul terki ve mezuniyet durumları üzerinde önemli bir etkiye sahip olduğunu göstermektedir. Zayıf bir sosyoekonomik altyapıya sahip olmak, bir öğrencinin okulu bırakmasına neden olan önemli faktörlerden biridir. Ulaşılan sonuçlar göstermektedir ki okul terkinin, bireysel ve toplumsal kalkınma üzerindeki olumsuz etkilerini azaltabilmek için öğrencilerin sosyal ve ekonomik durumlarıyla ilgili engeller olmadan eğitimlerini tamamlayabilmeleri gerekmektedir. Bu çalışma, sosyoekonomik durumun öğrencilerin okuldan ayrılma ve mezuniyet durumları üzerinde önemli bir etkiye sahip olduğunu ortaya çıkarmıştır. Bu nedenle yükseköğretim sosyoekonomik eşitsizlikleri giderebilecek politikalarla desteklenmelidir. Yükseköğretim süreçlerinde sistemden çıkmalarına neden olabilecek sosyoekonomik faktörlerin iyileştirilmesine ve fırsat eşitliğine dayalı katılımın sağlanmasına ihtiyaç vardır. Çalışmada borcu olan öğrencilerin mezun olma oranlarının borcu olmayan öğrencilere göre daha düşük olduğu tespit edilmiştir. Bu nedenle öğrencilere yönelik sosyal yardım programları düzenlenmesi önerilmektedir. Ayrıca bu çalışmada CHAID algoritması kullanılmıştır. Başka çalışmalarda farklı karar ağacı algoritmaları kullanılarak kendi aralarında karşılaştırmalar yapılabilir.

Introduction

The performance of individuals in higher education plays an important role for individual and social development. Graduating from higher education has many positive consequences for both the individual and society. These are the reduction in unemployment, healthier individuals, lower crime rates, higher productivity and growth (EACEA, 2015). In OECD countries, higher education graduation is a criterion that shows the competencies and skills required to be included in the workforce (Himmetoğlu et al., 2022). However, students who do not graduate on time or dropout of school can cause both the family and the country's economy to be negatively affected, as well as the decrease in the young workforce.

Dropout is seen as a burden on public finances and a waste of valuable resources (Quinn, 2013). This situation represents the most important problem that higher education institutions should address in order to increase their success (Behr et al., 2021). Dekkers & Claassen (2001) defines the concept of dropout as the inability of a student to continue and complete the educational level he/she is in due to different negative reasons. Cullen (2000) on the other hand, defines dropout as the inability of the students to complete their education level due to adverse living conditions. Dropout is a measure of students leaving higher education institutions. There are three basic types of dropouts defined in the literature: stop out, institutional departure and system departure. Students who stop out usually return after a short while, those who depart from the institution can transfer to another institution, and those who depart from the system leave the university completely for various reasons (Chen, 2008).

The reasons why students leave the university can be compulsory or voluntary. Compulsory dropout can be caused by reasons such as failing many courses, a serious illness, a different job opportunity, family problems, financial difficulties, and adjustment problems. Most of the students in this situation leave the system and it is very difficult for them to return to school. Voluntary dropout can be caused by reasons such as being bored with the program, feeling inadequate, not liking friends or lessons. The reasons for voluntary dropout are usually external, with financial problems being the most important (Bennett, 2003). Tinto (1997) argues that when external factors are considered fixed, dropout can be considered as the result of an individual's experiences within the academic and social systems of the university, and both can have an impact on dropout.

Different models have been developed to reveal the structure and characteristics of school dropout in higher education, such as, explanatory sociological model for school dropout (Spady, 1970, 1971), student attrition model (Bean, 1980, 1983) the student adaptation model (Tinto, 1975, 1993, 1997), the student retention model (L. Thomas, 2002). Among these models, the model put forward by Tinto (1975) as the Student Integration Model 'SIM' has been widely accepted as the most effective model and has been tested by many researchers and improved with some criticism (Araque et al., 2009; Bruinsma, 2003; Chen, 2008; DesJardins et al., 1999; McCubbin, 2003; Napoli & Wortman, 1998; L. Thomas, 2002). Various factors affecting school dropout in higher education have been defined with the Student Integration Model. These factors include students' family structure, background characteristics, educational goals, pre-university preparation processes, financial factors and university experiences.

Although its type and reasons vary, many countries are faced with the problem of dropout in higher education. According to an impartial European Commission report, the number of students quitting their higher education courses before they finish is too high (Quinn, 2013). Even in Denmark, the most successful country, only over 80% of students complete their education, while in Italy, the figure is only 46%. This report also identifies critical factors that contribute to student dropout, with socioeconomic situations being the primary culprit. European Statistics (Eurostat, 2022) data also show that early leaving is a problem that concerns most higher education institutions in the world (Figure 1).

As seen in Figure 1, dropout is a common problem shared by the higher education systems of many countries. This problem has economic implications for all stakeholders of higher education, considering the societal and especially individual costs. School dropout leads to extensive economic impacts on society. Individuals who drop out often enter the labor market with low qualifications, increasing the risk of unemployment and potentially reducing the overall economic efficiency of the community. This situation can have adverse effects on general economic development. Those who leave school early are typically deprived of career opportunities and income potential. Due to their lower educational attainment, these individuals often find themselves compelled to work in low-wage jobs. This circumstance can diminish their quality of life and make achieving economic independence in the long term more challenging. The state can gain up to $392k in present value social gain by persuading a potential high school dropout to graduate. (Belfield & Levin, 2007). The higher the dropout rates, the less qualified workforce that is aimed to be brought into the country's economy (Tinto, 2017). The dropout rate is accepted as an important measure of a country's educational status and an important indicator of current and future problems (Graeff-Martins et al., 2006). In addition, it is stated that in societies where school dropouts are high, qualified workforce decreases, unemployment and poverty rates increase, and the tendency to crime increases (Belfield & Levin, 2007; Schargel & Smink, 2001). Thus, dropout, which is a major concern for education communities, is an important issue that needs to be addressed.

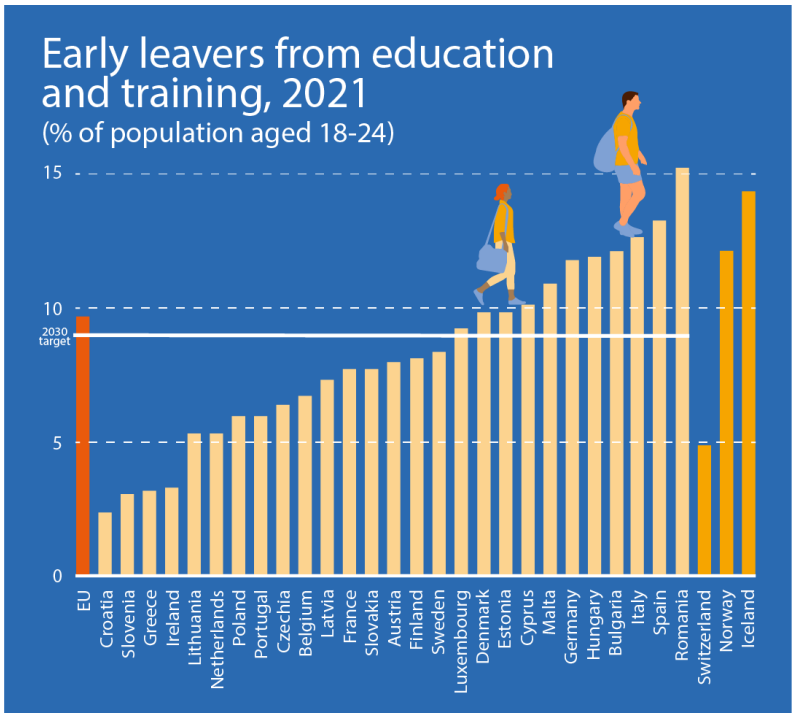

Figure 1. Statistics on dropout from education in the European Union (EU) (Eurostat, 2022)

Literature of dropout includes topics such as, dropout in higher education (Belloc et al., 2010; Gury, 2011; Hovdhaugen, 2009), defining dropout and explaining the causes of dropout (Lassibille & Gómez, 2008; Liu et al., 2009), estimating students' academic performance (Daud et al., 2017; Martins et al., 2021; Saa et al., 2020). In some studies, it is emphasized that having a weak socioeconomic background is an important factor that causes students to dropout (Manona, 2015; Quinn, 2013; White & Kelly, 2010). In this study, we aimed to determine the socioeconomic variables that could predict the dropout or graduation status of students and to determine the order of importance of these variables. No research has been found in the conducted literature review that investigates the variables predicting dropout and graduation status among higher education students using CHAID analysis.

The conditions of each individual starting higher education are different and the path they follow in the process may be different. While some individuals complete the process successfully, some cannot complete the process in the required time, while others leave the system before completing the process. It is important to examine the socioeconomic variables that predict the dropout and graduation status of students and their order of importance so that students can complete the higher education process and prevent dropout. It is necessary to determine which students may experience dropout, to take the necessary measures to prevent possible dropout and to reduce possible dropout rates. In this way, awareness will be raised about what needs to be considered in order to reduce the dropout rates of higher education students and to increase the rate of graduates from higher education institutions. Through the results obtained, different strategies can be developed that enable students with different opportunities to complete higher education. Having information about socioeconomic variables that predict school dropout or graduation is also important in terms of more efficient use of resources transferred to education. For this reason, we have utmost confidence that this study will contribute to the existing literature. In addition, the fact that the database in which the study was carried out consists of a wide range makes this study generalizable.

Purpose of the research

This study aims to identify the socioeconomic variables and their order of importance, that have a significant effect on the dropout and graduation status of higher education students.

Methodology

Pattern of the Research

In this study, conducted to examine the relationship between variables, a relational (correlational) research has been preferred. Relational research is a form of analysis in which parameters and variables are interrelated and information is systematically integrated (Cohen et al., 2007). Relational studies are used to detect the relationships between two or more variables and to determine the effects of these relationships on cause and effect (Fraenkel et al., 2012). Research and publication ethics were followed. For this research, the ethical approval was obtained from the Dicle University Social Sciences Ethics Committee (Date: 30.12.2022, Number: 349).

Dataset

"Students Dropout and Academic Success Dataset" was used in the study (Realinho et al., 2022). The dataset is created by the Polytechnic Institute of Portalegre (acquired from several disjoint databases) related to students enrolled in different under graduate degrees, such as education, nursing, agronomy, design, social service, technologies, management and design. The dataset includes demographic data, socioeconomic and macroeconomic data, data at the time of student enrollment, and data at the end of the first and second semesters. The data refer to student enrollment records from 2008/2009 (after the Bologna Process was applied to higher education in Europe) to 2018/2019. The dataset contains 4424 records, with each record representing an individual student. The dataset contains the information known to the students at the time of enrollment. Information about the participants of the study is given in Table 1.

Table 1. General Information on the Participants of the Study

Variable		f	%
Marital status			
	Single	3919	88.6
	Married	379	8.6
	Widower	4	0.1
	Divorced	91	2.1
	Facto Union	25	0.6
	Legally separated	6	0.1
Displaced			
	Yes	2426	54.8
	No	1998	45.2
Gender			
	Male	1556	35.2
	Female	2868	64.8
Age at enrollment			
	17-21	2873	64.9
	22-26	600	13.6
	27 and above	951	21.5
International			
	Yes	110	2,5
	No	4314	97.5
Total		**4424**	**100**

Each record was classified as graduate, enrolled, dropout depending on the time that the student took to obtain each degree. Graduate means that the student obtained the degree in due time, enrolled means that the student took until three extra years to obtain the degree, and dropout means that the student took more than three extra years to obtain the degree or doesn't obtain the degree at all. Socioeconomic characteristics in the data set were used as independent variables. Table 2 contains information about the independent variables used in the study.

Table 2. Variable details with possible values for the data set

Attirubute	Variable Type	Possible Values
Father's qualification	Independent	No education (0), Primary education (1), Secondary education (2), High school (3), University (4), Unknown (5)
Mother's qualification	Independent	No education (0), Primary education (1), Secondary education (2), High school (3), University (4), Unknown (5)

Educational special needs	Independent	Yes (1), No (0)
Debtor	Independent	Yes (1), No (0)
Tuition fees up to date	Independent	Yes (1), No (0)
Scholarship holder	Independent	Yes (1), No (0)

Analysis of Data

Initially, necessary arrangements and analyzes were made on the data set. In the data editing phase, the categories belonging to the "father's qualification", "mother's qualification", "age at enrollment" variables were combined, adhering to the data integrity. Chi-square Automatic Interaction Detection (CHAID), a decision tree-based algorithm via IBM SPSS Modeler program was applied to the reformatted data. Decision trees are methods for separating data into small groups by going through a series of decision-making stages. Each discrimination process makes the members of the group more similar to the others (Linoff & Berry, 2011). Decision trees are graphical representations of all possible solutions to a decision based on certain conditions. With their tree-like structure, branches, and nodes where each leaf represents a class, they form some rules about the data, thus dividing the dataset into smaller subsets (Sullivan, 2017).

Decision trees are a data mining approach often used for classification and regression. Unlike other methods used in classification such as artificial neural networks, decision trees have many advantages such as easy interpretation and understanding. In addition, it allows the analysis of various data without requiring assumptions (Chien & Chen, 2008). CHAID analysis is a method that can also be preferred in educational sciences research (Kayri et al., 2014).

Proposed by Kass (1980), CHAID is a method that uses chi-square statistics to diagnose optimal splits. CHAID is an effective statistical technique used for segmentation purposes. As a tree-based algorithm, some splits may contain more than two branches. Target and input fields can be numeric value ranges (continuous) or categorical. CHAID extensively searches for independent variables that show the greatest variation in the dependent variable. It uses a systematic algorithm to detect the strongest relationship between these variables (Chan et al., 2006; van Diepen & Franses, 2006). Categorical variables of student completion status (graduate, enrolled, dropout) were used in this study.

The reason for preferring the CHAID decision tree algorithm in this study is to leverage the advantages of this algorithm, which allows for a rapid and clear understanding of complex relationships and interactions. Additionally, CHAID enhances the interpretability of the model by automatically determining the most effective splits, making it easier to comprehend and interpret the results. Therefore, the CHAID decision tree algorithm has been chosen as the optimal option for the purpose of analyzing the dataset.

Findings

What is the order of importance of the predictive variables that have a significant effect on students' dropout and graduation?

The order of importance of the predictive variables that have a significant effect on students' dropout and graduation is shown in Figure 2.

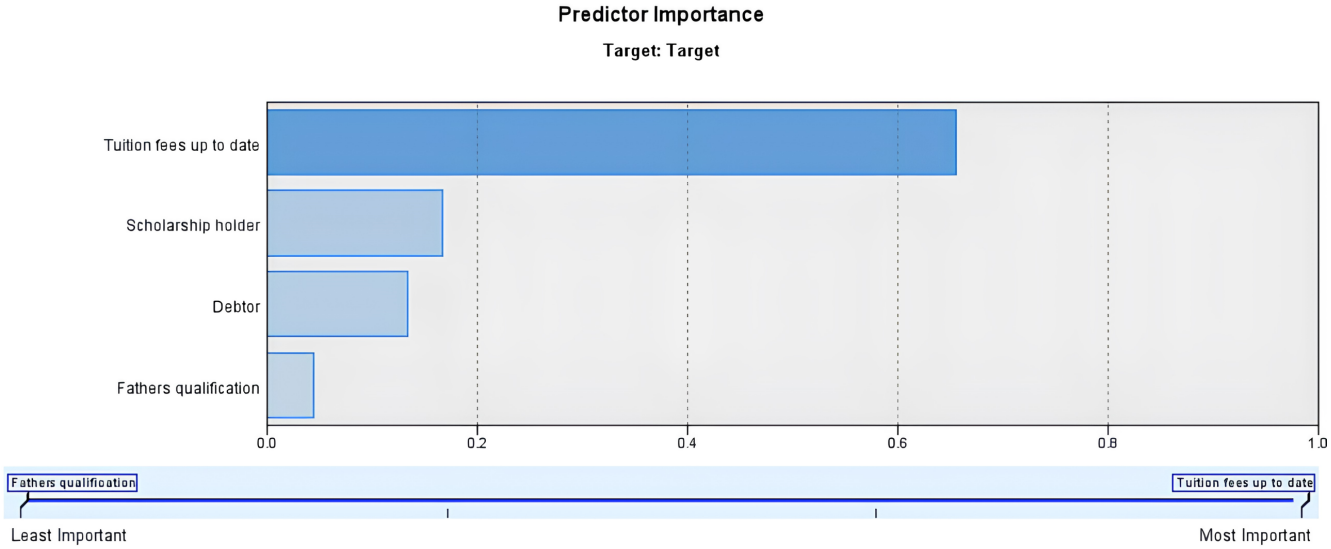

Figure 2. Predictor importance for variables

As seen in Figure 2, "tuition fees up to date" is found as the predictive variable that has the highest effect on students' graduation. Other variables were detected as "scholarship holder", "debtor", and "father's qualification". We used four predictor variables ("tution fees up to date", "scholarship holder", "debtor", "father's qualification") that have the highest effect on students' school completion levels for CHAID analysis.

How is the decision tree algorithm obtained by CHAID analysis of students' school dropout and graduation?
The decision tree regarding the dropout and graduation of the students is given in Figure 3.

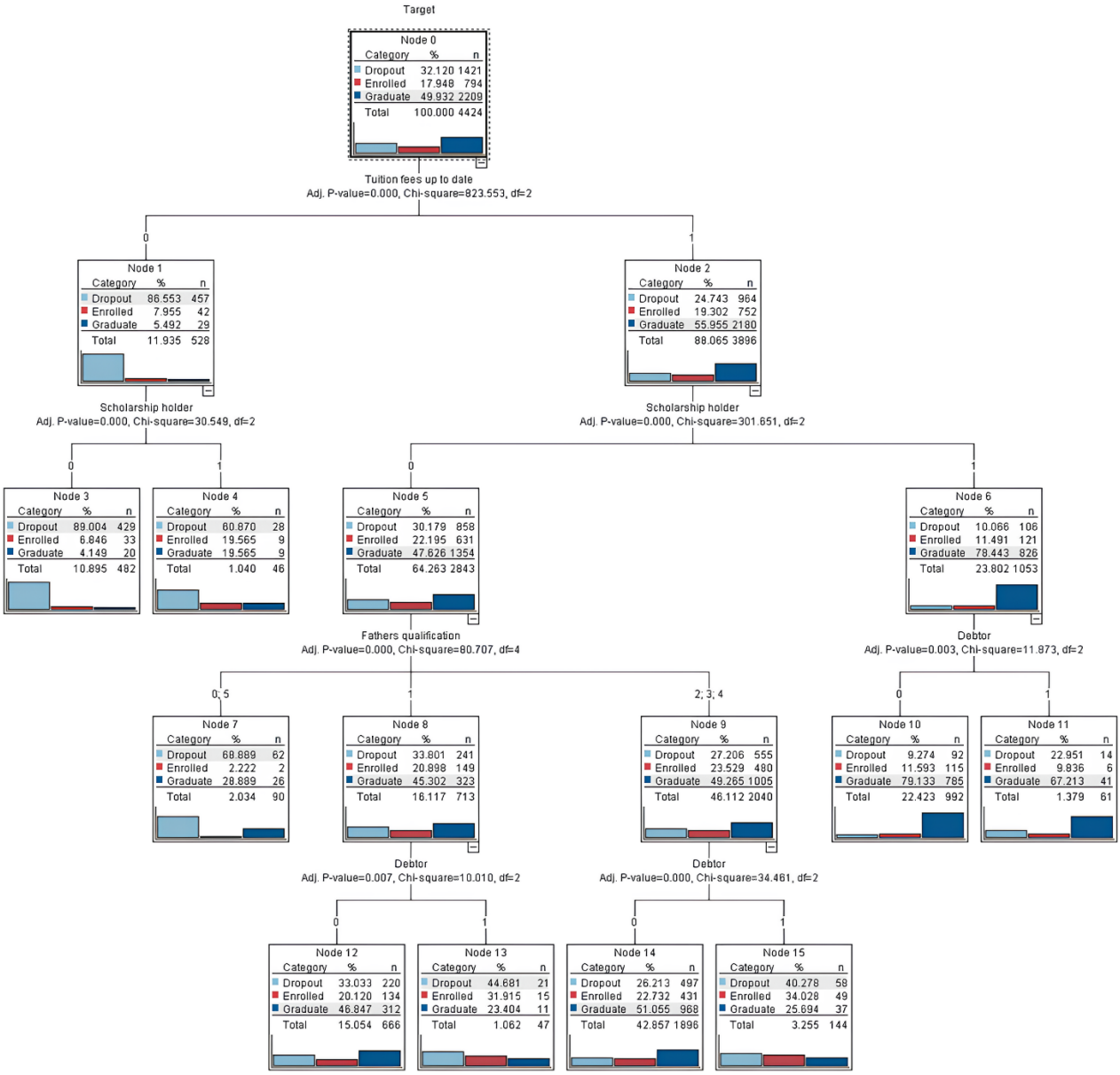

Figure 3. Decision Tree Obtained by CHAID Analysis of Students' School Dropout and Graduation

When Figure 3 is examined, it is seen that there are 15 nodes explaining the dropout and graduation of the students. According to used dataset, 49.932% of the students are "graduate", 32.120% are "dropout", and 17.948% are "enrolled".

"Tuition fees up to date" were found as the variable that best explains students' school completion (Chi-square:823.553, P-value:0.000). It is found that, of students with "tuition fees up to date = 0", 86.553% are "dropout", 7.955% are "enrolled" and 5.492% are "graduate". Of students with "tuition fees up to date = 1", 55.955% are "graduate", 24.743% are "dropout" and 19.302% are "enrolled".

"Scholarship holder" was found as the variable that best explains the cluster formed by "tuition fees up to date = 0" (Chi-square: 30,549, P-value:0.000). It is found that, of students with "tuition fees up to date = 0" and "scholarship holder = 0", 89.004% are dropout. Of students with "tuition fees up to date = 0" and "scholarship holder = 1", 60.870% are dropout.

"Scholarship holder" was found as the variable that best explains the cluster formed by "tuition fees up to date = 1" (Chi-square:301.651, P-value:0.000). It is found that, of students with "tuition fees up to date = 1" and "scholarship holder = 0", 47.626% are graduate. Of students with "tuition fees up to date = 1" and "scholarship holder = 1", 78.443% are graduate.

"Father's qualification" was found as the variable that best explains the cluster formed by "tuition fees up to date = 1" and "scholarship holder = 0" (Chi-square:80.707, P-value:0.000). It is found that, of students with "tuition fees up to date = 1", "scholarship holder = 0" and "father's qualification = 0 or 5", 68.889% are dropout. Of students with "tuition fees up to date = 1", "scholarship holder = 0", and "father's qualification = 1", 45.302% are graduate. Of students with "tuition fees up to date = 1", "scholarship holder = 0", and "father's qualification = 2 or 3 or 4", 49.265% are graduate.

"Debtor" was found as the variable that best explains the cluster formed by "tuition fees up to date = 1" and "scholarship holder = 1" (Chi-square:11.873, P-value:0.003). It is found that, of students with "tuition fees up to date = 1", "scholarship holder = 1", and "debtor = 0", 79.133% are graduate. Of students with "tuition fees up to date = 1", "scholarship holder = 1", and "debtor = 1", 67.213% are graduate.

"Debtor" was found as the variable that best explains the cluster formed by "tuition fees up to date = 1", "scholarship holder = 0", and "father's qualification = 1" (Chi-square:10.010, P-value: 0.007). It is found that, of students with "tuition fees up to date = 1", "scholarship holder = 0", "father's qualification = 1", and "debtor = 0", 46.847% are graduate. of students with "tuition fees up to date = 1", "scholarship holder = 0", "father's qualification = 1", and "debtor = 1", 44.681% are dropout.

"Debtor" was found as the variable that best explains the cluster formed by "tuition fees up to date = 1", "scholarship holder = 0", and "father's qualification = 2 or 3 or 4" (Chi- square:34,461, P-value:0.000). It is found that, of students with "tuition fees up to date = 1", "scholarship holder = 0", "father's qualification = 2 or 3 or 4", and "debtor = 0", 51.044% are graduate. Of students with "tuition fees up to date = 1", "scholarship holder = 0", "father's qualification = 2 or 3 or 4", and "debtor = 1", 40.278% are dropout.

What are the rule sets obtained as a result of the CHAID analysis on the dropout and graduation of students?
The rule sets obtained as a result of the CHAID analysis on the dropout and graduation of students are given in Figure 4.

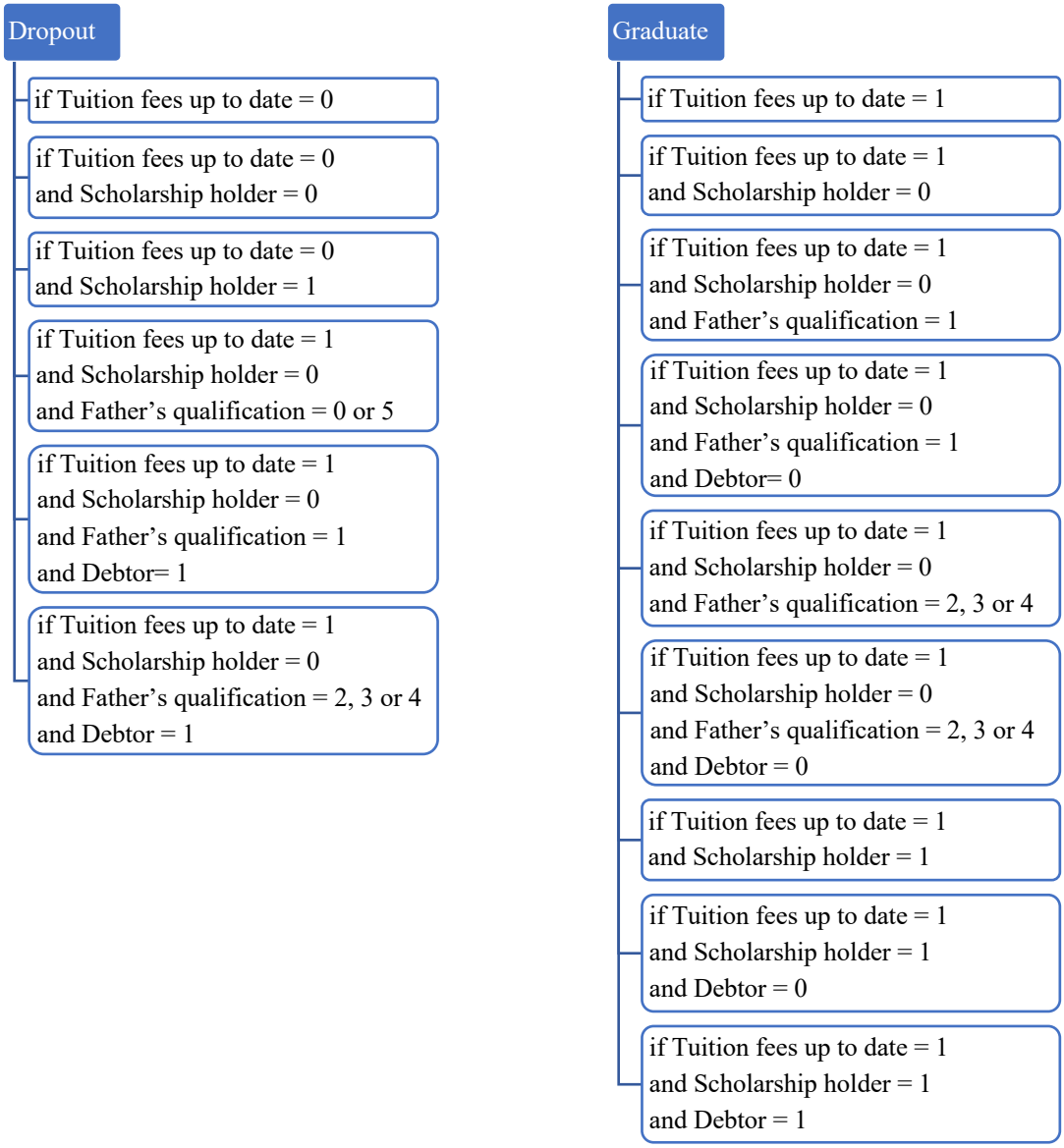

Figure 4. Rule Sets Obtained from the CHAID Analysis

Decision trees determine rules based on the majority. This implies that when deciding which class specific data points belong to at a certain node, the decision is made according to the class that has the highest number of instances. Important rule sets obtained as a result of the CHAID analysis on the dropout and graduation "of the students are as follows:

- Status for students with "tuition fees up to date: No" ==> Dropout
- Status for students with "tuition fees up to date: No" and "scholarship holder: No" ==> Dropout
- Status for students with "tuition fees up to date: No" and "scholarship holder: Yes" ==> Dropout
- Status for students with "tuition fees up to date: Yes" ==> Graduate
- Status for students with "tuition fees up to date: Yes" and "scholarship holder: No" ==> Graduate
- Status for students with "tuition fees up to date: Yes", "scholarship holder: No", and "father's qualification: No education, Unknown" ==> Dropout
- Status for students with "tuition fees up to date: Yes", "scholarship holder: No", and "father's qualification: Primary education" ==> Graduate
- Status for students with "tuition fees up to date: Yes", "scholarship holder: No", "father's qualification: Primary education", and "debtor: No" ==> Graduate

- Status for students with “tuition fees up to date: Yes”, “scholarship holder: No”, “father’s qualification: Primary education”, and “debtor: Yes” ==> Dropout
- Status for students with “tuition fees up to date: Yes”, “scholarship holder: No”, “father’s qualification: Secondary Education, High School, University” ==> Graduate
- Status for students with “tuition fees up to date: Yes”, “scholarship holder: No”, “father’s qualification: Secondary Education, High School, University”, and “debtor: No” ==> Graduate
- Status for students with “tuition fees up to date: Yes”, “scholarship holder: No”, “father’s qualification: Secondary Education, High School, University”, and “debtor: Yes” ==> Dropout
- Status for students with “tuition fees up to date: Yes” and “scholarship holder: Yes” ==> Graduate
- Status for students with “tuition fees up to date: Yes”, “scholarship holder: Yes”, and “debtor: No” ==> Graduate
- Status for students with “tuition fees up to date: Yes”, “scholarship holder: Yes”, and “debtor: Yes” ==> Graduate

Discussion and Conclusion

Reducing the dropout rate of students and ensuring successful graduation is one of the most important challenges encountered in higher education institutions. For this reason, it is necessary to identify the variables that could predict the dropout and graduation of students. In this study, it is aimed to find the socioeconomic variables and their order of importance that have a significant effect on the dropout and graduation of the students. Results show that a significant part of the students dropout or prolong the school. Therefore, it is believed that it is necessary to examine the variables that have a positive effect on students’ school completion and to make arrangements that will enable students to complete higher education on time.

“Tuition fees up to date” variable was found as the variable that best explains the students’ school completion. This variable divided the dependent variable into two groups and significant differences were obtained between the groups. The majority of students with outstanding tuition debts are found to drop out of school, whereas the majority of students without tuition debts are observed to graduate.

Students who are not in good socioeconomic status have difficulty in paying their tuition fees, or they have to work to pay their tuition fees, which may slow down or prevent them from completing their education. Students in this situation may not be able to meet the direct or indirect costs of education and leave higher education (Orr et al., 2014). In some studies, it has been revealed that problems related to individual spending on university education are an important determinant in the decision to leave school (Belloc et al., 2010; Smith & Naylor, 2001).

“Scholarship holder” variable was found as the best variable that meaningfully divides the cluster formed by the students with “tuition fees up to date = yes or no”. It is found that majority of the students who have “tuition fees up to date = no” and “scholarship holder = no” dropout the school. Majority of the students with “tuition fees up to date = no” and “scholarship holder = yes” are dropout. Meanwhile, majority of the students who have “tuition fees up to date = yes” and “scholarship holder = no” are graduated. Majority of the students with “tuition fees up to date = yes” and “scholarship holder = yes” are graduated. In line with these results, it could be said that the school completion status of the students who receive a scholarship is higher than the students who do not receive a scholarship. Studies states that the main factor underlying early leaving is economic inequalities (Rumberger, 2020), and students who do not receive economic support are more likely to dropout than other students (Araque et al., 2009).

“Father’s qualification” variable is found as the best variable that meaningfully divides the cluster formed by the students with “tuition fees up to date = yes” and “scholarship holder = no”. With “tuition fees up to date = yes” and “scholarship holder = no” variables, having “father’s qualification = no education or unknown” have 68.889% dropout rate, having “father’s qualification = primary education” have 45.302% graduation rate, and having “father’s qualification = secondary education, high school or university” have 49.265% graduation rate. Results show that the graduation rates of students whose “father's qualification” is “secondary education, high school or university” are higher than students whose “father's qualification” is primary education. At the same time, the majority of students whose “father's qualification” is “unknown or no education” dropout the school.

It is found that the sociocultural status of the family is an effective variable on the dropout status of the students. In a different study, the school attendance status of the students, the education level of their families and their socioeconomic status were found as highly determining factors in school dropout (Allen et al., 2008). Higher education levels are generally associated with higher incomes and have the potential to reduce socioeconomic inequalities (OECD, 2022). The fact that no one in the family has had a higher education experience has a significant impact on dropout. In Italy, for example, undergraduate students whose fathers or both parents have only compulsory education are more likely to dropout (Aina, 2013). The low level of education of parents is stated as a cultural capital that also determines and reproduces the educational status of children (Şahin & Uysal, 2017). As stated in Bourdieu's (1986) Cultural Capital

Theory, sociocultural inequalities between social classes can initiate a series of events that cause some children to dropout of school. The sociocultural level and educational status of the family can have an impact on the tendency of individuals to dropout of school.

"Debtor" variable was found as the best variable that meaningfully divides the cluster formed by the students with "tuition fees up to date = yes", "scholarship holder = no", and "father's qualification = primary education". According to the obtained rules, with "tuition fees up to date = yes", "scholarship holder = no", and "father's qualification = primary education", students having "debtor = no" are graduated and students having "debtor = yes" dropout the school.

Similarly, "debtor" variable was found as the best variable that meaningfully divides the cluster formed by the students with "tuition fees up to date = yes", "scholarship holder = no", and "father's qualification = secondary education, high school or university". According to the obtained rules, with "tuition fees up to date = yes", "scholarship holder = no", and "father's qualification = secondary education, high school or university", students having "debtor = no" are graduated and students having "debtor = yes" dropout the school.

Many research results support the view that students' financial difficulties are a strong indicator of school dropout and school success (Belloc et al., 2010; Bennett, 2003; Gury, 2011; Lassibille & Gómez, 2008; L. Thomas, 2002). Similarly, in the study conducted by Bülbül (2012), both students and faculty members stated the financial difficulties experienced by students as one of the important reasons that lead to school dropout.

This study shows that socioeconomic status has a significant effect on students' dropout and graduation status. Coming from a poor socioeconomic background is one of the major factors that causes a student to dropout of school. Students from low socioeconomic status backgrounds are less likely to complete education programs (HEFCE, 2013; McCulloch, 2014). The reason for this is not any basic feature, but the inequalities brought about by a weak socioeconomic background (Quinn, 2013). It is stated that socioeconomic status has a significant effect on dropout and dominates all other factors such as ethnicity and gender (E. Thomas & Quinn, 2007). St. John & Starkey (1995), in their economic approach model, stated that the reasons that are effective in the decision of higher education students to dropout of school are due to the economy. Similarly, Aina (2013) stated that students in the upper economic class have less tendency to dropout and socioeconomic levels of students affect the probability of students leaving school. The results show that in order to reduce the negative effects of school dropout on individual and social development, students should be able to complete their education without obstacles related to their social and economic conditions.

Suggestions

- This study revealed that socioeconomic status has a significant effect on students' school leaving and graduation status. For this reason, higher education should be supported with policies that can overcome socioeconomic inequalities. There is a need to improve socioeconomic factors that may cause them to leave the system in higher education processes and to ensure participation based on equal opportunities.
- It is found that graduation rate of students with debt is lower than students who do not have debt. Social assistance programs should be organized for students.
- It is revealed that the graduation rate of students from higher education is not at a sufficient level. Therefore, studies should be conducted on the graduation rates of higher education students.
- In this study, the CHAID algorithm was used. Different decision tree algorithms can be used and comparisons can be made among themselves.
- "Tuition fees up to date" variable was found as the variable that best explains the students' school completion status. Arrangements can be made to assist students in tuition fees.
- Other rule sets can be reached by using different variables in future studies.

Contribution Rate of the Researchers

This study has a single author.

Financial Support and Acknowledgment

The authors declared that this research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest

The authors have disclosed no conflict of interest.

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