

# MATCHING GROUPS OF STUDENTS AND INSTRUCTORS IN DISTANCE EDUCATION: LITERATURE REVIEW AND A BIBLIOMETRIC ANALYSIS

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## Abstract

Distance education is a challenging endeavour. The last few years especially with the COVID pandemic, distance education became the norm. The following years, returning to the everyday life, distance education remained as an established methodology and approach for teaching and learning. It is also true that this online approach is based on various aspects and parameters that need to be considered and evaluated in order to increase its efficiency. In the core of the specific e-learning process are located students and instructors. One of the challenges associated with this online teaching and learning experience is to create optimum groups of students and assign them to the proper instructors. The goal is to maximize the educational performance and satisfy both students and instructors. There are many techniques originating from various fields of studies and operations to match people. The current paper provides an extensive literature review focusing on matching techniques with emphasis on distance education. Investigation on relevant tools and approaches has covered all years until 2023. A number of papers were identified and a corresponding relevant database was organized in Mendeley. This database included 167 documents. The findings reveal that a plethora of mathematical models and techniques have been widely implemented in order to facilitate organizational issues in education in general and in distance education with emphasis in matching students together, or assigning students to courses and instructors. Furthermore, a bibliometric analysis has taken place, through the use of VOS-viewer, and identified fundamentals concepts that are associated with the development and evolution of matching techniques with emphasis in education. Terms that were identified during the analysis included but were not limited to Heuristics, Decision Support Systems and Set Partitioning.

Keywords: Matching Approaches, Education, Distance Education, Teaching, Learning.

## 1 INTRODUCTION

Matching people and creating groups is a critical task, with an extensive field of implementation. Grouping techniques of various kinds are being used across several scientific fields, such as: Medical Science, Human Resource Management, Education and Sport Management. People who are subjects in relevant research initiatives come from a vast variety of age, social or cultural backgrounds. The present study deals specifically with the application of matching techniques with a focus on distance education.

In particular, a thorough literature review is provided regarding the tools, approaches and techniques employed for grouping students or matching students and instructors. An important issue investigated in this paper concerns the types of matching that have been done in the international literature. For instance, it is examined whether the previous studies are related to matching students together, or matching students with instructors, or assigning students to courses, or matching learning styles with teaching styles, etc. Moreover, the mathematical models and techniques that have been implemented for the purpose of matching are explored. Another interesting issue regarding the literature review concerns the exploration of the specific fields of application, in the context of distance education, where the matching techniques have been applied.

As far as the structure of the paper is concerned, section 2 contains a description of the conducted literature review and its results. In section 3, the methodology that was applied in the study is presented. Subsequently, section 4 includes the presentation of the bibliometric analysis that was performed, providing a visualization of the results. Finally, section 5 contains the conclusions which were drawn from the present study.

## 2 LITERATURE REVIEW

The vast majority of the examined papers deal with applications of matching, as well as research into learning styles and teaching styles, in the field of Education. More specifically, more than half of the papers in the literature review concern the field of University and in general higher education. Many of these studies involve research on undergraduate students in particular. Regarding the kind of academic faculties and schools where the method of matching is applied, some indicative examples are a group of students of mathematics and science, students of a faculty of foreign languages, medical as well as dental students, mechanical engineering students, pharmacy students, students of an Accounting course, pre-service teachers, while in one paper the participants come from three different academic disciplines: mathematics, physics, and public administration.

Apart from the above ones, there are also studies concerning other levels of education, such as students of elementary schools [1] or middle-school students [2]. It is also notable that, unlike most papers which are related to Education in general, there is only one study which deals with the field of application of Education Psychiatry, and one which deals with Pedagogy.

A large majority of the reviewed papers examine exclusively issues related to matching. It is noteworthy that most of them deal with the issue of matching learning styles with teaching styles. A significant number of these studies aim to investigate the potential impact of the match or mismatch between teaching and learning styles on the academic achievements of the learners.

It is of particular interest that many of these studies advocate the proposition that students can attain greater academic achievements when there is alignment between their preferred learning styles and the instructors' teaching style [3,4]. Furthermore, these studies argue that it is of utmost importance for teachers to possess an understanding of learner preferences and to take them into consideration when designing their teaching approaches[3]. However, there are also certain studies which assert that matching teaching style to learning style may not help students, claiming that the idea of tailoring instruction to individual learning styles lacks strong empirical support [5]. At the same time, there are also other papers which indicate that, while there are advantages to aligning teaching styles with learning styles, it must be noted that this alone does not guarantee higher levels of student achievement, since the preferred learning styles of students evolve over time [6].

Another type of matching identified in certain studies was the teacher-student gender matching. The influence of this matching on academic achievement was investigated, but according to a specific paper, the fixed-effects estimates reveal that in eight out of fifteen countries that were examined, the teacher-student gender matching has no significant impact on students' test scores [7]. Moreover, there was a paper which dealt with matching student personality types and learning preferences to teaching methodologies [8]. To identify the most prevalent personality types, the Myers-Briggs Type Indicator was used. Besides, the correlation between students' learning styles and their satisfaction with the course format in an online course was examined in another study, where a statistical analysis was conducted and it revealed no significant correlation between them [9].

Regarding the topic of group formation, a noteworthy study dealt with using similarity measures for the formation of collaborating groups, in distance learning environments [10]. Its primary objective was to automate the formation of learning groups and environments, by aligning educational methods and objectives. In this study the importance of utilizing widely accepted tools such as learning theories, instructional design, information retrieval and taxonomy, is demonstrated. In addition, another worth mentioning study has used a cross-sectional investigation to compare pre-service teachers having two different majors[11]. The aim of the study was to investigate the possible differences between the academic achievements obtained by the two groups of students when instructed with various teaching strategies. Finally, another notable paper describes the development of an integrated taxonomy that combines learning styles, different teaching strategies, and the corresponding appropriate electronic media, in order to use the vast resources offered by IT in such a way to adapt teaching material and strategies to the learner's skills [12].

## 3 METHODOLOGY

In recent years, distance education has become an established approach for teaching and learning. It is evident that this online approach depends on a number of factors and parameters that must be taken into account and assessed, in order to maximize its effectiveness. The fundamental components of the particular e-learning process are the students and the instructors. Creating optimum groups of students

and matching them with the proper teachers is one of the challenges related to this online teaching and learning process. This could lead to the optimization of the educational achievement.

The objective of the present study was to conduct a thorough literature review focusing on matching techniques with a particular emphasis on distance education. The research on relevant tools and methods has covered all years up to 2023. Various papers were identified and a corresponding database was organized in Mendeley, including 167 documents. According to the findings of the literature review, a wide range of mathematical models and techniques have been used extensively to support organizational issues in distance education, with a focus on matching students together, or matching students with instructors and courses.

The next part of the applied methodology concerns the bibliometric analysis which has taken place, through the use of VOSviewer. This type of analysis has identified fundamental concepts that are related to the development of matching techniques, with a focus on education. There were certain terms that were identified during the analysis, which included but were not limited to Heuristics, Decision Support Systems and Set Partitioning.

For the needs of the literature review, the partners investigated the scientific databases Scopus and Google Scholar, using the following keywords: "Multicriteria Analysis", "Multicriteria Decision Analysis", "Distance Education", "Online Courses", "Higher Education", "Matching Groups".

The inquiry was focused on "Article Title" for all the years till 2023. This investigation was necessary in order to see the evolution of the discussion around distance education, matching groups and multicriteria analysis through the years. The final set, as mentioned earlier, included 167 papers. These papers were imported in the reference manager Mendeley and in addition, the software VOSviewer was used to create three types of maps:

- Network visualization
- Overlay visualization
- Density visualization

In the following section, the various visualizations will be presented, followed by a summary of some of the papers that were analyzed. The complete methodological approach is presented in the following flowchart:

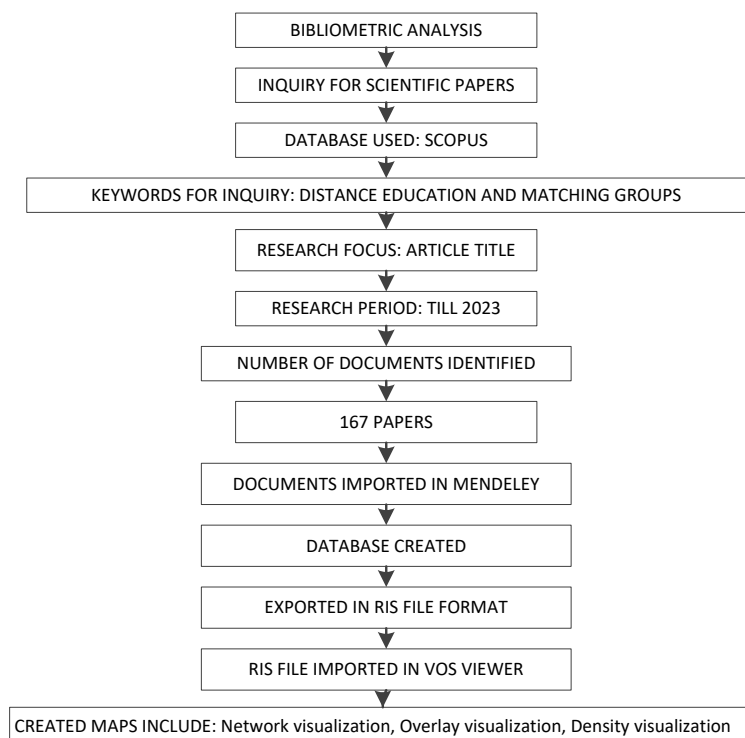


Figure 1. Flowchart of the process for the literature review.

## 4 VISUALIZATION OF THE RESULTS

The bibliometric analysis took place with the aid of VOSviewer, which is a software tool for constructing and visualizing bibliometric networks.

The following figures present the Network Map (Figure 2), Overlay Map (Figure 3) and Density Map (Figure 4), which were designed for occurrences of keywords.

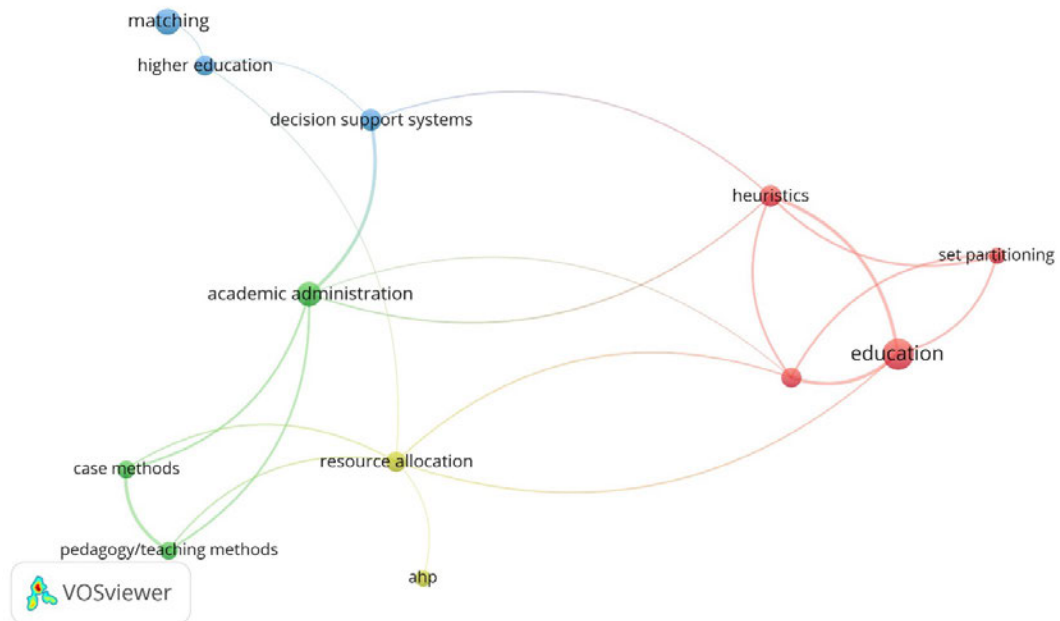


Figure 2 Network Map Designed for Occurrences of Keywords

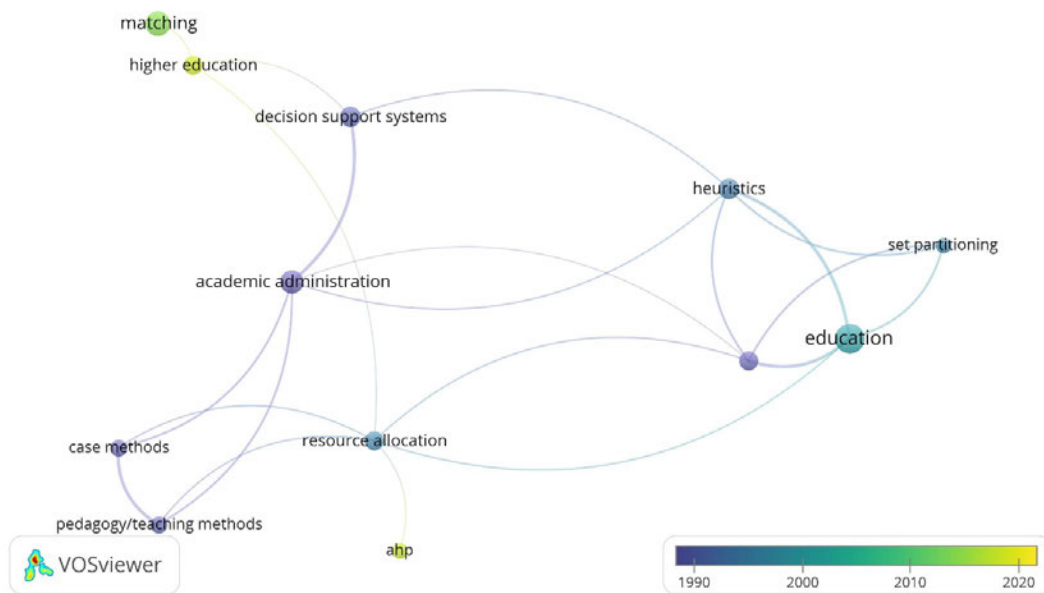


Figure 3 Overlay Map Designed for Occurrences of Keywords

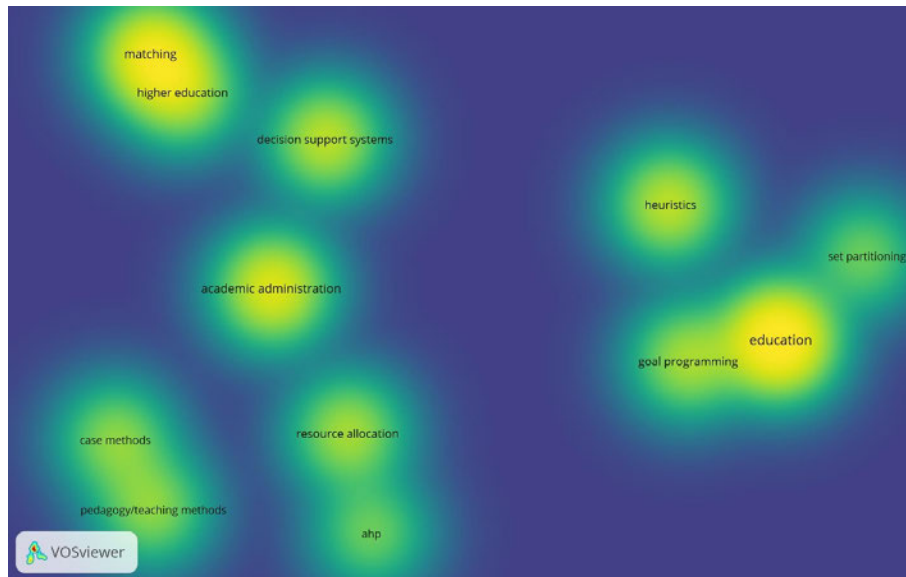


Figure 4 Density Map Designed for Occurrences of Keywords

## 5 CONCLUSIONS

The analysis of both the papers along with the consideration of the bibliometric analysis led to a number of conclusions, which could be summarized in the following. It should be mentioned that the findings are based on the collection of the specific sample of papers:

- Matching as a concept is associated with higher education in the sample of the selected papers.
- Education is also associated with goal programming, heuristics and set partitioning.
- Resource allocation is also associated with AHP pedagogy and teaching methods are connected to case methods.
- Decision support systems also present a core concept within the distance education field.

Based on the **Network Map**, the concepts that seem to be dominant include:

- Education
- Academic Administration
- Matching
- Resource Allocation

The analysis for occurrences of keywords based on the **Overlay map** identified the following:

- Matching
- Decision Support Systems
- Academic Administration
- Education
- Heuristics
- Case Methods

The analysis based on the **Density Map** identified certain core concepts:

- Matching and Higher Education
- Decision Support Systems
- Academic Administration
- Education and Goal Programming
- Resource Allocation and AHP
- Case Methods and Pedagogy / Teaching Methods

Regarding the limitations of the current paper, it is noteworthy that the scientific databases Scopus and Google Scholar were used, as well as the software tools VOSviewer and Mendeley. The number of papers that were investigated and exploited was 167.

The future research could include the use of other scientific research databases such as Web of Science. Moreover, some different keywords could be used. These could include more general terms than the ones that were used in this study. In addition, in the current study the inquiry was focused on the “Article Title”, while in future research it could be focused also on the Keywords of the articles.

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