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Inclusion and Wellbeing for the Data Society

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· ID 151 ·

Trends in the use of multivariate analysis in educational research: a review of methods and applications in 2018-2022

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Our society can be labeled a "data society" or "big data society" due to the considerable volume of data we produce daily, mainly through digital devices.
In disciplines such as information philosophy and knowledge management, in the well-known DIKW pyramid (also called "information hierarchy", "knowledge hierarchy", or "wisdom hierarchy"), data are defined as symbols, objective observations, basic elements that have no meaning or value until processed. Procedures of classification, selection, sorting, and calculation allow us to transform data into information with meaning and significance; the combination of information, experiences, human understandings, skills, and values generates knowledge (Ackoff, 1989; Rowley, 2007).
Turning data into useful information and knowledge requires operations of analysis and interpretation that necessitate an interdisciplinary set of skills, rigorous practices, and proper tools.

A large amount of data is also stored in platforms and contexts related to the educational sector.
Digital learning environments host large numbers of learners. Methods of online interaction are increasingly sophisticated. Accurate tracking systems indicate when and how people browse online environments. Online surveys or assessments, digital tools, and robots are easy-to-use mechanisms in the digital world to produce and collect data. Training entities and companies store (sometimes *open*) data on the management and monitoring of their system.
These data produced in the education field can represent an interesting resource for research to give an understanding of how learning and education systems work and how to enhance the teaching process and training entities' management.
Computing and interpreting processes and skills must be put in place to transform data into useful information and knowledge.
Multivariate analysis is one of the statistical solutions we can use for this purpose. Operating simultaneously on many variables and data, which is important in complex educational inquiry scenarios (Ary et al., 2010), the methods of multivariate analysis allow us to develop classifications (i.e., cluster analysis) and models (i.e., regressions) and reduce dimensionality (i.e., factorial analysis) by returning data-driven understandings of educational phenomena (Bartholomew et al., 2008; Hair et al., 2014; de Lillo et al., 2007; De Santis, 2022).

How does the international educational research community make use of multivariate analysis techniques?
In recent studies, researchers used multivariate analysis to investigate teachers' training and skills, students' opinions and assessments, efficacy of teaching methods, educational poverties, and organization of training institutions.
For example, starting from the hypothesis that the improvement of digital skills of the teachers influences the acquisition of digital skills of the pupils, García-Vandewalle and colleagues (2023) describe the level of digital skills in future teachers in early childhood education, in primary and secondary education through the results of a survey analyzed using descriptive statistics, factorial analysis, and multivariate linear regression. Moving to students, Sointu and colleagues (2023) discuss the factors that, according to the university students, can create a successful flipped course distinguishing pedagogical, social, and technological dimensions. They applied an exploratory factorial analysis to verify the validity of a survey administered, and a structural equation model is built for predicting the students' satisfaction. On the management of training organizations, Mordhorst & Jenert

(2023) investigate the structural and pedagogical features of dual study programs that integrate academic and vocational learning in the German higher education system, identifying different organizational and curricular integration combinations through a cluster analysis.

Our study aims to identify trends in the application of multivariate analysis methods over the past five years.
We have conducted a review of research that utilized these techniques. We described the kind of studies, data, and methods together with the themes and contexts to which the studies are referred.
The review covers five years between 2018-2022 and consists of two phases.
In the first one, we conducted a more general investigation by inserting the term "multivariate analysis" in the search string. In the second phase, aware that multivariate analysis includes numerous techniques, we refined our search based on the results of the first phase adding the most popular multivariate analysis techniques in the strings.
We extracted only the paper written in English, archived in the Scopus database, and published in journals in the category Education. Our review included bibliometrics such as years of publications, leading journals, most cited articles, and authors.
We used RStudio and Vosviewer to perform the analysis and represent the results.

By investigating the most recent scientific literature, we can gain awareness of how multivariate analysis techniques are being used in educational research, the topics for which the use of such techniques is well established, and the fields in which further actions need to be adopted.

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