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**Research Article**

## A Game-Theoretical Approach to Conjoint Analysis

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### ABSTRACT

The study aims to combine the results of Conjoint Analysis, which is frequently used to determine customer preferences in marketing and market research areas, with Game Theory as suggested in the article of Choi and DeSarbo (1993). In this context, the application of the proposed approach was made within the framework of the factors affecting private university preferences of university candidates and the marketing decisions of school administrations. Student preferences were determined by the choice-based conjoint analysis method. As a result of a study conducted with 296 prospective students who were in the selection process after the 2016 university entrance exams. The reasons for preference in order of importance were determined as the availability of the program to be studied, the academic reputation of the school, and campus facilities. The data relating to the characteristics of university managements care in their marketing activities obtained from the interviews with the school administrators and the data obtained from the Conjoint Analysis of students' reasons for preference were used as input in the payoff matrix organized in the context of Game Theory, and the solution of the game was completed as a two-person zero-sum game. As a result of the application of the method with empirical data, it is observed that how student preferences will change when the weights of strategic marketing factors change in the decisions taken by school administrations from the business point of view. In addition, with the help of this approach and by obtaining competitor data, it allows to describe the situation of the market in general and to make a comparative evaluation of each university on its own.

### Keywords:

Conjoint Analysis, Game Theory, University Preference

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## 1. Introduction

We move forward by making many decisions, big or small, difficult or easy, both in our daily life and in planning our future based on our present. Sometimes we do these within the framework of a certain habit and in the natural flow of life, sometimes by thinking and evaluating it for a long time. In the scientific field, making inferences from the physical functioning of the human brain and determining how our decision-making processes as a social entity work have been the subjects of study for many years. Based on human nature, how to make economic and managerial decisions correctly and rationally, and the analysis of different modes of action under different conditions or constraints with mathematical methods are the subjects of current decision theory. Although the development of the theory was initially with simple problems, however, it has evolved into a more complex structure to meet the needs due to the increase of factors affecting and directing the decision-maker in parallel with the growing information and data volume.

This study is focused on how to guide decision-makers with a different perspective by blending conjoint analysis and game theory, which are two methods used in decision making for different purposes. The application of the proposed approach is performed in the context of the university preference problem, which currently concerns more than a million people in Turkey. This problem is always the literature of the wishes and preferences of prospective students here in recent years has been focused on understanding considering the rivalry between a rapidly growing number of private universities in Turkey have been reviewed together with the business perspective. The causes of this problem and to date have not previously encountered, not a weighted structure despite earlier state universities in Turkey is rapidly increasing number of private universities and colleges candidate after 2010. From this point of view, the paradigm of preference for the student and the preference for the school has changed surprisingly. Due to the intense data flow to both prospective students and new universities that are on the way to becoming a preferred university, both parties have to decide before they can analyze the process correctly. This situation is for the students who are at the stage of making a vital and professional decision and who cannot predict what they expect from a university during their ongoing education life, to settle in some departments of several universities before they have full knowledge, and for schools who know that the way to become a successful institution is preferred by successful students. It drives them to stay below their expectations in this area with wrong investments. In addition to the fact that this problem is multilateral and multi-criteria, it is thought that the approach proposed within the scope of the study will be suitable for the application of the study since it is not known whether complete information can be reached at the decision stage.

In the study prepared for the purpose outlined above, before the introduction and application of the mentioned approach, the fundamentals of decision theory and the conjoint analysis leg of the mixed approach proposed in the study will be explained in general terms. Then, the game theory will be summarized and examples from the research carried out in a hybrid structure similar to the approach proposed in this study will be given. In this context, studies using both game theory and other decision-making techniques as well as conjoint analysis and game theory will be

discussed. In the third part of the study, the information will be given about the structure of the higher education placement process for university candidates, the criteria affecting their choices, and the literature in this field. In the fourth part, after explaining the purpose, scope, and methodology of the research, first, the data obtained from the conjoint analysis will be detailed, and then the results obtained when blended with game theory will be discussed. In the last part, what kind of inferences can be made based on the results obtained with the proposed approach and how to answer the decision-making problems of both candidate students and school administrations will be discussed.

## 2. Conceptual Framework

### 2.1. Decision-Making Theory

One of the most important processes subject to human activity is decision-making. The concept gains relative importance, especially in economic, political, military, and similar systems. Although decision theory is influenced by various departments of both administrative and humanities, it is based on statistics and operations research disciplines. The core of decision theory is the "decision-making" process. Decision theory, which shows continuous improvement on its own, emerged as a separate discipline in the mid-20th century. Here, the study named "Theory of Games and Economic Behavior" published by Von Neumann and Morgenstern in 1944 can be shown as the starting point. In addition, decision theory has become the subject of statistics, psychology, political and social sciences, and even philosophy. For example, while examining how people make the decision to vote in political science, and the behavioral dimension of this decision in psychology, the rationality of these decisions is discussed in philosophy. Although the problems overlap in an interdisciplinary context, researchers have different methods specific to their field. One of the most important developments in decision theory is the "Prospect Theory" developed by Tversky and Kahneman (1979). The study, which was awarded the Nobel Prize in Economics in 2002, paved the way for the adaptation of decision techniques to current life problems. On the other hand, Aliev and Huseynov's "Decision Theory with Imperfect Information" (2014) can be shown as a criticism of the familiar techniques based on Aristotle's bivalent logic and Bayesian probability with the assumption that complete information is obtained. Decision theory is simply concerned with decisions. In this respect, although it does not seem very complicated, there are many different ways and different research approaches to handle decisions theoretically. Considering daily life, people need to make a decision and finalizing some of the situations and/or problems they face, either on their own or with their community. Decision theory discusses how people use their free will in the decision-making process. In this context, theorists argue that when they have to make a choice, people do not act accidentally, but choose for a specific purpose. Decision theory is divided into two as normative and descriptive. To explain this distinction simply; normative decision theory deals with how the decision is made, and descriptive decision theory deals with how it should be taken. The requirement here has been used in the context of the rational decision-making requirements set by the theorists. The word normative means to be based on certain rules, norms, and rules. The norms of rationality in decision theory may not be the only or the most important criteria that a person would want to apply in any decision. So much so that in practice the norms of relativity

are applied more than the rational ones. Decision theory does not deal with situations where the rules or norms in question are not determined ethically or politically. This type of normative issue most often arises when the person has incomplete knowledge of the situation. In addition, the individual decisions made by the individual over time or how a particular group coordinates the social decisions made in the social decision process are discussed in the context of the problem. For example, if a general wants to win a war, decision theory can tell how to achieve this goal. But it is not concerned with the decision to strive to win this war. Although normative situations are thought to have a limited scope in decision theory, often descriptive and normative situations cannot be separated from each other with sharp lines. In such cases, it is necessary to look at what is involved in falsifying a decision theory (Hansson, 2005).

It is important to consider the subject within the framework of business science. Because, considering the subject of the study, it is necessary to touch on managerial decision-making in terms of businesses, which are living organizations. Every business aims to maintain its existence and profitability by achieving its strategic goals. Every manager should know that the way to achieve these goals is to make effective decisions. Before the science of management was born, classical managers base their decisions on limited knowledge, intuition, and personal experience. With the developing world, businesses under the complexity of industrial relations and increasing competition, and challenging cost conditions accepted the obligation to make rational decisions and started to evaluate the issue in an analytical framework (Can, 2015: 1). In the decision-making phase, besides the environmental factors likely to affect the businesses, the decision-maker's approach to the issue is also effective. The factors affecting decision-making behavior are cognitive level, culture, risk and information resources, and personal deviations (Gerald and Tracy, 2008: 8). To avoid potential deviations, managerial decision-making processes have been established and placed on a rational basis. Accordingly, the decision-maker who wants to change the current situation first observes the situation. Both quantitative and qualitative information is used to evaluate the options under consideration. Then, the most preferred option is applied according to the evaluation criteria determined (Öztürk, 2001: 9). However, it should not be forgotten that the decision process is continuous, and their operability should be followed after the decisions are taken.

When decision making is considered as a whole, defining this process that develops intensely in the human brain requires the use of mathematical methods that will provide reasoning ability. Based on the information available, decision-making procedures contain common concepts. For example, the decision-maker must have a set of alternatives and there must be at least two members in this set. Another indispensable is to know all possible results (sample space) of the actions to be taken for the alternatives. These results can be infinite in some cases. The decisions to be made will provide a qualitative or quantitative output based on the sample space we have mentioned. To generalize, each decision problem includes the three elements we mentioned above: the set of alternatives, the sample space, and the outcome of the decision (Aliiev and Huseynov, 2014: 1). Some methods are formulated based only on outputs and their probabilities, without considering the sample space, such as lotto or lottery games.

The main issue here is the necessity to take into account the rational assumptions of the decision-maker on choices. This depends on the quality and quantity of information available about the sample space. While analyzing people's decision-making behavior in theory; It is assumed that the information about the components of the problem subject to selection is precise and complete. It is assumed that the selection and decision-making behavior takes place under these conditions. Expected value and probability are used as two basic criteria in comparing decisions and choices made under uncertainty in the theory of statistics, which regards the individual as rational. The concept of probability, which is defined as the probability of an outcome, is closely related to the event itself; It is also influenced by people's past experiences and expectations regarding this event. Therefore, the objective interpretation of probability is made by considering the frequency of occurrence of events. According to the theory mentioned above, it is seen that individuals at the decision-making stage benefit from the following skills (Işığışık, 2015: 3):

- Using knowledge,
- Evaluating probabilities correctly,
- Evaluating the beneficial or unhelpful aspects of decisions,
- Evaluating alternative options

In this context, different approaches have been developed. The first is the "decision-making under certainty" approach in which the decision-maker has complete and accurate information about the sample space. Again, if the probability of realization of every possible result in the sample space is known, the approach is defined as "decision making at risk". Another situation is that some difficulties are encountered in evaluating these exact possibilities. This approach is called "decision making under ambiguity, incomplete information, or ignorance". Finally, the absence of any information about the possibilities in question is called "decision making under uncertainty or complete ignorance". All four conditions mentioned have exact correspondences in our lives. However, since we have flawed information about all the elements of the problem for decisions taken in daily life, we usually face the problem of "making decisions under imperfect information". According to Zadeh, defective information can be imprecise, uncertain, incomplete, unreliable, vague, or partially true. In addition, the flawed information we mentioned may be the subject of all four decision-making situations. From another point of view, the preferences of the decision-maker may be dependent on psychological, cognitive, or other factors (Aliev and Huseynov, 2014:4). As a result, whether from a consumer or business perspective, based on preference or knowledge; The basic approach used in the solution of decision-making problems is to take the best action according to the goal of the decision-maker.

## 2.2. Conjoint Analysis

Conjoint analysis, which is defined as a kind of "thought experiment" by Hair et al. (1995), is a technique used to measure how and according to what consumers make a multi-featured product preference. Therefore, in today's markets where there is a wide range of products and services, it is one of the methods used when we want to make new product development and improvement studies on existing products.

Without a doubt, the area where conjoint analysis is of most interest is marketing research. The technique was developed based on Luce and Tukey's (1964) work called conjoint measurement. After the emergence of the analysis, it was first used to measure the differentiation of consumer preferences based on multi-featured products. (Green and Rao, 1971). The technique has also been one of the topics that are widely discussed in academic research (Green & Srinivasan, 1990). According to Cattin and Wittink (1989), who examined the industrial use of conjoint analysis, apart from academic studies in the late 1980s, conjoint was used as a method in more than 300 studies every year in the USA and Europe. Most of these studies were on new product development, competitor analysis, and market segmentation.

Following the introduction of computer programs developed for analysis in the article of Green and Srinivasan (1990), different approaches were developed by Sawtooth Software Co. According to a recent survey that was conducted by Sawtooth Software, the total number and also size of conjoint studies have increased (Liu, Brazell and Allenby, 2020). Such programs operating within the framework of these approaches calculate the importance of product features from the data interactively, while also offering the user the opportunity to simulate in different scenarios. If the general objectives of the analysis are evaluated from the business science point of view;

- To determine the contribution of product features and levels to consumer preferences. (marginal contribution)
- Creating a model that can explain consumer decisions.
- To design products with optimum features.
- To be able to learn the preference features between products with different features.
- To be able to seize product opportunities that are not currently available in the market but may have a sales potential.
- To be able to identify the consumer groups that attach importance to the different features of the products.

Numerous applications have been made to determine consumer preferences for products and services in almost every sector, new product/service design, simulation, and market segmentation since the 1980s, when both industrial and academic use became widespread. When the topics of the studies conducted in recent years are examined, some studies seek answers and bring new approaches to the various problems encountered in conjoint as well as those related to practice. For example, in studies where price and brand are determined as features, changing the customer perception of the product, brand value calculations, increasing the estimation efficiency by using different methods, application of analysis in heterogeneous groups, innovations in utility estimation algorithms, and combining conjoint with different methods can be given. However, the selection algorithm is now a method used not only for product or service managers in marketing departments but also for all factors of businesses. Green, Krieger, and Wind (2001) proposed the following topics as the development of conjoint analysis and its areas of use until its publication and the topics that are expected to be studied in the future with conjoint analysis:

1. New simulation optimizers that maximize market share or revenue
2. Solutions to new marketing problems: Bundle preference offered in telecommunications or banking applications
3. More visual and realistic presentation of the product's features and levels to the respondents
4. Conjoint applications in different fields: Tourism, entertainment industry, health, etc.
5. New application areas: internet-based hybrid applications
6. New methods to measure the reliability and validity of the conjoint model
7. Moving customer-based applications to the face of competition between businesses, employees, other business stakeholders, or government agencies
8. New dynamic simulators that take action-response behavior into account
9. Prototype simulators: Taking customer preferences based on experience by having the product tested

During the time that has passed since the literature study prepared by Green, Krieger, and Wind (2001), various research on these topics has been started and is still ongoing (Lemke, Mazarakis and Peters, 2021). For instance, even though the conjoint methodology is seen as superior to traditional survey techniques in terms of quality of data collection methodology, in a contemporary study by Howell, Ebbes, and Liechty (2021), a statistical method was proposed to identify respondents who provide low-quality information content in conjoint studies. Obviously, newer perspectives on conjoint analysis, which has a history of about 60 years, continue to be developed every day

### 2.3. Game Theory

Game theory, whose origin dates back to 500 BC and was based on the Talmud used by the Babylonians in organizing their social lives, and which was used in economics by Neumann and Morgenstern's "The Theory of Games and Economic Behavior" in 1944, It has been one of the indispensable methods for economic analysis to examine its behavior. The technique, which developed in the 1950s with the contribution of J. F. Nash to the theory of rational behavior, has been used in many interdisciplinary studies in the field of social sciences due to its interaction with social life and its strategic nature. Game theory, in its simplest definition, is an analysis that serves to identify the superior strategies of the parties consisting of two and/or more actors in this context. Within the scope of decision-making approaches, it is a way to help decision-making in a way that is more suitable for real-life problems, in a sense, with the addition of competition. Actors with a competitive relationship are named as players within the scope of the analysis, and their winning strategies are shaped according to the strategies of their competitors rather than their conditions and constraints. The movement of players by creating their relative strategies for winning is called a game. Games can be divided into "luck" and "strategy" games. The games discussed here in the context of game theory will be strategy games (Taha, 2015: 544-545). Commonly used concepts in game theory literature are:

**Player:** Actors who make decisions that affect each other in the game. At least two players in each game must be rational. They aim to maximize their earnings.

**Gain:** It is calculated at the end of the game and refers to each player's win or loss (payout) against their opponent.

**Strategy:** The movements of the players that will provide the maximum profit are called the strategy. A strategy that maximizes the player's utility or gain is called a full strategy. It is said that the players use the same strategy every time the game is played. This strategy may be optimal for some games. The exact strategy that makes one player's benefit optimum is also optimal for the other player. The hybrid strategy is defined by the probability distribution in the complete set of strategies.

**Payoff Matrix:** It is the matrix that shows the gains and losses resulting from the various combinations of players' strategy choices, and their elements can be positive, negative, or equal to zero. If any element of the payout matrix is positive, the player in the column pays this amount to the player in the row. If any element of the matrix is negative, the player in the row pays the player in the column equal to the absolute value of that negative element. If the element of the matrix is zero, none of the players pay each other. In any game, regardless of the strategies played by the players, if the math sum of each player's gains and losses is zero, the game is a zero-sum game. These games are games for two. A player's win is equal to the other player's loss.

**Expected Value:** The meaning of the expected value in game theory, discussed in detail in the previous chapters, is the sum of the products of the probability of the event and the value of the event (Öztürk, 2009: 656-657). There are four basic game types. These are:

**According to Cooperation Status:** Players participating in the game can cooperate with other players to get the highest profit. In such cases, the cooperating players are considered as single players.

**According to Knowledge Level:** Games can be called games with complete or incomplete information, considering the level of knowledge of the players. For games for which full information is available, every player knows his own and other players' gains and losses while creating his strategy. There is no information on this subject in games with incomplete information.

**According to Earning Status:** Games can be grouped as zero-sum or non-zero-sum games in terms of the earnings that players will gain. Such games are called zero-sum games when one player's gain refers to the loss of the other and otherwise non-zero-sum games.

**According to the State of Interaction:** It could be mentioned that dynamic games when the players are aware of the moves of other players before the move they will make, and static games in the absence of them. In static games, players take all their decisions and make their moves at once, but dynamic games can take place in a wider time interval and continue with mutual moves (Romp, 2011: 16).



## 2.4. Literature Review

There are many applications of game theory in the literature. In this section, examples of studies in which data to be used for game theory are obtained by multi-criteria decision-making techniques will be given with the idea that the study will be parallel to the method of the study.

Akdağ (2015) used game theory to determine the most effective advertising tool on prospective students in an educational institution in his thesis. In the study, the data of the game decision matrix prepared for the advertising industry and two players determined as candidate students were obtained by fuzzy TOPSIS method after the questionnaire study was answered by the students and the advertiser. Arsenyan Üşenmez (2011) made a hypothetical structure modeling for the product development strategy in his thesis. The study aims to guide the practitioners by creating a holistic collaborative product development structure. First of all, a general collaborative product development structure based on Axioms has been introduced and this three-dimensional structure has been detailed within the framework of collaborative software development. Then, these three dimensions are discussed separately: partner selection with fuzzy AHP, conditions of cooperation with game theory principles, and technology planning problems with an integrated fuzzy method. These developed models have been applied and tested in collaborative software development processes. In his thesis, Aplak (2010) handled the data he obtained with the fuzzy TOPSIS method in the context of a non-fixed-sum game for two people, based on the example of international conflict. Deny et. al. (2014) introduced a game theory approach to the decision-making process under uncertainty. The information resources of the decision-maker were obtained by the Dempster-Shafer belief function, and the subjective decisions of the experts were handled within this approach. Then, game theory is used to choose the optimal strategy. Turskis and Juodagalvienė (2016) suggested in their article that the type of stairs to be selected for two-story houses should be made using multi-criteria decision techniques. This method proposes the solution of the data obtained by TOPSIS with a two-person zero-sum game. Perić (2016), after solving the problem of determination of supply quotas and vendor selection with multi-purpose programs in line with three main criteria, completed the determination of the most effective seller with a collaborative game theory approach. Madani and Lund (2011) GMCR II, the multivariate decision-making technique for the California Sacramento-San Joaquin Delta problem. they used the decision support system package and analyzed the weights obtained from this for alternatives with the Monte Carlo type game approach. Angelou and Economides (2009), in their articles, addressed this investment problem as a multi-criteria decision-making problem due to the insufficient cost-benefit analysis while making investment decisions in the axis of industrial regulations for companies producing information technology, and obtained the benefit values of investment instruments with the AHP method and the competitive element. By involving them, they determined their optimal strategies with game theory. Finally, Debnath et al. (2018) are used multi-agent MCDM as an evolutionary game and the evolutionary strategies are defined as sustainable decisions in a problem of decision making in the Indian Tea Industry. On the other hand, studies using conjoint analysis and game theory together are detailed below:

Hauser, Eggers and Selove (2019) mentioned the role of CBC data in the evaluation of product pricing strategies along with game theory. Kuzmanovic and Martic (2012), in their article, determined consumer preferences with the method of conjoint analysis and determined the product line design in the competitive environment with game theory. Similarly, Steiner (2010) made use of conjoint analysis in determining the new product profile with consumer preferences, and with the involvement of competition, a game theory model in Nash equilibrium for optimal product design. Blokhuis et al. (2012), in their study on environmental design, proposed an approach to optimize the social conflict arising from the re-evaluation of idle lands with a game theory approach in line with the preferences of the inhabitants of the environment determined by conjoint analysis and the requests of the investors.

### 3. University Preference and Placement Process in Turkey

Today the first steps of the higher education admissions process implemented in Turkey with the central examination system were laid in 1974 with the passage of the university student admission. Before, without a central examination system in this way, candidates were applied by applying to universities and being evaluated according to various criteria, if any, and being settled. As mentioned, in 1974, the Interuniversity Council approved that university entrance exams should be held from a single center and established the Interuniversity Student Selection and Placement Center (ÜSYM) on 19 November 1974, based on Article 52 of the Universities Law No. 1750. Student selection and placement procedures for universities were carried out by this center until 1981 in line with the preferences of the candidates and the central placement process was implemented. In 1981, Interuniversity Student Selection and Placement Center (ÜSYM) became a subsidiary of the Council of Higher Education with the name of the Student Selection and Placement Center (ÖSYM) with the 10th and 45th articles of the Higher Education Law numbered 2547. Since 1982, graduation averages from the secondary education institution that the candidates graduated from have been taken, and these have been added to the exam scores with various weights as Secondary Education Success Score (OBP). Since 1987, candidates who make their higher education preferences in certain fields have been given the option of answering only certain tests in exams. In 1999, the second of the two-stage selection and placement exams, which had been held until then, was abolished, and it was transformed into a one-step examination under the name of Student Selection Examination (ÖSS). In the same year, considering the area of graduation in secondary education, higher CFP use in placement was implemented. There was no change in the scope of the exam with this change. With the amendment made in 2006, the single-stage application of the exam was continued, but some of the questions were prepared in the type of ÖSS, similar to the previous years, and some were prepared considering the whole high school curriculum. As of 2011, the examination system has been changed again and, as before 1999, the two-stage system was used. The first stage is called the Higher Education Transition Exam (YGS) and the second stage is called the Undergraduate Placement Exam (LYS). In this new system, both the number of exams has been increased and the score calculation system and score types have been changed. With the score types calculated separately in YGS and LYS, students are allowed to choose according to different score types (Yılmaz, 2012). Since 2017, Basic Proficiency Test (TYT) and Field Proficiency Tests (AYT) have been introduced instead of these two exams. Candidates who want to enter the

departments that accept students with language scores after TYT must take the Foreign Language Test (YDT) (OSYM, 2021).

### 3.1. Higher Education Institution Preference

Factors affecting students' higher education institution preferences should be analyzed both to be successful in schools in the educational economy, to determine the right strategies and to make effective positioning, and to raise generations who have made the right career choices in the future and completed their education processes in the quality they want. In this context, the selection process of university candidates and the factors affecting this process were examined with examples from the studies in the literature.

There are various studies in the literature regarding the higher education institutions preferences of students. An important part of these are studies related to the undergraduate level. A small part is made for the graduate. When the literature is examined; it is seen that students go through more than one stage in the decision-making process. In 1995, Kotler and Fox, for example, proposed a 7-stage model (Raposo and Alves, 2007: 3). However, many other researchers focus on less stepped models. Many studies focus on 3 main stages (Desjardins, Ahlburg and McCall, 1999: 382). One of the prominent three-stage models is the work of Hossler and Gallagher (1987). Researchers have defined a development process consisting of predisposition, research, and selection stages, and ends when the student starts higher education. In the study, which was later carried out by Hossler, Braxton, and Coppersmith (1989), the authors expanded their previous study and identified several sub-stages belonging to 3 basic stages. In the first stage of the model developed in this direction; students set goals for higher education. At this stage, students decide whether to continue higher education or not. It may take a long time for the students to develop their thoughts and tendencies about higher education. This process can start from early childhood and extend to high school years and beyond. Although this first stage varies from person to person, it generally occurs during primary and secondary education (Desjardins, Ahlburg and McCall, 1999: 382). By the time they reach high school level, students generally set their goals for higher education. When the trends in higher education are examined, students are divided into 3 groups: Those who decide to continue higher education, those who are unsure whether to continue higher education, and those who do not intend to continue higher education (Adams, 2009: 42). Hossler, Braxton, and Coppersmith (1989) divided this stage into two as request and decision. The stage of request refers to the student's tendency to receive higher education. At the decision stage, the student not only wants to pursue higher education but also refers to the process in which the decision to study higher education is made. In this first stage, which is generally called the susceptibility stage; it was stated by the researchers that factors such as the socio-economic status of the family, the academic ability of the student, the education level of the parents, the family's encouragement, friends' plans for higher education, the encouragement of teachers, and the educational goals of the student. The second phase is the research phase. This stage includes determining a certain number of higher education institutions to be enrolled in and making applications. At this stage, students try to obtain information from various sources to decide which higher education institutions they will prefer (Desjardins, Ahlburg and McCall, 1999: 383). At this stage, students identify the institutional factors that are important to them and try to

complete their knowledge deficiencies, while higher education institutions provide them with the information they need. In this way, they start to identify the institutions that they think are right for them. In the meantime, students who still cannot decide whether to continue their higher education or not, during the research phase, decide more clearly whether they want to continue their education and which higher education institutions they will choose as their target (Adams, 2009: 43). In addition, at this stage, students take exams that must be successful to study for two or four years. The third and final stage of the model includes the acceptance of the student, the registration process, and the start of going to university. Although not available in many countries like Turkey (Adams, 2009: 43). In Turkey, this case operates only at the graduate level. At the undergraduate level, the student prepares a list of preferences according to the score he/she gets. After creating the preference list consisting of private universities and state universities, it is directed to a specific institution by the system. Later, the student goes to that institution and completes the registration procedures and starts his/her higher education. However, the quality of the preference list prepared at this stage is very important. High school graduates often do not have any experience in working life. Therefore, a clear career choice cannot be formed for the majority. Even if some students have a clear vocational goal, among the universities they may prefer, they may turn to those offering different opportunities by pushing the score factor to the background. Therefore, it is possible to influence the preferences of these students by highlighting their various characteristics in terms of universities. Considering Turkey in general, in terms of offering students various and different opportunities; although there are studies about state universities, it can be stated that such studies are not carried out for private universities.

### 3.2. Factors Affecting University Candidates' Choices

Factors affecting students' higher education institution preferences should be analyzed both to be successful in schools in the educational economy, to determine the right strategies and to make effective positioning, and to raise generations who have made the right career choices in the future and completed their education processes in the quality they want. In this context, the selection process of university candidates and the factors affecting this process were examined with examples from the studies in the literature.

In this decision-making process, university candidates try to learn about many subjects such as the available courses and opportunities while researching in institutions. They make their choices by using the limited knowledge they have and taking into account the various factors that they care about in decision making. Researchers state that in the last 20 years, research on students' preferences has increased. Such studies are found in Australia, Spain, Denmark, England, and America. In an environment where quality student resources are limited, attracting successful students becomes more and more important for universities (Veloutsou, Paton and Lewis, 2005: 280). Such research can be enlightening for universities in our country as well. Higher education institutions that can transform the results of the research into the right strategies can also gain an important competitive advantage. In the literature on factors affecting student preferences, Krampf and Heinlein (1981), Chapman (1981), Hooley and Lynch (1981), Kallio (1995), Hanson, Norman and Williams (1998), Joseph and Joseph (2000), Soutar and Turner (2002), Hoyt and

Brown (2003), Veloutsou, Paton, Lewis (2004), Domino et al. (2006), Yamamoto (2006). The factors emerging in these studies are generally under the following headings:

- Academic reputation
- Location of the university
- Education quality
- Availability of the preferred program
- Quality of the faculty
- Costs
- Studying in a reputable program
- Financial aid opportunities
- Employment rate of graduates
- Diversity of courses offered
- Size of the institution
- Community
- Availability of master's programs
- Opportunities for students to find a job
- Size of classes
- Quality of social life
- Existence of extra-curricular programs
- Application opportunity to graduate programs
- Friendly personnel services
- Existence of links with other reputable institutions
- Admission requirements
- Attractiveness of campus facilities

Rather than directly taking the above-mentioned factors into the conjoint design to be applied within the scope of the study, a pilot study was deemed appropriate to evaluate whether they are really important for the university candidate. As a result of the evaluation of the factors obtained from the aforementioned pilot study, the ones with a high degree of importance were separated and the features to be used in the conjoint design were input. Details of the application phase of the study will be given below.

#### 4. Application

For many years, the scarcity of universities in our country and the fact that they were mostly established by the state have created the perception that they are more successful academically and have been the focus of choice by successful students. New private universities that are rapidly joining the higher education system today have been included in the selection process of university candidates. Whether or not candidate students prefer private universities, which differ fundamentally with their various features, with which inputs should come to the agenda as a question that needs an answer. Considering the unemployment rates for the current young and university-educated population, university preferences in the coming years may cause both the candidate's future and the qualifications of the educated and trained workforce to become debatable. On the other hand, it is seen that the mentioned private universities tend to market their offerings with similar approaches and considering that education is considered as a service today, it is observed that they

are in intense competition to have the preferences of the consumers who will receive such a service. In this intense competition, schools that cannot train qualified graduates and provide jobs for them will become economically ineffective with the decrease in their preference level in the short term. In this context, the preference process that comes to the fore for the prospective student carries uncertainty and poses a risk for his / her future. In addition, taking into account the current state of the system, the decision process is far from rational due to the inadequacy of access to full information. As a result, the investments made by the private universities that provide educational services towards the preferences of the candidates may become dead. When the problem is considered from two angles (university candidate and the university itself), a multi-criteria decision problem emerges for both parties. While the first is a rational selection problem for the student, the second is to make the necessary investments by determining the factors that satisfy student preferences and desires for schools. At this point, if the problem is handled from a business perspective, it is a multi-dimensional marketing problem that cannot be addressed with a standard multi-criteria decision-making method.

In the literature, no approach that offers a solution proposal by evaluating it from both the consumer and the business point of view has not been followed. The choice of the field of education as the application suggestion stems from the belief that the decisions to be made by both players will affect the future in a holistic sense. Universities that invest in the right fields rather than just concerned for profit will mediate the future generations to be well-educated and well-equipped individuals, but on the other hand, the purpose of establishing each enterprise and the reason for its existence, the purpose of making a profit will not be ignored. On the other hand, emphasizing the importance of making rational decisions for the future of university candidates, it is hoped that the study will be evaluated as a contribution to our social future in terms of preventing them from acting with insufficient knowledge and irrational factors “just for being a university graduate”.

#### **4.1. Research Design**

Under the title of research design, the information will be given about the sampling method of the study, data collection, and evaluation process.

##### **4.1.1. Sampling**

In the context of the purpose of the study, the number of students who entered the YGS in 2016, corresponding to the preparation period of the data collection study to be carried out, and getting at least 150 points from any type of score, was announced as 1,879,812 according to ÖSYM data (ÖSYM, 2017: 11). This number constitutes the sampling frame of the phase of the study to be conducted with prospective students. The scope of the study is limited to the province of Istanbul. Determining the sufficient sample size in Conjoint Analysis planning may differ according to the subject of the study and the type of analysis. While Akaah and Korgaonkar (1988) suggested that a sample size between 100 and 1000 is ideal, but observation of 300 to 550 people would be sufficient, Green and DeSarbo (1978) stated that effective estimates can be made with smaller samples. In this context, the sample size of the study was determined as 300 considering the above assumptions. In the sampling process, the private universities in Istanbul, which are intended to be evaluated within the scope of research purposes, were grouped and selected among them by cluster

sampling. The criteria for the evaluation of equivalence here; placement points and annual tuition fees for the same departments of universities (4-year departments of administrative sciences). Accordingly, all private universities in Istanbul are ranked according to placement scores and are considered to be a cluster of seven equivalent schools with equal prices. Two private universities in the cluster selected as a result of sampling were determined for the field study. Participants were randomly selected among the candidate students who came to make their university choices during the preference days' events held before the 2016-2017 academic year of these two universities. Within the scope of the study, it was planned to collect data from private universities to determine in which areas school administrations invest and/or allocate resources to become a "preferred" university, as well as to examine the reasons why candidate students prefer schools. According to the data of Higher Education Institution 2016, there are 65 private universities in our country (YÖK, 2016). However, to determine the schools that are comparable with each other, schools were ranked according to placement scores and annual tuition fees for the same departments (4-year administrative sciences departments), and 12 schools with similar characteristics were selected. The selection process is limited to private universities in Istanbul province. It was planned to collect data from all of these schools, but the feedback was received from 10 of them. The selected schools and the mentioned criteria are shown in Table 1 below.

University	Tuition Fee Without Scholarship	Tuition Fee with Scholarship	Base score
University A	26,077	6,519	208
University B	42,768	10,692	200
University C	28,000	14,000	198
University D	27,000	13,500	208
University E	23,750	11,875	199
University F	26,125	13,063	202
University G	27,000	13,500	206
University H	25,000	12,500	215
University I*	34,715	17,358	201
University J	26,460	12,701	216
University K	33,500	16,750	210
University L*	27,000	13,500	206

\* No feedback was received.

**Table 1.** Information about the Universities that Included in the Study

#### 4.1.2. Data Collection

The first step of the data collection phase of the study, as mentioned briefly above, is a pilot study in which the validity of the university students and the reasons for university preference will be tested. This study was carried out in October 2015 among freshman students newly settled in three private universities in Istanbul. These three schools were deemed equivalent to each other in terms of placement scores and prices. Within the scope of the study, a questionnaire was applied to 40 first-grade students selected by random sampling by face-to-face interview method. The reasons for preference to be evaluated in the pilot study were mostly taken from studies conducted abroad. They prefer the university process in Turkey is also

important to assess whether they are valid. In this context, to determine if there is a different reason for preference that is not included in the questionnaire of the pilot study, an open-ended "other preference reason" question was put in the form. However, as a result of the study, it was seen that there were no reasons for preference other than the factors determined before the study and asked to be evaluated by the students. As a result of the pilot study, the most preferred factors among the factors that were stated to be effective in university preference were separated and the expert teachers who guided the students in the university preparation process were confirmed in terms of whether they are really important in the selection process. As a result, five different preference reasons were taken into the conjoint analysis design to be applied in the continuation of the study. Details of the design will be given below.

It was thought that it would be important to make the conjoint application with the students who are in the university selection process and the selection phase, to get the answers healthier. Therefore, the results of the university selection and placement exams (YGS and LYS) held in 2016 were expected to be announced for fieldwork. In July 2016, computer-aided face-to-face questionnaires were conducted with 310 people selected from among the university candidates who came to two universities determined in the context of sampling, and the data were collected. Since the creation of query cards in the Sawtooth program, which is used in the data collection phase, was determined completely randomly, each interviewer made a selection from the different card sets, and all possible combinations were evaluated in sufficient number. The purpose of the study was explained to the participants at the beginning of the questionnaire, and the selection cards were asked which one they would choose if they were presented with the options shown on the cards while choosing the university they would prefer (at the university preference stage). 296 of 310 people in total were included in the analysis because they completed the questionnaire completely. Thanks to the convenience of the conjoint design, a total of 5920 choices were made to the 296 people mentioned. The information to be obtained from the university administrations was collected from the public relations managers of the selected private universities between June-August 2016 via e-mail and phone calls, and as stated above, 10 of the 12 schools returned.

#### 4.1.3. Data Analysis

The methodology followed in the data analysis to be made in the context of the proposed approach to the research problem described above can be explained as follows:

1. In October 2015, a pilot study was conducted to test the validity of the reasons for preference with newly placed students. This study aimed to reveal the reasons for personal preference independent of the "brand" and "price" of the school they prefer. At this stage, the students were asked to evaluate the importance levels of the reasons for preference in the literature. In addition, it was questioned in the questionnaire whether there was a different reason other than these. The most prominent reasons for preference in the pilot study were used as inputs in the design of the later conjuncture. Before these preference factors were included in the conjoint design, both the university administrations and the expert teachers who guide students in the university preparation process were also



confirmed in terms of whether they are really important in the student selection process.

2. The conjoint design was created, with the "preference" factor components being the most important and/or the most chosen among the reasons for preference, and the private universities in the market being the "brand" factor. After the 2016 university placement scores were announced with the choice-based conjoint (CBC) method of the prepared design, university candidate students were evaluated during the selection process, and the data collection process was completed in July 2016.
3. To create an optimal marketing strategy in terms of university administrations, it was planned to obtain information from the public relations managers of the 12 private universities selected by e-mail and telephone through a pilot study, and information about the investments they made in the context of the preference factors used in the conjoint analysis. The managers were asked to make their evaluations by weighing the investments on these characteristics over 100 (giving a total of 100).
4. The importance (in terms of investment) that universities attach to prominent features in the selection process and the factors that students attach importance to from their approaches measured according to conjoint analysis are compared with game theory. On this occasion, the optimal decision components for both the university administration and its candidate were determined.

The data collected for conjoint analysis were analyzed with the help of Sawtooth Software 4.10 CBC System 2.7 package program (Sawtooth Software, 2001). The calculations required for game theory were made with MS Excel.

## 4.2. Application of The Design

In this section, the results of the pilot study applied within the scope of the study, the findings obtained from the evaluation of the university candidates' school preferences with the conjoint analysis method, and the comparative evaluation of candidate student preferences with the game theory approach will be included.

### 4.2.1. Pilot Study

The first stage in the context of the research approach mentioned above is a pilot study in which the validity of the reasons for preference with university students will be tested, as detailed before. In the study, in which 40 students participated, the students were given the reasons for university preference in the literature, by grouping those who are conceptually similar. The students were asked to mark the factors they consider important in their university preferences among these, and then choose the 3 factors they consider the most important among them and rank them from 1 to 3. Finally, it was asked whether there is any other factor in university preferences.

According to the pilot study, the most selected factors as a result of evaluating all the factors that are important in students' university choices are listed as follows:

- Availability of the Preferred Program (63%)
- Ease of Transportation (55%)

- Quality of Education Provided (53%)
- Quality of Teaching Staff (53%)
- Personal Purposes (53%)
- Academic Reputation of the University (50%)
- The Quality of the Programs in the Field I Want to Study (50%)

It is seen that most of these factors are found under the heading "Academic Structure of the University".

The students were asked to rank the first 3 factors that they thought were the most important among these factors. Accordingly, the most important factors are:

- Availability of the Preferred Program (28%)
- Academic Reputation of the University (10%)
- Financial Aid / Scholarship Opportunities (10%)

According to the results obtained from the pilot study, the following attributes will be included in the conjoint cards to be prepared for the evaluation of candidate students within the scope of the conjoint design:

- The awareness of the university / being a brand
- Quality of the academic staff / academic reputation of the school
- The attractiveness of the campus and its facilities
- The school is located in a central location/ease of transportation
- Diversity of the departments where education is given

"The awareness of the university / being a brand" selected as the first factor was added to measure the need for a particular university among the options to be offered to prospective students and the impact of this brand. Although the quality of the faculty members and the academic reputation of the school are considered as two separate options in the pilot study form, the "quality of the academic staff / academic reputation of the school" option was created by combining them in order not to make the conjoint design difficult for the respondent by adding too many factors. To meet the options such as "Quality of campus life", "The attractiveness of the campus", "University life" in the pilot form, the factor "The attractiveness of the campus and its facilities" was created. The ease of transportation of the school, its distance to home, location, and similar features are gathered under the factor of "The school is located in a central location/ease of transportation". The "Diversity of the departments where the education is given", which is added to the conjoint design, represents the characteristics of the department that the students want to receive education such as "The Availability of the Preferred Department", "The Variety of Courses", "The Level of Meeting the Demands of the Courses Offered", which are among the most important factors for students. It is thought that this factor may reflect the importance of reading their ideal section for prospective students. The levels of these attributes that will be presented to the evaluation in conjoint cards are determined as follows:

**Attribute 1:** The awareness of the university / being a brand

- Level 1: University A
- Level 2: University B
- Level 3: University C
- Level 4: University D

- Level 5: University E
- Level 6: University F
- Level 7: University G

**Attribute 2:** Quality of the academic staff / academic reputation of the school

- Level 1: Faculty members/staff are experienced in their field
- Level 2: Faculty members/staff are new and inexperienced in their field

**Attribute 3:** The attractiveness of the campus and its facilities

- Level 1: It has an attractive campus
- Level 2: Poor campus facilities

**Attribute 4:** The school is located in a central location/ease of transportation

- Level 1: Far from home & hard to reach
- Level 2: Far from home & easy to reach
- Level 3: Close to home & easy to reach

**Attribute 5:** Diversity of the departments where education is given

- Level 1: The program I want is available
- Level 2: The program I want is not available

#### 4.2.2. Reasons for Preference of University Candidates

With the choice-based conjoint analysis, the efficiency of the conjoint design was examined before determining the factors and importance levels of the candidate students in their school preferences, and then the importance of the factors that affect the school selection based on the total group. In addition, bidirectional interactions between factors and their levels are also examined and explained below.

##### 4.2.2.1. Design Efficiency

With the CBC analysis, the efficiency of the conjoint design was examined before determining the factors and importance levels of the candidate students in their school preferences, and then the importance of the factors that affect the school choice based on the total group. In addition, bidirectional interactions between factors and their levels are also examined and explained respectively below.

The procedure followed by the analysis program used to investigate the effectiveness of the design is aimed at investigating the effectiveness of the design to be tested rather than the choices of the respondents. The efficiency of estimation of the utility coefficient of each factor is examined in the least-squares-based procedure. Thus, it enables the relative effectiveness analysis of each factor at the level of its sub-qualifications. For each feature and level, a zoom is made according to the relative standard error of each major effect under the total analysis results, and each version is assumed to be seen only once in the total observations. Test design uses ordinary least squares (OLS) instead of the multinomial logit for this purpose and uses information about option design rather than only participants' responses. This design evaluation method gives relative standard error estimates similar (but not identical) to the Multinomial Logit Model (Sawtooth Software, 2021). In this test, the emphasis is on the pattern of relative magnitudes relative to each other, not an exact estimate of each standard error for a given number of participants. To guess it is necessary to level up each attribute. The first level of each factor is automatically deleted from this analysis. The column named "Actual" gives the estimated standard error for the analyzed data. The column named "Ideal" gives an estimate of what these standard

errors will be if the design is exactly orthogonal and has the same number of observations. The explanation of the real and ideal values given for each level in the analysis output given in the table below is as follows: The ideal value calculated for the relevant level shows the optimal value for the relevant level within the framework of an orthogonal design with the determined sample size, independent of the respondents, while the actual value is calculated with the data obtained. The minimum difference between these is considered to be the main indicator of the effectiveness of the design. The "Efficiency" column gives the relative efficiency of this design in terms of estimating each parameter compared to the hypothetical orthogonal design (which is the square of these ratios). When the "Efficiency" column in Table 2 is examined, it is seen that the random design has an average efficiency of approximately 99 percent compared to a hypothetical orthogonal design. This value is an indication of the efficiency of the design realized against a hypothetical orthogonal design. The median efficiency criterion of a randomized design is 0.97. The values can be interpreted accordingly (Sawtooth Software, 2021).

To examine the effectiveness of the design with a more sophisticated method, the D-activity calculated using the standard errors from the LOGIT estimate to be obtained by simulating the answers created in the form of dummy variables (Kuhfeld, Tobias, & Garratt, 1994), the evaluation of the effectiveness of the design will be evaluated, especially when the number of samples is small. It is important when the number of factors is low or the number of product combinations to be evaluated for participants is low. Since the design made in this study has no disadvantages in this regard, the standard evaluation procedure described above and based on the OLS was deemed sufficient.

Actual	Ideal	Efficiency	Level
(this level deleted)			Faculty members/staff are experienced in their field
0.0183	0.0183	0.9999	Faculty members/staff are new and inexperienced in their field
(this level deleted)			It has an attractive campus
0.0183	0.0183	0.9997	Poor campus facilities
(this level deleted)			The program I want is available
0.0183	0.0183	0.9996	The program I want is not available
(this level deleted)			Far from home & hard to reach
0.0258	0.0258	1.0007	Far from home & easy to reach
0.0258	0.0258	0.9989	Close to home & easy to reach
(this level deleted)			University A
0.0445	0.0447	1.0018	University B
0.0445	0.0447	1.0078	University C
0.0446	0.0447	1.006	University D
0.0447	0.0447	1.0009	University E
0.0447	0.0447	1.0007	University F
0.0448	0.0447	0.9971	University G

**Table 2.** Design Efficiency

#### 4.2.2.2. Estimation

The model and utility coefficients at the level of main effects were estimated with the Multinomial Logit Regression. Before interpreting the obtained coefficients, it is necessary to look at the general fit of the model and the efficiency of the predictive

power. The goodness of fit coefficient was found as 4103.43 for the ideal model and 2578.63 for the actual model. The test statistic calculated to test the goodness of fit under the validity hypothesis of the ideal model, degrees of freedom: Number of levels - number of features ( $16-5 = 11$ ). The critical value is  $=19.675$ . The test statistic is greater than the critical value, so the null hypothesis is rejected. The model is sufficient for estimation (Wilks, 1938: 62). Other criteria used in choosing the appropriate model are Consistent Akaike Info Criterion (CAIC): 5263.82 (the smaller model is preferred in the evaluation) and Percent Certainty, which is an equivalent criterion with Pseudo R2: 37.15899 (the larger model is preferred in the evaluation), Chi-square: 3049.58 and Relative Chi-Square: 277.23. Since the large chi-square values in the evaluation are accepted as an indicator of the predictive power and adequacy of the model, the estimated model was also found effective here (Sullivan, Ferguson & Donndelinger, 2011). When the utility values obtained from the Multinomial Logit Model were examined based on the levels of each factor, the following results were obtained (see Table 3).

Level	Effect	Standard Error	t
Faculty members/staff are experienced in their field	0.51143	0.02006	25.50097
Faculty members/staff are new and inexperienced in their field	-0.51143	0.02006	-25.50097
It has an attractive campus	0.32961	0.01816	18.1538
Poor campus facilities	-0.32961	0.01816	-18.1538
The program I want is available	0.79723	0.02085	38.2385
The program I want is not available	-0.79723	0.02085	-38.2385
Far from home & hard to reach	-0.1955	0.0286	-6.83678
Far from home & easy to reach	0.10182	0.02825	3.6039
Close to home & easy to reach	0.09368	0.02834	3.30514
University A	0.31059	0.05583	5.56317
University B	-0.06751	0.05566	-1.21288
University C	-0.02838	0.0562	-0.50506
University D	-0.1057	0.05485	-1.92732
University E	0.01583	0.05562	0.28453
University F	-0.15504	0.05577	-2.77996
University G	0.03023	0.05581	0.54162

**Table 3.** Multinomial Logit Estimation

Specific to the attribute of "Quality of the academic staff / academic reputation of the school", the level "Faculty members/staff are experienced in their field" has an importance level of 0.51143 for students and ( $t: 25.50 p < 0.05$ ) the coefficient of the model is statistically significant. The effect of the "Faculty members/staff are new and inexperienced in their field" level, which is the opposite, is negative and statistically significant. Universities that can be regarded as equivalent to students are shown in the attribute of "The awareness of the university / being a brand". Among them, University A was found to have the highest significance level (effect: 0.31059) ( $t: 5.56 p < 0.05$ ). The utility coefficient of this level in the model is positive and statistically significant. Considering the "Diversity of the departments where education is given" attribute, it is seen that the option "The program I want is available" has the highest level of importance for candidate students (effect: 0.7972) and ( $t: 38.23 p < 0.05$ ). it makes sense. The option of not having the desired program is at the same size and negative significance level. Among the levels in the attribute of "The school is located in a central location/ease of transportation", the level "far from home & easy to reach" is the level that has the most importance. (effect: 0.1018) ( $t: 3.63 p < 0.05$ ). Another remarkable point here is that the opposite effect of the level

"Far from home & hard to reach" is quite high. (effect: -0.1955) (t: -6.83 p <0.05). The third level found in this factor; "Close to home & easy to reach" has almost the same level of significance as "Far from home & easy to access" attribute and its coefficient is statistically significant (effect: 0.0936) (t: 3.30 p <0.05). Finally, the coefficient of the "It has an attractive campus" level among the options offered for the attribute "The attractiveness of the campus and its facilities" is statistically significant. (t: 18.15 p <0.05).

As a result of the analysis conducted for the main effects, the level of "The program I want is available" was statistically significantly higher (Chi-square: 1738.38 p <0.01) than "The program I want is not available" with 77% in the "Diversity of the departments where education is given" attribute in the main effects. In the attribute of "The awareness of the university / being a brand", it was determined that University A was preferred more than other options at a statistically significant level (Chi-square: 13.33 p <0.05), with 55% preference. Among the levels in the attribute of "Quality of the academic staff / academic reputation of the school", the level "Faculty members/staff are experienced in their field" is the most preferred level with 65% preference (Chi-square: 511.42 p <0.01). For the attribute of "The attractiveness of the campus and its facilities", the most preferred level, which is also statistically significant, is the option "It has an attractive campus" with a percentage of 60% (Chi-square: 217.99 p <0.01). Among the levels in the attribute of "The school is located in a central location/ease of transportation", "Far from home & easy to reach" option is the most preferred level with 53% (Chi-square: 24.21 p <0.01). Preference percentages for each factor are given in Table 4 below.

Level	Preference	Chi-square	p
Faculty members/staff are experienced in their field	64.70%	511.41	0
Faculty members/staff are new and inexperienced in their field	35.30%		
It has an attractive campus	59.60%	217.98	0
Poor campus facilities	40.40%		
The program I want is available	77.10%	1738.38	0
The program I want is not available	22.90%		
Far from home & hard to reach	45.50%	24.21	0
Far from home & easy to reach	52.50%		
Close to home & easy to reach	52.00%		
University A	55.20%	13.33	0.015
University B	48.40%		
University C	49.30%		
University D	48.70%		
University E	50.50%		
University F	47.40%		
University G	50.40%		

**Table 4.** Main Effects

#### 4.2.3. Identification of the Characteristics that School Managements Care in Marketing Activities

The authorized persons (public relations officer or general secretary) interviewed in the schools selected within the scope of the study were asked to what extent students gave importance to the factors they put forward as the "reason for preference" in the promotional activities of their schools. They were asked to distribute it to represent the degree. The factors to be evaluated are given in the same way as the attributes presented to students. Accordingly, the evaluations made by the school officials are given in Table 5 below.

University	The awareness of the university / being a brand	Quality of the academic staff / academic reputation of the school	The attractiveness of the campus and its facilities	The school is located in a central location/ease of transportation	Diversity of the departments where education is given
University A	20	20	20	20	20
University B	40	30	10	10	10
University C	20	30	15	15	20
University D	20	40	20	10	10
University E	30	30	15	10	15
University F	25	25	20	15	15
University G	20	40	20	5	15
University H	12	13	25	25	25
University J	15	30	15	20	20
University K	35	20	15	10	20
<b>Mean</b>	<b>23,7</b>	<b>27,8</b>	<b>17,5</b>	<b>14,0</b>	<b>17,0</b>

**Table 5.** Evaluations of University Authorities

With reference to Table 5, it is observed that school administrations invest the most in increasing the quality of faculty members, followed by increasing the brand values of these schools. The relatively least important factor is the location of the school and its transportation facilities.

#### 4.2.4. Results

In the approach suggested within the scope of the study, the averages of the importance values taken from the schools and the preference percentages obtained from the conjoint analysis of the traits preferred by the candidate students were arranged as a two-player game in which these alternatives are defined as strategies. For the evaluations made by the prospective students to be 100-sum, indexing is made as follows (see Table 6).

Attribute	Preference (%)	Index
The awareness of the university / being a brand	31	15.1
Quality of the academic staff / academic reputation of the school	51	24.9
The attractiveness of the campus and its facilities	33	16.1
The school is located in a central location/ease of transportation	10	4.9
Diversity of the departments where education is given	80	39
<b>Total</b>	<b>205</b>	<b>100</b>

**Table 6.** Indexing Percentages of Prospective Students Obtained from Conjoint Analysis

In this context, the payoff matrix (see Table 7) created by subtracting the student importance index value for each attribute from the importance value for the university player for the prospective student who is a row player is given below. The solution of the two-person zero-sum game was made using the minimax method and the value of the game was found to be 11.2. In a sense, the income of the prospective student who is a line player shows the loss of the school administration. The row minimum column shows to what extent the prospective student's importance level for the relevant feature is met by the university's current strategies. The negative value here shows how much the university can exceed the prospective student's expectations in the relevant feature with the strategies in hand. A positive result indicates that the importance level of the prospective student regarding the relevant feature cannot be met by any strategy of the university.

		Importance	University					Row min
			Attr. 1	Attr. 2	Attr. 3	Attr. 4	Attr. 5	
Prospective Student	Attr. 1	15.1	-8.6	-12.7	-2.4	1.1	-1.9	-12.7
	Attr. 2	24.9	1.2	-2.9	7.4	10.9	7.9	-2.9
	Attr. 3	16.1	-7.6	-11.7	-1.4	2.1	-0.9	-11.7
	Attr. 4	4.9	-18.8	-22.9	-12.6	-9.1	-12.1	-22.9
	Attr. 5	39	15.3	11.2	21.5	25	22	11.2
	Column max		15.3	11.2	21.5	25	22	11.2

Attr. 1: The awareness of the university / being a brand, Attr. 2: Quality of the academic staff / academic reputation of the school, Attr. 3: The attractiveness of the campus and its facilities, Attr. 4: The school is located in a central location/ease of transportation, Attr. 5: Diversity of the departments where education is given.

**Table 7.** Payoff Matrix of Prospective Student and University Management (Total)

The column maximum row shows to what extent the prospective student's importance level for any feature is met by the university's relevant strategy. The negative value here shows how much the school can exceed the prospective student's expectations in terms of all characteristics with the relevant strategy. If it is positive, it shows to what extent the importance levels of all the features that the prospective student takes into account with the relevant strategy of the university are not met. The diagonal axis of the matrix shows how well the university and prospective students meet their expectations. If the values found here are positive, it shows that the student's expectation for the relevant feature was not met, and a negative one shows that it was met and even exceeded the expectations.

It is expected that the diagonal elements of the ideal matrix are 0, considering that if the university administration has full knowledge, it will take action accordingly. In other words, university administrations will fully meet all expectations of prospective students. However, due to the nature of business management, managers may prefer to invest in different features at different rates. In this case, the answer to the question of whether the prospective students can maintain their preference by putting forward the different features they invested in (considered as a strategy) in the selection process is one of the solution suggestions of the approach proposed in this study.

According to this, university administrations do not make the necessary investment in the "diversity of the departments in which the education is given", which is the most important attribute for the student, by not being able to read the demands of the prospective students correctly and they face losses as a result of the game. For prospective students, since the "Quality of the academic staff / academic reputation of the school" attribute, which schools attach relative importance to, is at the second level, they cannot find the department they are looking for, but they close the gap arising from the lack of departments thanks to the quality of the academic staff that the school has invested relatively more. However, if the evaluation is made from the perspective of the university management, it seems possible that the students they want to choose themselves will experience losses due to investments that do not match their expectations. In the current situation, it can be said that they compensate the minimum loss with the investments they make in the academic staff when it is accepted that the prospective students are looking for the universities with the departments they want. Because the superior strategies of the departments against the diversity preference seem to be their investments to ensure the quality of the faculty. Although they cannot provide the diversity of departments, which is the most important factor in the university choices of prospective students from a business



perspective, increasing the quality of faculty members will be the best strategy. On the other hand, considering the diagonal axis figures, investments made in branding and location for schools are above the expectations of prospective students. Investments in these areas may be shifted to other features. As a result, it cannot be said that the universities whose data were collected within the scope of the research regarding the decisions to be made about the investments to be the preferred university are generally successful. However, the prospective student profits in the context of the university she/he chooses and the features she/he seeks in the university she/he wants to settle in.

In the proposed approach, universities within the scope of the study can also be considered one by one. In other words, through the two-way interactions obtained from the conjoint analysis, the preference percentage of the feature that the prospective student evaluates with a specific university and the weights of the attributes that the selected university attaches importance can be arranged in the same way as a game for the determined one. The approach suggested for all universities covered in the research has been applied below.

Attribute	University A	University B	University C	University D	University E	University F	University G
The awareness of the university / being a brand	55%	48%	49%	49%	51%	47%	50%
Quality of the academic staff / academic reputation of the school	70%	63%	65%	62%	65%	62%	66%
The attractiveness of the campus and its facilities	65%	58%	59%	59%	59%	59%	58%
The school is located in a central location/ease of transportation	57%	52%	50%	52%	54%	50%	53%
Diversity of the departments where education is given	80%	76%	79%	75%	77%	74%	79%

**Table 8.** Percentages of Preferences of the Prospective Students Obtained from Conjoint Analysis (University-Based)

The preference percentages taken from the two-way interactions data in the conjoint analysis were indexed to be 100-sum as done before moving to the game matrix.

Attribute	University A	University B	University C	University D	University E	University F	University G
The awareness of the university / being a brand	16.8	16.2	16.2	16.6	16.6	16.1	16.4
Quality of the academic staff / academic reputation of the school	21.4	21.2	21.6	20.8	21.3	21.1	21.7
The attractiveness of the campus and its facilities	20	19.5	19.6	19.8	19.3	20.3	18.9
The school is located in a central location/ease of transportation	17.3	17.5	16.6	17.6	17.5	17.3	17.3
Diversity of the departments where education is given	24.5	25.7	26	25.2	25.3	25.3	25.8

**Table 9.** Indexed Percentages of Prospective Students Obtained from Conjoint Analysis (University-Based)

Conjoint analysis over the choices of the prospective students and the preference percentages obtained on the basis of the university and the indexed values obtained from them and the importance values obtained from the universities will be placed in the game matrix on the basis of the school and the row player will be analyzed with the maximin method for the two-person zero-sum line player prospective student. The university-based results are given in the following tables (Table 10-16) below.

		Importance	University					Row min
			Attr. 1	Attr. 2	Attr. 3	Attr. 4	Attr. 5	
Prospective Student	Attr. 1	16.8	-3.2	-3.2	-3.2	-3.2	-3.2	<u>-3.2</u>
	Attr. 2	21.3	1.3	1.3	1.3	1.3	1.3	<u>1.3</u>
	Attr. 3	19.9	-0.1	-0.1	-0.1	-0.1	-0.1	<u>-0.1</u>
	Attr. 4	17.3	-2.7	-2.7	-2.7	-2.7	-2.7	<u>-2.7</u>
	Attr. 5	24.5	4.5	4.5	4.5	4.5	4.5	<u>4.5</u>
	Column max			<u>4.5</u>	<u>4.5</u>	<u>4.5</u>	<u>4.5</u>	<u>4.5</u>

Table 10. Payoff Matrix of Prospective Student and University Management (University A)

		Importance	University					Row min
			Attr. 1	Attr. 2	Attr. 3	Attr. 4	Attr. 5	
Prospective Student	Attr. 1	16.2	-23.8	-13.8	6.2	6.2	6.2	<u>-23.8</u>
	Attr. 2	21.2	-18.8	-8.8	11.2	11.2	11.2	<u>-18.8</u>
	Attr. 3	19.5	-20.5	-10.5	9.5	9.5	9.5	<u>-20.5</u>
	Attr. 4	17.5	-22.5	-12.5	7.5	7.5	7.5	<u>-22.5</u>
	Attr. 5	25.7	-14.3	-4.3	15.7	15.7	15.7	<u>-14.3</u>
	Column max			<u>-14.3</u>	<u>-4.3</u>	<u>15.7</u>	<u>15.7</u>	<u>15.7</u>

Table 11. Payoff Matrix of Prospective Student and University Management (University B)

		Importance	University					Row min
			Attr. 1	Attr. 2	Attr. 3	Attr. 4	Attr. 5	
Prospective Student	Attr. 1	16.2	-3.8	-13.8	1.2	1.2	-3.8	-13.8
	Attr. 2	21.6	1.6	-8.4	6.6	6.6	1.6	-8.4
	Attr. 3	19.6	-0.4	-10.4	4.6	4.6	-0.4	-10.4
	Attr. 4	16.6	-3.4	-13.4	1.6	1.6	-3.4	-13.4
	Attr. 5	26	6	-4	11	11	6	-4
	Column max			6	-4	11	11	6

Table 12. Payoff Matrix of Prospective Student and University Management (University C)

		Importance	University					Row min
			Attr. 1	Attr. 2	Attr. 3	Attr. 4	Attr. 5	
Prospective Student	Attr. 1	16.5	-3.5	-23.5	-3.5	6.5	6.5	<u>-23.5</u>
	Attr. 2	20.7	0.7	-19.3	0.7	10.7	10.7	<u>-19.3</u>
	Attr. 3	19.7	-0.3	-20.3	-0.3	9.7	9.7	<u>-20.3</u>
	Attr. 4	17.6	-2.4	-22.4	-2.4	7.6	7.6	<u>-22.4</u>
	Attr. 5	25.2	5.2	-14.8	5.2	15.2	15.2	<u>-14.8</u>
	Column max			<u>5.2</u>	<u>-14.8</u>	<u>5.2</u>	<u>15.2</u>	<u>15.2</u>

Table 13. Payoff Matrix of Prospective Student and University Management (University D)

		Importance	University					Row min
			Attr. 1	Attr. 2	Attr. 3	Attr. 4	Attr. 5	
Prospective Student	Attr. 1	16.6	-13.4	-13.4	1.6	6.6	1.6	<u>-13.4</u>
	Attr. 2	21.3	-8.7	-8.7	6.3	11.3	6.3	<u>-8.7</u>
	Attr. 3	19.3	-10.7	-10.7	4.3	9.3	4.3	<u>-10.7</u>
	Attr. 4	17.4	-12.6	-12.6	2.4	7.4	2.4	<u>-12.6</u>
	Attr. 5	25.2	-4.8	-4.8	10.2	15.2	10.2	<u>-4.8</u>
	Column max			<u>-4.8</u>	<u>-4.8</u>	<u>10.2</u>	<u>15.2</u>	<u>10.2</u>

Table 14. Payoff Matrix of Prospective Student and University Management (University E)

		University	University					Row min
			Attr. 1	Attr. 2	Attr. 3	Attr. 4	Attr. 5	
		<i>Importance</i>	25	25	20	15	15	
Prospective Student	Attr. 1	16	-9	-9	-4	1	1	<u>-9</u>
	Attr. 2	21	-4	-4	1	6	6	<u>-4</u>
	Attr. 3	20.2	-4.8	-4.8	0.2	5.2	5.2	<u>-4.8</u>
	Attr. 4	17.2	-7.8	-7.8	-2.8	2.2	2.2	<u>-7.8</u>
	Attr. 5	25.3	0.3	0.3	5.3	10.3	10.3	<u>0.3</u>
		Column max	0.3	0.3	5.3	10.3	10.3	0.3

**Table 15.** Payoff Matrix of Prospective Student and University Management (University F)

		University	University					Row min
			Attr. 1	Attr. 2	Attr. 3	Attr. 4	Attr. 5	
		<i>Importance</i>	20	40	20	5	15	
Prospective Student	Attr. 1	16.3	-3.7	-23.7	-3.7	11.3	1.3	<u>-23.7</u>
	Attr. 2	21.6	1.6	-18.4	1.6	16.6	6.6	<u>-18.4</u>
	Attr. 3	18.9	-1.1	-21.1	-1.1	13.9	3.9	<u>-21.1</u>
	Attr. 4	17.2	-2.8	-22.8	-2.8	12.2	2.2	<u>-22.8</u>
	Attr. 5	25.7	5.7	-14.3	5.7	20.7	10.7	<u>-14.3</u>
		Column max	5.7	-14.3	5.7	20.7	10.7	-14.3

**Table 16.** Payoff Matrix of Prospective Student and University Management (University G)

Considering the results of the games organized on the basis of universities, prospective students for A and F Universities are dominant compared to other universities in the context of investment decisions and the attributes that prospective students attach importance to in their preferences, in other words, these schools cannot fully meet the student expectations by using all the strategies they have. These two universities could not meet the expectations of the prospective students, especially in terms of the diversity of the departments, and they got a result in favor of the prospective student (positive score) in the game matrix. The value of the game for A (in favor of the prospective student) was found to be 4.5, and that of University F was 0.3.

Since University A attaches equal importance to all attributes, prospective students do not have a dominant strategy against the diversity of departments, which is the most important expectation. With all the strategies it has, it faces some sort of loss in the prospective student's preference for this attribute. In this context, the university administration's correct reading of the prospective students' expectations and acting more targeted will strengthen the superiority strategy. University B has achieved superiority in the eyes of the prospective students with the strategy of becoming a school with awareness in the selection process. Although the level of importance that the prospective students attach to each attribute (when the diagonal axis is evaluated) cannot be achieved, the investment they make in the brand value of their schools appears like the superior strategies of the students against the importance they attach to the diversity of departments. Universities E, C, D, and G have established the strategy of superiority with the quality of the academic staff, and it seems to be the winning side of the game, as the value of the game is in favor of the university administration (negative). Although University E does not have a single superior strategy despite the prospective students' choice of department diversity, it seems to have gained an advantage with the investments made in the awareness of the school and the quality of the academic staff. In this game, two strategies of equal value can be combined, and the result can be achieved with a complete strategy. In this case, as mentioned above, brand value and quality of academic staff as a single strategy will provide superiority for the school. University

F, on the other hand, did not have a single superior strategy despite the students' choice of department diversity, just like in University E, but it could not achieve full advantage with the investments it made in the brand value of its school and the quality of the academic staff. Although University F has not achieved a full superiority strategy as in University E, the result can be achieved by combining the two strategies of the school with equal value, namely brand value and increasing the quality of the faculty members, but despite this, it cannot fully meet the expectations of the students with existing decisions.

The comparative strengths and weaknesses of the schools considered one by one above are summarized below. According to this, it is seen that University A is advantageous compared to the majority of other schools in terms of "The attractiveness of the campus and its facilities" and "The school is located in a central location/ease of transportation" attributes. Similarly, Universities D and G differ from most of the other schools in terms of "The attractiveness of the campus and its facilities" and show performance above student expectations. As stated before, according to the game matrix, E, C, D, and G Universities seem to be able to compensate the areas they fall short of student preferences and expectations with their strengths. However, when we look at the game matrices at Universities A, F, and B, they could not complete their strengths and their shortcomings in the eyes of the students. It can be said that these universities should focus on their investments towards student demands, to gain a competitive advantage.

## 5. Discussion

The findings obtained as a result of the application made on the proposed approach were explained in detail in the previous sections. Accordingly, if the main problem of the research is taken as a problem of being preferred by successful students by making investments that will meet the expectations of university candidates with the decision to be taken during the university preference process in terms of candidate students, the results can be evaluated as follows: As they give importance to having the department, they want in the school the most in their selection process. Not having the department, they want is effective in not choosing the school while other factors are fixed. Later, the feature they attach importance to is the quality of the faculty members and the academic reputation of the school. Finding the school academically disreputable has a negative effect, just like the change in preference in whether the department they want is or not. Another evaluated attribute is the facilities and features of the campus and appears to be important at the third level. Perceiving the university's campus facilities as weak in terms of university candidates adversely affects the preference processes.

University A seems to have a high level of importance in the attribute of "The awareness of the university / being a brand", which is the evaluation of the awareness of schools and brand perceptions. It is thought that the reason for this may be the fact that they have been researched before by the participants, their support during the selection process or they do not have full knowledge about other schools. Because the impact coefficients of other schools were found to be statistically insignificant. In this case, the fact that the brand factor does not make a difference can be understood from the fact that the order of importance of the characteristics

attributed to importance does not change when the dual interactions on university-based are examined. The last attribute included in the design is the location and transportation availability of the universities. This attribute has been evaluated in the contexts of three levels, and it is ensured that the options cover all possible situations in terms of appealing to each student. These lower levels were "far from home & hard to reach", "far from home & easy to reach" and "close to home & easy to reach". According to the results, it seems that only the level "Far from home & hard to reach" has a negative effect. In this context, it is important for students that the location of the school is easy to access rather than close or distant.

When the results obtained as a result of research in this field are compared with the findings obtained from the study, the reputation of the university and the quality of the faculty members are one of the prominent features in each study, and it is seen that parallel results are reached in this study. In the light of the information obtained from the marketing and public relations managers of the selected and accepted universities, it is seen that the schools mostly invest in the academic reputation of the school and the quality of the faculty members, followed by the expenses necessary for the university to have a brand value. It is thought that there may be reasons for schools not to direct their resources based on "the variety of departments in which they are taught", which is the feature that students attach the most importance to according to the results of the conjoint analysis due to the investment cost of opening new departments, or that schools make decisions by considering the general preferences supported by research. When the characteristics that schools attach importance to one by one are evaluated, it is seen that they differ among themselves. In this respect, they can develop their strengths in different areas and continue to be preferable. The point to be noted here is that although it is thought that the candidate students have the goal of "at least one university placement", in general, it is seen that they are directed to a specific field and that they show that they want to study in this field in their preferences. At this stage, university administrations can attract more students' preferences by improving the diversity of departments within the framework of the areas that students are currently interested in. The evaluations made by the universities at this stage were evaluated in the analysis based on the belief that they have made progress in the field of investment. For example, it has been accepted that schools, which convey that they attach the highest investment and importance to the quality of the academic staff / academic reputation of the school, are successful in this field and can use this as a superiority strategy according to the situation.

The last analysis that is conducted within the scope of the study is based on the application of the approach proposed in this study with the available data. Accordingly, the importance levels of the candidate students, which were obtained from the conjoint analysis and which they considered in their university preferences, were placed as row player strategies in the game matrix. Universities were placed as the second player against it, and in the light of the evaluations received from school administrations, importance (investment) weights attributed to the same features formed coefficients for strategies. In this context, the analysis of game matrices has been made and discussed in detail above. If we need to interpret the available data in the light of this approach, the schools included in the study generally cannot meet the expectations for the student. While university candidates want to settle in a

university that provides education especially in the field they want to study, schools invest in different fields rather than this. For example, although the location of the school and transportation facilities are not of high importance for the candidates, universities allocate high shares for it, but their investments in this area do not compensate for the areas they lack in student preferences. The investment areas that overlap with the expectations of the students are, to increase the campus facilities and the quality of the faculty, respectively. Highly preferable schools can get ahead of others with the importance they attach to these areas.

After the collective evaluation based on the acceptance of schools as equivalent to each other, it was possible to evaluate the preference of schools one by one with the proposed approach. Here, from the two-way effects results of the conjoint study conducted with the students, the information on how the factors of preference on a school basis were evaluated was obtained and the payments matrix was created based on the school. Accordingly, A and F Universities cannot fully meet the expectations of the students by using all the strategies they have. By attaching equal importance to all preference factors, A University has not been able to establish a dominant strategy against the diversity of departments, which is the most important expectation of prospective students. Therefore, it experiences a kind of loss in the student's preference point of view. B University seems to have achieved superiority in the eyes of the students with the investments made in the brand value of the school during the selection process. Considering the situation of meeting the individual reasons for preference on the diagonal axis, although the level of importance given by the students for each feature cannot be met by the school, the investment they make in the brand value of their schools stands as the superior strategies of the students against the importance they attach to the diversity of departments. Universities C, D and, G have established the strategy of superiority with the quality of the faculty and seem to be the lucrative side of the game. Among these, if the values of the elements on the diagonal axis are evaluated close to 0, it is striking that C University is more successful than the others in terms of reading student expectations and directing their investments in this field. Although F and E University does not have a single superior strategy despite the student's choice of department diversity, they try to gain an advantage with the brand value of their school and investments in the quality of the faculty members. In this type of game, two strategies of equal value can be combined to achieve a complete (puree) strategy, but in this case, F University cannot provide an advantage while E establishes a superiority strategy.

Considering the diversity and subjectivity of the results obtained with the proposed approach, it is the most important superior aspect when considering the data such as the preference order between schools or superiority matrix that will be obtained using other multi-criteria decision-making methods. In addition, the examination of how the student preferences and their strategies will differ when the weights of the features attributed to importance in the decisions taken by school administrations are changed can be obtained quickly with a small change in the numbers in the game matrix, rather than the total recalculation of the procedure as in other methods. In addition, as in this study, it also provides the opportunity to make a comparative evaluation of the general market situation and the specific schools by obtaining

competitor data. If desired, the position to be taken against the competition can be evaluated utilizing game theory by arranging a game matrix between the opponents.

In the literature, the subject was first discussed theoretically in the article of Choi and DeSarbo (1993), Wedel and Kamakura (2012) proposed the approach of Choi and DeSarbo in their book on market segmentation as a supplementary study after the conjoint analysis, the comparative evaluation of the competitors in the market. They stated that they found it a useful approach as it enabled it to be done. However, in recent studies in this field, it is striking that game theory and mostly TOPSIS and fuzzy TOPSIS methods are used together. Although it is similar in theory, the preference data obtained by the conjoint analysis were found to be more reliable than TOPSIS's data acquisition method. When looking at the studies in the literature on blending game theory with conjoint analysis, it was seen that Kuzmanovic and Martić (2012) and Steiner (2010) worked on new product and product line design, and they used a Nash equilibrium model in game theory. In the case of new product design, it is possible to design an optimal product in which the characteristics of other competing products are also taken into consideration by evaluating the findings obtained with selection-based or adapted conjuncture methods rather than classical conjuncture within the framework of conjugate simulations for competitive analysis. Moreover, conjoint simulators provide flexibility in this sense and also allow repetitive analysis. Blokhuis et al. (2012), on the other hand, took an alternative subject on the agenda and used the game theory for optimization purposes by obtaining the preferences of the surrounding people with the classical conjoint design in the solution of the disputes over the re-evaluation of the idle lands in their study on environmental design. VIKOR, one of the multi-criteria decision-making techniques, could also be used for this study in terms of having a similar approach. Because the decision taken will be valid in the resolution of a one-off dispute. Both the preferences of the local people on the subject are fixed, and the problem of re-evaluation by changing the characteristics that are attributed to the decision-maker and searching for the optimal strategy is not valid. Cahpman and Love (2012) presented an approach that draws attention to the importance of using conjoint analysis and game theory together in the field of strategic decision making at the conference organized by Sawtooth Software. It may not be rational to take and apply customer preferences, especially during the new product design or revision of the existing product, due to the company's marketing decisions or the position of the competitors. In this context, the importance of the use of game theory in the strategic decision to be made on whether the planned changes should be made within the framework of the company's business plans after determining the customer preferences with the conjoint was emphasized. This approach is also supported in this study, but a different problem is discussed as an application approach. In the paper of Arenoe, Van der Rest, and Kattuman (2015), conjoint analysis is discussed with an application in the field of tourism management with a game theory approach. In the study, after determining the importance coefficients of the features of the hotels operating in an oligopolistic market, which are given importance by the customers, with the selection-based conjoint method, the market shares of the hotels and the game theory approach were applied and the optimum level for room prices was tried to be determined.

## 6. Conclusion

The application of the approach proposed in this study, in which game theory and conjoint analysis are handled together, has been applied in the evaluation of a problem that has become more important than ever before. In this context, the problem is evaluation of investment activities with their students preferred algorithm since the beginning of the year, depending on the issues dealt the 2010s an increasing number of universities in Turkey opened private universities and to thrive preferred. The aforementioned selection process creates uncertainty in all respects for both university administrations and candidate students, and especially for the future of students, and considering the current state of the system, it is far from being rational due to the inadequacy of access to full information or data pollution. In a sense, the investments made by the private universities that provide educational services towards the preferences of the candidates may become dead. When the problem is considered in terms of both the university candidate and the university itself, a multi-criteria decision problem emerges for both parties. The findings obtained as a result of the application made to find an answer to this problem through the proposed approach have been explained in detail in the previous sections. In the course of the research, 5 main factors were obtained as a result of the pilot study conducted to determine the prominent factors in the university selection process. These are the brand value of the school, in other words, its awareness, campus facilities, availability of the desired department, the quality of the faculty members and the location of the school and transportation facilities. At this stage, although the price factor came to the fore along with the others in the pilot study, since the schools to be evaluated within the scope of the study were selected among those with similar prices, scholarship opportunities, and academic levels (placement points), the candidate who will make the choice may prefer these schools, in other words, he can pay the tuition fee decision, it was not included in the scope of the design, considering that the price factor is not a reason for preference.

The evaluation of the price factor creates a deviation in the preferences of the respondent in the conjoint analysis, as in similar analyzes. While consumers are deciding between multi-featured products, they start to learn the choice after a certain point and tend to choose the price, which is the most sensitive factor for them, and only dependent on it, which makes it difficult to reveal the true preference pattern. In this respect, it can be said that the fact that the price factor was not included in the research design has provided more healthy results.

Considering the results of the conjoint design based on the selection made with the determined preference factors, it is seen that the candidate students attach importance to the existence of the department they want to choose in order to receive education in the field they want most. This is followed by the quality of the faculty members at the university / the academic reputation of the university, the recognition/brand value of the school, then the campus facilities, and finally the location and transportation facilities. In the light of the information received from school administrations within the framework of the proposed approach, information was obtained on the areas where schools direct their marketing investments to become a preferred educational institution.



The game theory approach of the study was applied by placing these two data in a two-person game matrix in a way that each preference and investment reason is a strategy. When we look at the results obtained here, the investment decisions of the schools together are insufficient against the preferences of the students, especially these schools, which are relatively newly established, do not allocate enough resources to the level of department diversity expected by the student; It has been determined that the investments they make are compensated by the resources they allocate to increase the brand value and awareness of the school and offer preferable features for students. In this context, if it is necessary to make an evaluation, prospective students can direct their preferences to the relevant school by accepting the other features of the school as suitable in their preference paradigm, even if the department they want is not available in the relevant school.

The result of the analysis will provide students with information about the current situation of the schools and will enable them to access more detailed information during the selection process and to settle in a higher education institution that they will be happy knowing what they want. On the other hand, when the subject is evaluated by school administrations, instead of evaluating student preferences unilaterally, they will be able to make investment decisions in a multidimensional way, taking into account the status of their close competitors and the student preferences within the general framework of the education sector they are in.

Although the diversity of the results obtained through the proposed approach, its reproducibility and ease of calculation are considered as the prominent aspect compared to other techniques, the fact that the approach has not been applied to the problems in different fields in the literature reveals the fact that it is an area open to improvement. Future studies in this field will be taken into consideration with the use of the approach in solving different decision problems and other multi-criteria decision-making techniques, as in this study, together with the game theory that considers the perspective of the managers who are decision-makers on the business side, investment decisions, together with the competitive element It is hoped that it will only improve upon obtaining far more comprehensive outcomes from the application of decision-making techniques. In addition, it is thought that the development of fuzzy conjoint designs and data collection approach will have significant contributions to the current literature, where calculation of all multi-criteria decision-making techniques employing fuzzy numbers obtained from linguistic variables.

Finally, when we consider the statistical decision-making techniques, it is accepted that the answers of the participants who are accepted to have made rational decisions from the data collection stage represent their opinions correctly. However, in the prospect theory proposed by Kahneman and Tversky (1979), which was proved that individual preferences violated this principle of expected utility underlying all decision-making techniques systematically, and it is found that individuals weighed possible results less than the results obtained. In this context, as it will be valid for all other decision-making methods in this study, the accuracy of participant preferences used as input to the analysis can be verified with post analyzes and its validity can be discussed. For this, specific to this study, candidate students whose opinions and preferences were obtained regarding the university elections can be obtained from which schools they were placed in after the selection stage and their compatibility

with previous preferences can be reviewed. This critical approach, which cannot be included in this study due to the limited access to candidate students participating in the study after the university placement process, will shed light on future studies, it is more accurate for all studies based on the expected value theory in general and with a hypothetical decision from the participants. It is thought that it will create an opportunity for improvement to obtain information.

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