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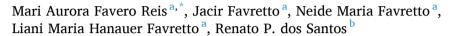
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## Case studies

# Knowledge management in the classroom using Mendeley technology



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#### ABSTRACT

Research in higher education institutions is present in all courses, and academic instruction in research methodology is vital, with educational technologies being an essential component of this process. With the Covid-19 pandemic, there were changes in teaching, learning, and in performing scientific research in undergraduate courses. Among the technologies, the Mendeley reference management tool has become increasingly helpful in these contexts. Therefore, this manuscript is an account of workshop experiences for the use of the Mendeley tool in the teaching of Research Methodology and Scientific Methodology offered in the distance education modality in undergraduate courses at the Universidade do Contestado, Brazil. After basic instruction on Mendeley, students participating in the workshops were guided to apply the tool using Bardin's content analysis technique. This technique is usually laborious and seldom involved in literature reviews by undergraduate students; Mendeley technology makes it more accessible. From experiences with the 2020 and 2021 workshops, during the COVID-19 pandemic, it is suggested that the content analysis method combined with the Mendeley technology can help students present better literature reviews, especially for final graduation projects such as course completion monographs.

### Introduction

The Scientific Methodology class in higher education institutions typically guides students to produce scientific articles and end-of-course monographs. A common difficulty student often have is citing and organizing the references according to the required standards. Another difficulty is finding and organizing a library for use in textual production. In both cases, the use of a reference management tool, such as Mendeley, can help students deal with their scientific productions. Researchers and students who use reference management tools to organize their work can save time for reading and writing (Gunn, 2014).

Mendeley was created in 2008 by three German students, Paul Foeckler, Victor Henning, and Jan Reichelt, who were inspired by the principles of what was, at the time, the world's largest social music service "Last.fm"; they took concepts gleaned from this service and applied them to research (Henning & Reichelt, 2008). Their goal was to create an open and interdisciplinary database with usage-based reputation metrics and collaborative filtering. Barbara Brynko (2013) reports that the acquisition of Mendeley in April 2013 represented a significant

economic, social, and scientific change for scientific publishing company Elsevier (2013), involving figures and evolution in the research industry.

Mendeley technology provides authors and readers with the tools Mendeley Desktop, a discontinued iOS or Android mobile version, and Mendeley Web system, all synchronized with the cloud, and a plugin that can be installed in MS Word or Libre Office systems (Hadiningrat, 2020). It offers a functional, easy-to-use PDF reader with resources to highlight important sections of text and make annotations so that changes are saved to the cloud when the device is online (Shin, 2016). Alternatively, when used as a social network, Mendeley technology helped share publications and increase citations, making it possible to discover job trends in a particular area of interest. The user could also contribute to the dissemination of scientific references, for greater opportunities to access scientific knowledge (Yamakawa, Kubota, Beuren, Scalvenzi, & Miguel, 2014).

Web 2.0 fostered changes when listening to music, looking for jobs, communicating on social networks and locating or sharing knowledge, which also enabled significant advances in the medical and academic

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fields (Zaugg, West, Tateishi, & Randall, 2011). In this sense, Mendeley technology has provided benefits to academic research, such as finding information, identifying partnerships for possible collaboration, disseminating the research itself, and developing a clearer understanding of which studies have had the most significant impact in a given field.

This type of technology promoted radical, rapid, and profound changes in science itself. It allowed the acquisition, manipulation, and storage of large amounts of data to facilitate the research process (Fausto et al., 2012). With university students, it is possible to use Mendeley technology as a library that can be accessed on a desktop, laptop, or even a tablet (Gunn, 2014). Studies show that these procedures can facilitate access to scientific material, citations, and even integration between the different subject areas of the researchers in the quotations (Thelwall, 2018)

As for reading incentives, a survey of 860 Mendeley users shows that 55% of Mendeley's library users have read or intended to read at least half of the publications added to their library (Mohammadi, Thelwall, & Kousha, 2016). The fact that authors and editors increasingly seek to publish scientific literature in digital format reduces printing costs and enables digital tools. A sample of publications taken at random from the Web of Science confirms that readers appear to share similar shapes across fields and can scale to a standard and universal form (D'Angelo & Di Russo, 2019).

In this context, the DOI Digital Object Identifier system operated by CrossRef that allows editors to assign unique identifiers to articles and collect standardized metadata from retrieving identifiers from bibliographic data (Pentz, 2001) – makes it easier to share academic, professional, and governmental publications, such as journal articles, research reports, data sets, and official publications (Santos, 2020). Furthermore, it speeds up registration in the Mendeley library (Thelwall, 2018) and helps to avoid problems with ethical issues, ensuring the integrity of scientific publications and copyright to researchers (Pithan & Oliveira, 2013).

Undergraduates, masters' level, doctoral students, professors, librarians, and other researchers around the world use the Mendeley platform, making it part of modern culture, quality education and obtaining lifelong learning skills. (Nagherneac & Magher, 2017). After the COVID-19 pandemic period, digital tools became a fundamental resource for education, as people started to carry out their activities in the home environment (Berry, 2020; Zenkteler, Darchen, Mateo-Babiano, & Baffour, 2019). In university and graduate education, research activities previously carried out in laboratories, clinics, or in the field, in many situations switched to digital technology as the only possible way to continue research (Joye, Moreira, & Rocha, 2020; Mohammadi et al., 2016; Nuere & de Miguel, 2020).

Online workshops can help students and teachers improve their skills in using Microsoft Word and Mendeley software resources in compiling final graduation projects (Husadha et al., 2021; Restianingsih, Deswardani, & Pebralia, 2020). At our university, the teaching of Scientific Methodology was carried out using Mendeley technology in research, in a workshop format, initially to assist students in the development of their research project for the course completion monograph. In a second stage, we added Bardin's content analysis technique (1977) to produce literature reviews. In the coming years, analysis of the results of the workshops in Methodology classes may be carried out, based on the work presented. The purpose of this column is to provide an account of workshop experiences for the use of the Mendeley tool as used in the disciplines of Scientific Methodology and Research Methodology offered in the distance modality for undergraduate students at the Universidade do Contestado.

# Mendeley in the discipline of methodology at the undergraduate level

Workshop-format activities on the use of Mendeley technology were

developed for the Scientific Methodology classes, taught in the first semester, and Research Methodology, taught in the final semester, prior to the course conclusion work for different undergraduate courses, taught online during the COVID-19 pandemic in 2020 and 2021. The workshops were held in three separate months on Google Meet: in July with medical students, in August with law students and in September with students from other undergraduate areas (Administration, Engineering, Accounting Sciences, Education, etc.). All lectures were held in the Virtual Learning Environment used in Distance Education classes. The workshops had students who participated online and others who performed the activity by accessing the workshop recording available on YouTube.

The lectures began with a brief presentation of Mendeley's technology and its relevance to scientific research. The instructor then taught the students to access the Mendeley Software website, register, download and install the program. After installation, one of the participants shared the screen with the room, and the instructor guided the system configuration, installing the text editor plugin, the Brazilian technical standard (ABNT), and creating a link to a folder labeled "library". After configuring the computers, students were instructed to search the Google Scholar or the EBSCOhost database for publications in their research project area. One of the students would share their screen again, and the instructor would guide them through using the personal library, preferably through the search address (DOI).

After accessing the methodology manual, which is available on the research page of the university's website, students accessed the research project template and methodology guide to produce their research project or article. When editing the text, the use of Mendeley facilitates citation and reference, essential elements in any type of scientific writing. The students were responsible for relating written material to the source of information and locating citations (Sau & Bhakta, 2018).

Before the intervention through these workshops, students spent significant time learning the particulars of each type of reference. There were also other problems, such as non-compliance with the standard, absence of references, or presence of references not mentioned in the text. However, the use of the software alleviates these problems and give the student more time for textual production and analysis of relevant literature on the subject. Knowledge outcomes from the workshops were evidenced by students' expression of thanks sent through the virtual learning environment, via email, or similar sentiments expressed by the teachers of the courses. Metrics also demonstrated there were a significant number of students accessing the recordings available on YouTube, showing that students revisited the information after the workshop.

Overall, the Mendeley program allows for quote management, online support, sharing quotes with others, and using social media-like features (Trout, 2014), and can also help with quote counting and tracking (Zahedi & Haustein, 2018). The advent of digital technologies has made it possible to track the diffusion of many forms of new knowledge, allowing for a new stream of analysis and its own related literature (D'Angelo & Di Russo, 2019).

# The use of Mendeley in content analysis, according to Bardin, in bibliographic research

After the organization of the personal library, the students were guided to produce bibliographic research based on the analysis of documents, according to the steps proposed by Bardin (1977): (i) preanalysis; (ii) exploration of the material; (iii) treatment of results, inference and interpretation. The pre-analysis phase occurs with "floating reading" of the publications added to the Mendeley library, where the first contact is made with the texts that will compose the research library's favorite documents (Fig. 1).

When organizing the critical criteria for the initial classification, it is crucial to note the frequency of occurrence of the primary criterion. For example, when one assigns the term "Mendeley" in the search (Fig. 2), the system notes 100 hits found. Articles of little relevance are usually

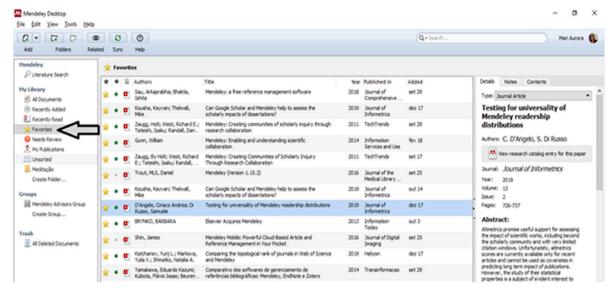


Fig. 1. Library to produce these articles about Mendeley.

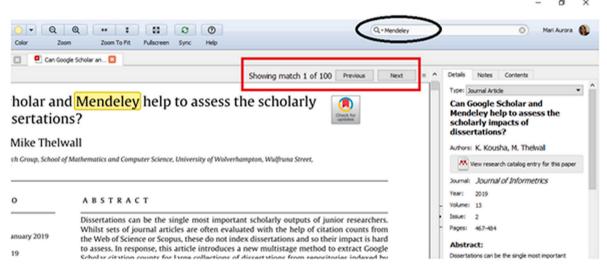


Fig. 2. Frequency of occurrence for the keyword Mendeley in the highlighted text.

discarded. In this phase, the researcher establishes the indicators, which result in categories (or criteria) and subcategories (secondary classification).

The administration of bibliographies and decision-making in the systematic review of the literature is a long and tedious phase (Bardin, 1977), especially when done manually. With Mendeley, this can be done as follows: The categories and/or subcategories and a previously configured spreadsheet can be highlighted when accessing the texts added in the favorites folder. For example, in the content analysis for research on Mendeley, considering the word "Citation" and the subcategory "research" as the main category, when selecting texts, it is possible to establish search results in the articles from the library. And, in the last stage - treatment of results, inference, and interpretation technology can contribute to significant results in systematic or integrative literature reviews. The raw data can be processed in Microsoft Excel to give meaning to the research, using statistics, meanings, figures, graphs, or other possibilities for presenting the results. In Excel, the researcher can use the function "classify and filter" (Fig. 3), classify the variables, and relate the categories to the results of the works analyzed.

In the previous figure (Fig. 3), a Psychology student relates

meditation techniques to other aspects of research using the content analysis feature of Mendeley technology, as demonstrated in the workshop. Other students also highlighted the importance of the methodology used in class in their research, enabling future publications and different areas and research themes. Qualitative research originating in the Humanities can be adapted to the unique realities in the health fields, and content analysis can be used to interpret the data (Hajinejad, Ebrahimi, de Jong, & Ravanipour, 2019; Wisur-Hokkanen, Glasberg, Mäkelä, & Fagerström, 2015). Moreover, content analysis has been one of the main techniques in analyzing audio transcriptions in qualitative research (McKenzie et al., 2017). In business, content analysis is used in organizational studies and in the hotel industry (Yu, 2020), which has evolved due to concern with the scientific rigor it has shown (Mozzato & Grzybovski, 2011).

As for the combination of the content analysis technique with Mendeley's technology, practical experience has shown that it can help students to present better-structured reviews in the preparation of their research projects for undergraduate monographs. In the workshops, other possibilities for using this methodology were considered: in the law course, students pointed out the possibility of using Mendeley

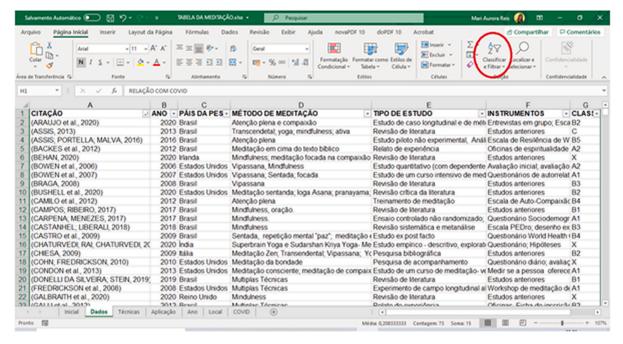


Fig. 3. Data for content analysis using a spreadsheet for the theme "Meditation" in a systematic literature review.

technology in content analysis for the analysis of civil laws and proceedings; in the medical course there was a discussion about using Mendeley's library to organize folders with medical records. Therefore, Mendeley's technology explored in the workshop made the work more attractive for students from different subject areas, who explored further opportunities for the application of the content analysis method in the teaching of Scientific Methodology and Research Methodology.

### Final considerations

In this manuscript, the methodological approach presents two possibilities for using Mendeley technology in higher education: the first, experience-based usage for Research Methodology, where it is demonstrated that it is possible to train students through non-classroom pedagogical lectures. The second is the possibility of using Mendeley technology to analyze content in the production of bibliographic research, ensuring agility and quality of scientific output.

The results of both experimental workshops showed gains for the courses involved and for the institution where the activities were carried out. These results are anecdotal, as there is, so far, no concrete data that assesses the effectiveness of the methodology applied to undergraduate students. However, changes were observed in how undergraduate students researched, as presented in the Psychology course. Therefore, both in face-to-face and distance education, there is evidence for the importance of software in assisting students in writing their graduation course conclusion papers. Once the students who had access to this methodology present their course completion papers, it will be possible to better assess how they took advantage of the training. In addition, based on their presented works, a comparative survey of their research with the research of previous students can be carried out.

## CRediT authorship contribution statement

Mari Aurora Favero Reis: Writing, preparation of the original manuscript.

**Renato P. dos Santos:** Conceptualization, knowledge of the software, supervision.

**Jacir Favretto** and **Liani Favretto:** Data Collection, Review and Editing.

Neide Maria Favretto: Course supervision, data collection.

### **Declaration of competing interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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