

RESEARCH ARTICLE/ARAŞTIRMA MAKALESİ

Determination of factors affecting university students' happiness levels through decision trees analysis

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Abstract

Throughout history, happiness has been a pivotal subject of study, often analyzed within the context of life quality. The notion of life quality includes various elements such as environmental conditions, family dynamics, health status, and income levels, each playing a significant role in shaping an individual's perspective on life and, consequently, their happiness. This research delves into the happiness of university students, a demographic that holds immense significance for the future of our nation. In the realm of academic studies focusing on the factors influencing the happiness levels of university students, methodologies such as factor analysis, regression analysis, correlation analysis, and logistic regression have been prevalently utilized. Nevertheless, this particular study distinguishes itself by employing decision tree methods, specifically the CART and CHAID algorithms, noted for their effectiveness in the analysis of extensive datasets. The research is based on primary data, gathered through face-to-face surveys conducted with students from Marmara University. The sample size, consisting of 600 participants, was ascertained using specially developed tables, and the Convenience Sampling method was employed in the design of the sample. Within the scope of this study, a total of 559 consistent data points, devoid of any missing observations, were subjected to analysis. The research initially investigates the correlation between the socio-demographic characteristics of the students and their levels of happiness. Subsequently, the applications of the CART and CHAID algorithms were executed using the SPSS software, focusing on two distinct dependent variables. The outcomes of this study indicate that socio-demographic elements, particularly factors such as income, age, and the occupations of the parents, exert a substantial influence on the happiness levels of individuals. Moreover, the study discerns a gender-based discrepancy in the primary sources of happiness, with love being predominant among women and success among men.

Keywords: Decision Trees, Happiness, Quality of Life, University Student

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1. INTRODUCTION

The concept of happiness has maintained its significance as a subject of research from antiquity to the present day. Happiness has periodically been the focal point of interest for individuals from various fields. There is a multitude of studies on the subject both internationally and in our country.

The pursuit of happiness generally falls within the interests of philosophers, artists, and behavioral scientists. However, the universal desire to achieve happiness also influences other scientific disciplines in terms of content. Happiness, which can fundamentally be considered a human behavior, has garnered the attention of economists and business administrators, and additionally, it is a topic of interest for political scientists. It can be asserted that happiness serves as a compelling subject of research for social scientists.

Happiness has been examined from diverse perspectives including biological, religious, economic, philosophical, and others. To illustrate, topics such as the economics of happiness and the chemistry of happiness can be cited. From a chemical standpoint, the hormones associated with the sensation of happiness have been identified, as well as the brain regions responsible for happiness, and the diseases that may emerge as a result of a decline in these hormones.

The aim of this study is to identify the socio-demographic determinants that influence university students' levels of happiness and the concepts they most associate with happiness, utilizing data mining methods, specifically the decision tree algorithms CART and CHAID.

2. HAPPINESS

Happiness is a concept as ancient as human history and, as such, eludes easy definition. Its deep and abstract nature means happiness is open to various interpretations. Some definitions of happiness in the literature include:

- The Turkish Language Association (TDK) defines happiness as "a state of joy arising from

achieving all desires continuously and without lacking."

- According to the Turkish Statistical Institute (TÜİK), happiness is "a condition characterized by the absence of pain, sorrow, and suffering, and the presence of joy, cheer, and a feeling of satisfaction; a general state of contentment with life" (TÜİK, 2022).

Happiness can also be described as the predominance of positive emotions over negative ones and the overall satisfaction derived from life (Diener, 1984) or "the pleasure taken from life when considered as a whole" (Veenhoven, 1991). Another definition of happiness is "a concept consisting of joyful moments when concepts of time and death are forgotten." Life satisfaction and happiness are intertwined concepts. TÜİK defines satisfaction as "a feeling of fulfillment arising from the meeting of needs and desires" (TÜİK, 2022).

Happiness is undoubtedly a state that everyone desires to achieve, and it is often said that people generally live to be happy (Cüceloğlu, 2023). By nature, humans seek to escape pain and sorrow and to pursue pleasure. Therefore, it is not incorrect to assert that happiness is a fundamental goal of life (Lama, 2000).

The importance of happiness in terms of health cannot be overstated. Unhappiness is a harbinger of many illnesses. When the bodily systems of unhappy individuals are disrupted, and their resistance is compromised, various ailments can emerge, leading to the manifestation of diseases (Gemici, 2008). Unhappiness also triggers depression. It is possible for individuals who are constantly troubled and unable to find happiness to suffer from depression. An increase in such individuals could potentially lead to a societal and global onset of depression, as the effects of depression can be swift and easily triggered (Mete, 2008).

In summary, happiness is anticipated to be crucial in life, and the lack thereof can lead to problems. Furthermore, the level of happiness can be defined as a measure of how positively an individual perceives their overall quality of life.

3. LITERATURE REVIEW

The international literature review has led to significant findings, including those by Veenhoven (1991), which concluded that an increase in income boosts happiness more substantially in the poor than in the wealthy. Furthermore, in another study, Veenhoven (2001) identified a positive relationship between happiness and three variables: environmental quality, economic prosperity, freedom, and social relationships. Frey and Stutzer (2002) found that economic factors such as unemployment, income, and inflation influence happiness, also noting a positive association with income. Hellevik (2003), in his work in Norway, determined that increases in income and wealth affect happiness, and that the economic status has a significant impact on it. Carbonell (2005) corroborated similar findings, indicating that lower incomes among the poor contribute to unhappiness and that income increases have a lesser impact on the happiness of the wealthy. Castriota (2006) mentioned that education positively influences happiness and that higher education levels correlate with increased income. Scoppa and Ponzo (2008) observed that income and wealth positively affect happiness, whereas unemployment negatively impacts subjective well-being.

It can be stated that happiness has been explored through various analytical techniques. Özdemir and Koruklu (2011) examined the correlation between happiness and values among university students using correlation and multiple regression analysis, concluding there is a significant relationship between the happiness felt by young people and hedonism. Bülbül and Giray (2011) utilized nonlinear canonical correlation analysis to find a significant relationship structure between individuals' perception of happiness and sociodemographic features, interpreting prominent relationships among various categories using TÜİK Life Satisfaction survey data. Akin and Şentürk (2012) identified the explanatory factors for individuals' happiness levels using the European Quality of Life Survey through ordinal logistic regression. Kızılıgöl and Öndes (2020) investigated the factors

affecting individuals' happiness levels using the ordered logit model. Studies involving decision trees and happiness frequently employed TÜİK microdata. Demircan (2015) addressed the factors affecting people's satisfaction and hope levels using classification algorithms. Yücel (2017) comparatively interpreted the results of CART and CHAID algorithms to identify the factors influencing happiness levels in Turkey. Şehribanoğlu and Diler (2018) explained the variables affecting happiness through decision tree methods.

A review of the literature on happiness reveals that a portion of the studies has focused on the relationship between happiness and a specific concept. Examples within this group include the relationship between happiness and income, income distribution inequality, democracy, tax burden, economic growth, development level, and tourism.

The aforementioned studies predominantly used macro data, often employing time series econometric techniques. Examples of topics that preferred microdata are:

- The relationship between happiness and virtues, happiness and family structure, happiness and job satisfaction or workaholism, happiness and self-critique, happiness and digital game addiction, happiness and optimism, happiness and social interaction, happiness and exercise, happiness and religiosity, etc.

Another group of studies on happiness focuses on the sociodemographic determinants of happiness (or life satisfaction). These studies commonly used data from TÜİK Life Satisfaction surveys, the European Social Survey, and the World Values Survey. In this group, the happiness question was typically taken as the dependent variable, and analyses were conducted using techniques such as Logit-Probit, Logistic Regression Analysis, and Decision Trees. Additionally, during the investigation of happiness-related studies, a group focused on individuals with specific characteristics emerged. Examples encountered are:

- Happiness during adolescence, happiness among the elderly living with their families,

happiness among young adults, happiness among teachers, happiness among teacher candidates, happiness in G8 countries, happiness among Istanbul Metropolitan Municipality employees, happiness among university students, etc.

When looking at happiness among university students, satisfaction with the university environment is usually researched, along with associations with online gaming addiction, psychological resilience, smartphone addiction, self-efficacy, Facebook usage, socializing, religiosity, social media usage, family belonging, leisure satisfaction levels, number of siblings, internet usage, loneliness, and patience levels, among others.

In this study, however, the focus is on university students' life satisfaction, i.e., their levels of happiness, which are not analyzed in isolation but in conjunction with their sources.

4. DECISION TREES

Decision trees are widely used in data mining methods for classification and regression models. Their popularity is due in part to the ease with which they facilitate the analysis of large data sets, their interpretability, and the clear rules they establish (Ayık Y. Z., Özdemir A., Yavuz U., 2007). Additionally, they are capable of generating successful models.

The structure of decision trees consists of roots, branches, and leaves, resembling an arboreal form. The process begins at the root node, which splits the larger data set into smaller subsets as it branches downward. The terminal nodes at the end of this branching process are the leaves (Pehlivan, 2006).

In a decision tree, the root node represents the dependent variable, while the information on the branches indicates the independent variables involved in the branching. Interpretations about the nodes on the decision trees can be made, and decision rules can be formulated (Altunkaynak, 2019). As the decision tree progresses through these stages, it examines past data to determine the class of new data using 'if-then' rules (Sayıcı, 2013). In formulating these rules, it poses several questions and takes steps based on the answers,

thereby constructing rules from the responses (Uzar, 2013).

The expansion of games by Von Neumann and Morgenstern is considered the genesis of decision trees. Breiman et al. (1984) were the first to implement the decision tree method in statistics. Quinlan conducted the initial study on artificial learning with decision trees (Quinlan, 1986). The foundational algorithms for decision trees, the AID algorithms, began to be used by researchers Morgan and Sonquist in the early 1970s. Not only were they the first algorithm, but they also represented the first decision tree-based software. There are various other algorithms as well, including CHAID, ID3, CART, SPRINT, C4.5, SLIQ, QUEST, MARS, Exhaustive CHAID among them (Akpinar, 2000).

Apart from these algorithms, there are other different algorithms available. In recent times, algorithms created by the combination of multiple classifiers have gained prominence (Köktürk, 2012). The algorithms show some diversity in terms of their operational rules and application areas (Öztürk, 2014).

When constructing decision trees, deciding which node or variable to start with and which algorithm to use is crucial. The importance of the algorithm stems from the fact that the tree structure can change according to the algorithm used (Hacıefendioğlu, 2012). For this reason, most algorithms involve a significant amount of value calculation at the beginning stage and proceed to the tree construction phase based on this (Tapkan, Özbakır, & Baykasoğlu, 2011).

Once it is decided which node to start with, this chosen variable becomes the root node. The questioning begins from the root node and, as it progresses, new nodes arise based on the answers. If no new question follows a node, the branching process concludes. Accordingly, each node can split into two or more branches. When branching ceases, a leaf that represents a class is formed (Akman, 2010). Ultimately, each path from the root to branches and then to leaves establishes a separate rule.

Another issue to be resolved is determining the criteria for branching, starting from the root.

These branching criteria are examined in two ways: one is based on entropy calculations such as gain ratio and split information; the other is based on purity functions. The criteria based on the purity function vary depending on whether it is a classification tree or a regression tree. While the criteria for classification trees include the Gini index and twoing split criterion, the criteria for regression trees are the least squares deviation (LSD) and the least absolute deviation methods (Saitoğlu, 2015).

4.1. CHAID Algorithm

The CHAID (Chi-squared Automatic Interaction Detector) algorithm is favored over other algorithms for its ability to work with both categorical and continuous data, and to split groups into more than two categories (Akpinar, 2000). Developed by Kass in 1980, the CHAID algorithm serves classification and regression purposes and is capable of dividing the universe into stable sub-nodes with a robust iterative algorithm, maintaining assumptions of homogeneity and normality. The algorithm can work with both continuous and categorical data, thus removing the distinction between parametric and non-parametric, enabling it to have semi-parametric characteristics (Kayri & Boysan, 2007).

Depending on the measurement level of the dependent variable, the algorithm utilizes the "chi-square test" for categorical data and the "F test" for continuous data (Oğuzlar, 2004). For categorical data differentiation, the "maximum likelihood test" is employed for ordinal data and the "Pearson chi-square test" for nominal values. The significance of the p-value is examined when merging categories, and the process ends when no significant category combination is found (Yücel, 2017). The algorithm's capability to divide not only into binary branches but also according to the number of different structures in the data, is due to the extensive use of cross-tabulations, hence its name (Koyuncugil & Özgülbaş, 2008).

The advantages of the CHAID algorithm include achieving successful results when an appropriate criterion is used, treating missing data as a

new category, and providing good estimates by utilizing large sample sizes. Moreover, as it has no assumptions, it can be recommended as a non-parametric tree diagram, a preferable modeling over ordinary least squares (OLS), binary, and multinomial logistic regression models (Gülpınar, 2008).

4.2. CART Algorithm

The CART (Classification and Regression Trees) algorithm has gained acceptance and increased usage over time. The delay in its popularity stemmed from the limited experience statisticians had with this method and its complexity. However, advancements in technology now allow many software packages to easily implement the algorithm. CART offers a flexible structure where variables to be used can be measured in numerical, categorical, or ordinal forms, providing a time-saving advantage without the need for processes like normalization or transformation. Furthermore, the interpretability of the algorithm, even by non-statisticians, is another benefit of CART (Oğuzlar, 2004).

Developed in 1984 by Breiman, Olshen, Friedman, and Stone, the CART algorithm features a structure where specified independent variables can appear multiple times at different stages of the tree, using entropy to determine the splitting criterion (Atilgan, 2011).

The CART algorithm ensures that at each stage, the relevant group is split into two subgroups more homogeneous than the original. In other words, each branch divides and grows into binary sub-branches. The splitting process uses the "twoing" and "Gini index" if the dependent variable is categorical, and the least squares deviation for continuous variables (Akpinar, 2000). The goal of the algorithm is to produce the most homogeneous possible groups related to the dependent variable. This is achieved by selecting the best independent variable using homogeneity and variability (Güner, 2015).

5. APPLICATION AND EMPIRICAL FINDINGS

5.1. Subject and Purpose of the Study

Today's technological advancements and expanding opportunities have the potential to enhance life quality by offering individuals welfare and a variety of options. However, the increase in consumer culture and the desire to possess everything can lead to isolation and unhappiness among individuals. University students are also affected by these technological developments (Akduuman, 2020).

As with any field, addressing the happiness of students in education is of great importance. Quality education brings along a qualified workforce (Atik, 2018). Students, being potential resources for the labor market, have been selected as the group forming the data set in this context. Our study aims to investigate the happiness of university students, who are the assurance of our country's future.

Previous studies often examined university students' satisfaction with their institutions. In contrast, this study investigates the students' own happiness levels, that is, how happy they are with their lives. Additionally, unlike other studies that only ask about individuals' life satisfaction, this research also examines what makes them happiest in life.

The purpose of this study is to investigate the factors affecting the concept of happiness, which has been a subject of research for a long time, using decision tree methods. As mentioned in the literature review, the concept of happiness, typically analyzed with different statistical analyses, is examined among university students in this study. Factors affecting the happiness levels of university students have been addressed with data mining methods, known for their ease of use in large data sets. The data application has been conducted using the CHAID and CART algorithms of decision tree methods.

5.2. Scope of the Study

Primary data has been used in the study. The data within the scope of the study were collected

through face-to-face surveys conducted on students at Marmara University using the Convenience Sampling method. The sample size was 600, with 559 non-missing data points analyzed.

The variables used in the study were determined through literature review and include gender, marital status, age, rural-urban distinction, educational status of parents, occupations of parents, and total family income level. Decision tree techniques from data mining methods were employed to identify the socio-demographic factors affecting the happiness of students.

For the socio-demographic examination of university students, the happiness variable was taken as the dependent variable, utilizing a Likert-type scale ranging from 1 to 5. The survey was conducted between December 2022 and April 2023 on undergraduate and graduate students at Marmara University. Descriptive statistics for the variables used in the study and their categories are presented in Table 1.

5.3. CHAID Algorithm Findings

In the studies conducted, the CHAID and CART algorithms are more commonly used, hence their comparative results have been considered in this research.

In the analysis of classification and regression trees, the CHAID algorithm was examined first, followed by the CART algorithm. Different ratios and criteria were applied to the algorithms. The best tree selection was made based on estimated values and graphics. In the research, the analysis was first carried out based on the dependent variable question "how happy are you with your life?" Then, the question "what makes you happiest in life?" was analyzed in order.

According to the CHAID analysis results in Figure 1, the primary influential variable on the happiness of university students was determined to be the total family income. It was observed that 48% of students with a family total income above 18,000 TL are happy. The happiness of students whose family total income ranges between 6,000 and 18,000 TL is influenced by age.

Table 1. Descriptive Statistics

Variable	Categories	Percent (%)
Age	19-23	%66,2
	24-28	%24,5
	29-33	%7,1
	34+	%2,2
Gender	1: Woman	%66,7
	2: Man	%33,3
Marital status	1: Single	%95,5
	2: Married	%4,5
The rural-urban distinction of the city	1: Central	%59,2
	2: District	%38,3
	3: Village	%2,5
Mother's education level	1: Illiterate	%2
	2: Literate	%2
	3: Elementary School	%31,5
	4: Middle School	%17,7
	5: High School	%29
	6: College	%2,5
	7: University	%14,1
	8: Graduate School - Doctorate	%1,3
Father's education level	1: Illiterate	-
	2: Literate	%0,7
	3: Elementary School	%19,5
	4: Middle School	%19,5
	5: High School	%32,7
	6: College	%3,8
	7: University	%20,6
	8: Graduate School - Doctorat	%3,2
Mother's occupation	1: Housewife	%59,2
	2: Civil servant	%6,8
	3: Worker	%12,5
	4: Retired	%8,9
	5: Other	%12,5
Father's occupation	1: Not working	%2,1
	2: Civil servant	%11,6
	3: Worker	%24,9
	4: Retired	%31,3
	5: Other	%30,1
Family's total monthly income level	1: 0-6.000 TL,	%8,4
	2: 6.000-10.000 TL,	%20,8
	3: 10.000-14.000 TL,	%24,7
	4: 14.000-18.000 TL,	%18,2
	5: 18.0000-22.0000 TL,	%10,7
	6: 22.000+ TL	%17,2
How happy you are?	1: Very unhappy	%5,9
	2: Unhappy	%12,9
	3: Neutral	%40,3
	4: Happy	%34,7
	5: Very happy	%6,3
What makes you happiest in life?	1: Power	%7,2
	2: Success	%27,9
	3: Work	%2,7
	4: Health	%18,1
	5: Love	%29,5
	6: Money	%14
	7: Other	%0,7

Accordingly, 45% of students aged 22-23 with a family income between 6-18,000 TL were determined to be happy. On the other hand, 44% of students younger than 19 with a family income in the same range were determined to be unhappy.

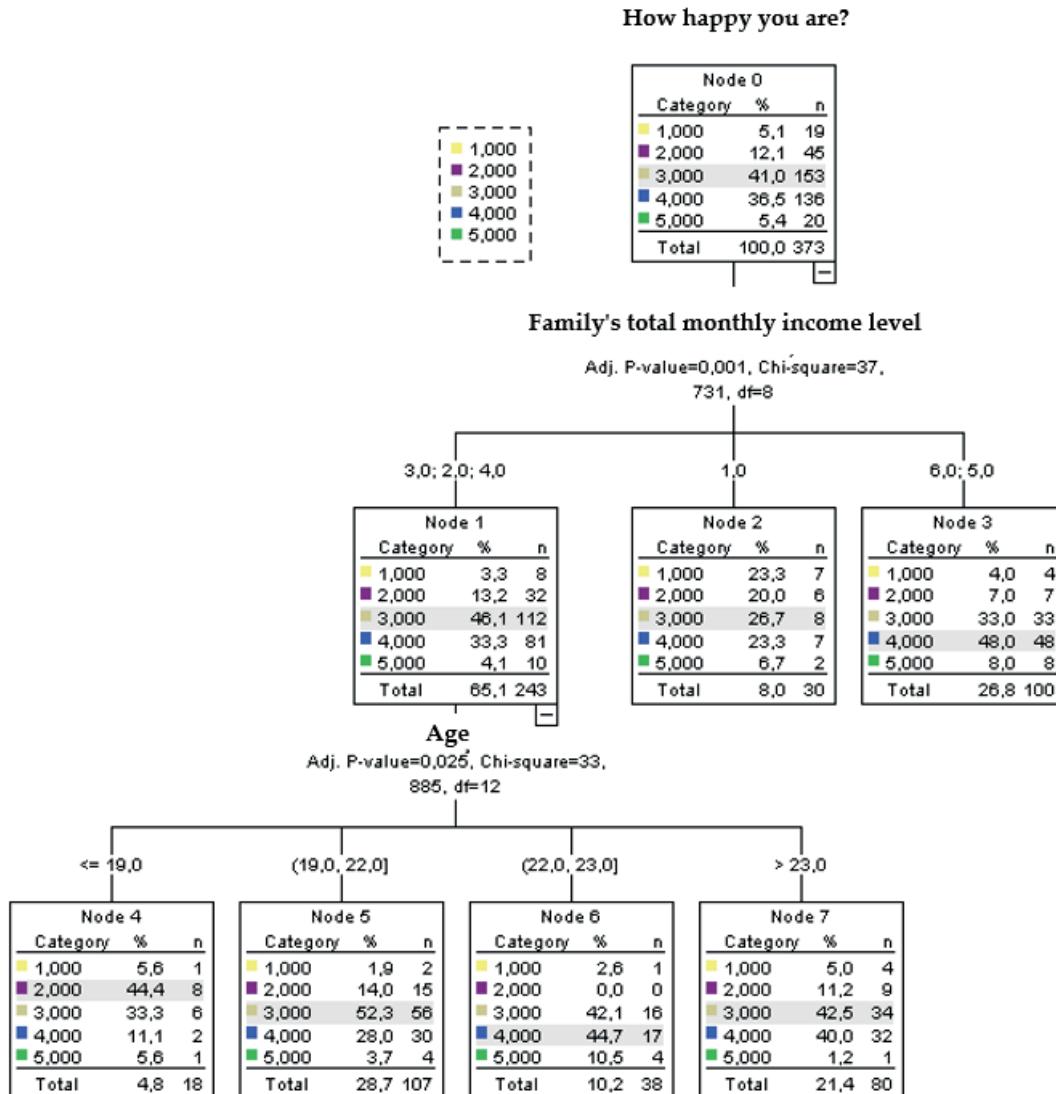
According to the CHAID algorithm in Figure 2, the primary significant variable affecting what makes students happy is gender. Success makes 29% of male students happy. For female students, 33% find happiness in love. Another significant variable affecting what makes female students happy is their mother's occupation. It was found that 56% of female students whose mothers are "civil servants" or "other" are made happy by success. For female students whose mothers are

"housewives," "workers," or "retired," 35% find happiness in love.

5.4. CART Algorithm Findings

According to the CART analysis results in Figure 3, the most important variable affecting the happiness of university students was determined to be the occupation of the father. It was seen that 50% of students whose father's occupation is "not working" are unhappy. Furthermore, students whose fathers are not working and have a family total income below 6,000 TL are very unhappy, and those with an income above 6,000 TL are also unhappy (regardless of the total family income level). For students whose father's occupation is "worker," "civil servant," "retired," or "other," the variable affecting happiness is age.

Figure 1. CHAID Algorithm Findings



According to the CART algorithm in Figure 4, the most significant variable affecting what makes students happy is gender. Success makes 29% of male students happy. For female students, 34% find happiness in love. Another important variable affecting what makes female

students happy is their mother's occupation. It was determined that 47% of female students whose mothers are "civil servants" or "other" are made happy by success. For female students whose mothers are "housewives," "workers," or "retired," 37% find happiness in love.

Figure 2. CHAID Algorithm Findings

What makes you happiest in life?

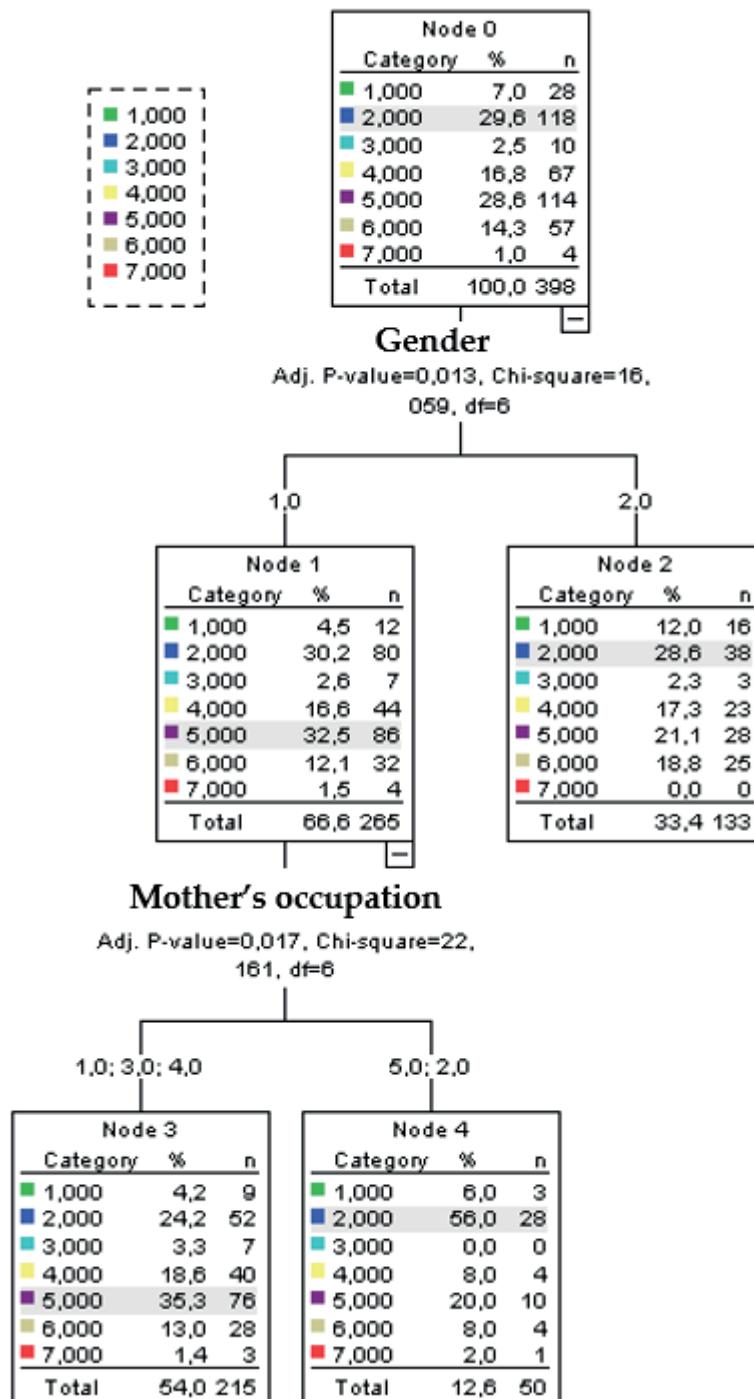


Figure 3. CART Algorithm Findings

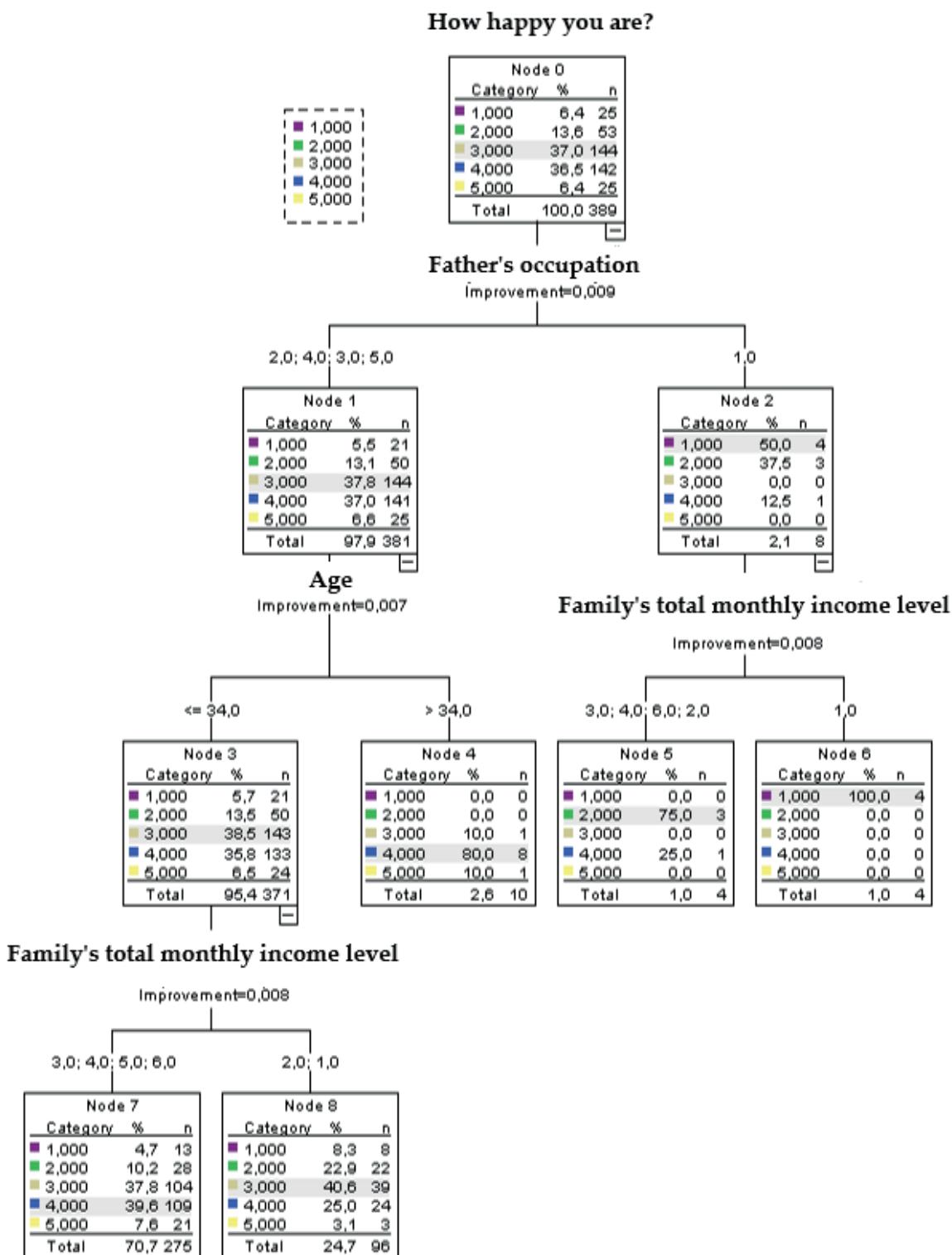
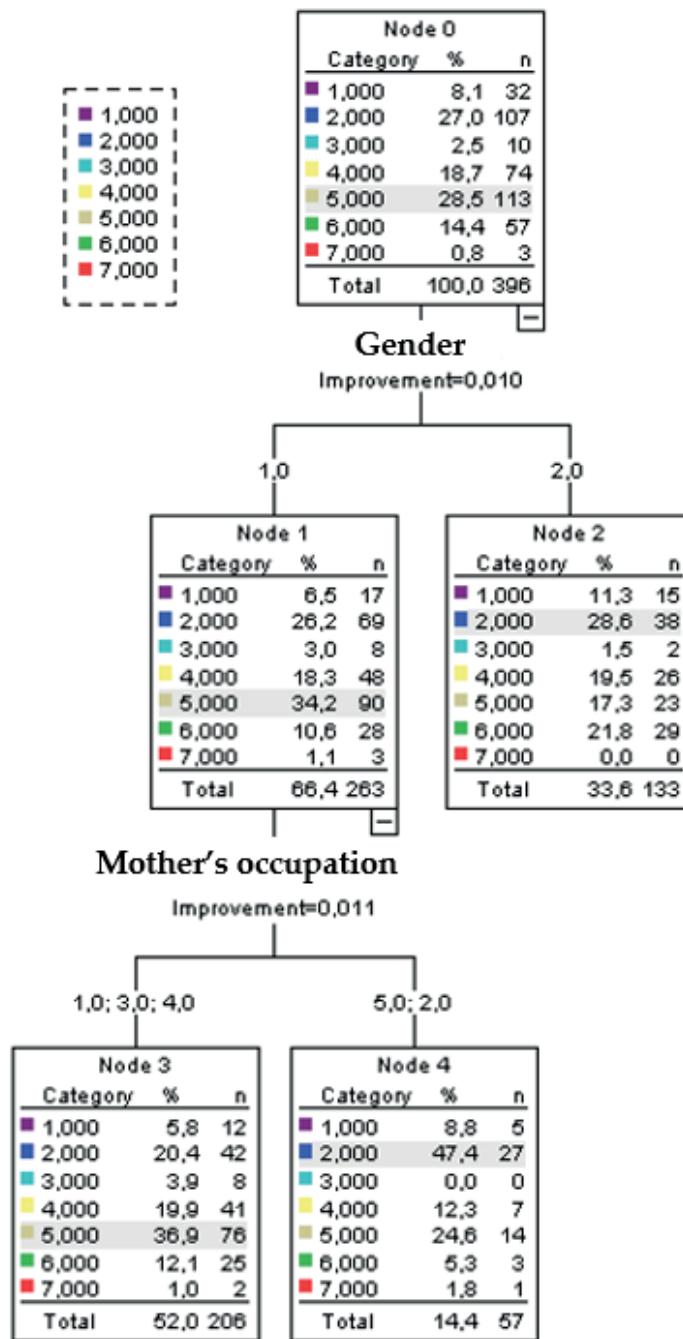


Figure 4. CART Algorithm Findings**What makes you happiest in life?**

6. CONCLUSION AND EVALUATION

In recent times, data has maintained its importance in every field, attracting everyone's attention. The transformation of vast amounts of data into meaningful and usable information is related to data management. Data that does not transform into information fails to contribute to the field of application. With technological advancement, the significance of big data has grown. Nowadays, data mining methods, which facilitate the transformation of big data into information, are utilized in most studies.

In this study, happiness has been addressed as a subject of application that could be described as a common area of study for disciplines such as economics, business, political science, psychology, and sociology, among others. The most effective socio-demographic characteristics on happiness levels and the concepts that make an individual happiest have been determined using decision tree algorithms.

The explanatory variables within the scope of the study have been identified through a literature review. Dependent variables and their categories have been established based on the TÜİK Life Satisfaction survey. Primary data were used in the study, and decision tree techniques were chosen as the analysis technique. By analyzing the data from a sample size of 600 created using the Convenience Sampling technique, it was found that the most influential factors on happiness levels are total family income (CHAID) and father's occupation (CART). The most significant socio-demographic characteristic affecting the source of happiness was found to be gender (CART, CHAID). These core findings are parallel with the literature review, which also identified income as one of the most critical variables.

If one wishes to detail the analysis results in terms of relationships between categories, it can be said that the concept of love stands out for female students, while the concept of success is prominent for male students. Following gender, the mother's occupation has been identified as the next most important socio-demographic variable.

In conclusion, this study, conducted with the participation of undergraduate and graduate students at Marmara University, found that family income is the most significant variable affecting happiness levels, with students from higher-income families tending to have relatively higher levels of happiness.

Determining all the variables that affect university students' happiness levels is crucial for detailed studies aimed at improving educational quality. It is hoped that this study will be beneficial for those who will work on life satisfaction in the future.

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