

## Engineering Education Research: what place for qualitative methodological orientation in Portuguese doctoral theses?

Marina Duarte<sup>1,2</sup>, Carlinda Leite<sup>3,4</sup>, Preciosa Fernandes<sup>3,4</sup>

<sup>1</sup>School of Engineering Polytechnic of Porto, Portugal. mic@isep.ipp.pt

<sup>2</sup>CIDEM-Centre for Research & Development in Mechanical Engineering Polytechnic of Porto, Portugal. mic@isep.ipp.pt

<sup>3</sup>Faculty of Psychology and Educational Sciences University of Porto, Portugal. carlinda@fpce.up.pt; preciosa@fpce.up.pt

<sup>4</sup>CIIE-Centre for Research and Intervention in Education University of Porto, Portugal. carlinda@fpce.up.pt; preciosa@fpce.up.pt

### 1 Abstract / Introduction

Engineering Education Research (EER) is an independent field of research that has emerged in recent years, although its tradition goes back over a hundred years (Borrego & Bernhard, 2011). More recently, Malmi (2018) characterised EER as having its focus on student learning in engineering sciences, innovations in engineering education and its impact on students' learning. Although most scholars who identify with EER "have been formally trained as engineers" and are "engineering academics" (Borrego & Bernhard, 2011, p.23), this is "an interdisciplinary area of study which draws upon a wide range of more traditional fields" (*ibidem*, p.24), like engineering, education, and psychology. According to Borrego, Douglas and Amelink (2009), the strong engineering background of its researchers explains the trend identified a decade ago, towards the resort to quantitative methods. Since then, although the use of qualitative methods has increased (Shekhar et al., 2019), the procedures for quantitative and qualitative data analyses seem to be underdeveloped, lacking sophistication and complexity (Malmi, et. al, 2018), which "underlines the necessity to improve the quality of how research in EER is performed and raise the methodological awareness among researchers" (Bernhard, 2018, p.169).

In Portugal, Hattum Janssen et al. (2015) found evidence of positive evolution in EER, despite the still modest structural and financial support. Portuguese publication in scientific journals and involvement in the development of EER have increased and, despite no masters' or doctoral courses in the specific area of EER are offered, the authors reported the existence of doctoral theses. If, on the one hand, due to the scope of study areas/fields of EER and the broadness of its aims, it would be expected some diversity of research methodologies, namely those of qualitative orientation, on the other hand, the still modest presence of EER in Portugal, may negatively influence these expectations. Having this argument by reference, the aim of this paper is to analyse Portuguese EER on doctoral theses, identifying its methodological orientations, regarding its diversity and use of qualitative approaches, and by doing so, contribute to deepening the debate on this issue.

### 2 Methodology

A search was done in RENATES database with the search expression «Engenharia» OR «Engineering» OR «Ensino superior» OR «Higher education». The inclusion criteria were: doctoral theses; conclusion period 2010-2018, Portuguese HEI; search expression applied to title and keywords. The exclusion criteria were: Non-Portuguese authors; Non-EER focus. The data extracted were: title, author name,



HEI, conclusion year, doctoral course, research scientific area. For missing data and abstracts, institutional repositories of HEI were searched. Information on authors was also obtained online. Descriptive statistics were computed. The abstracts were analysed resorting to the research strategy dimension of the categorization framework by Malmi et al. (2012).

### 3 Findings and conclusions

After the application of the inclusion criteria, 806 doctoral theses were selected. The exclusion criteria reduced it to 22 theses from Portuguese authors and HEI, concluded in 2010-2018, with a research focus on EER. This corroborates Hattum Janssen et al. (2015) idea of a positive evolution of Portuguese EER, although no trend was found in this period. Four HEI are responsible for 86% of these doctoral programmes, with Educational Sciences accounting for 59%, and Electrotechnics, Electronics and Computing Engineering and Sciences for 27%.

The authors are mainly HEI teachers (82%), in the polytechnic subsystem (59%), in engineering related areas (59%), confirming the trend suggested by Borrego and Bernhard (2011). The analysis of titles reveals some coherence, with certain terms being frequently used («Engineering» and «Higher Education» in 55% of titles). As for the keywords (present in 15 theses), 75 different ones were used, evidencing a lack for common vocabulary, consistent with a still emergent field.

Regarding the methodological orientations (research strategy dimension) present in the abstracts, only 14 authors clearly stated the research design, the most frequent being case study (9 theses), and mixed and qualitative methods (13 theses). The absence of information reiterates the need to raise the awareness, as mentioned by Bernhard (2018), and did not allow conclusions regarding data analyses procedures. The results do not confirm the trend for using quantitative methods identified by Borrego, Douglas and Amelink (2009), being consistent with the increase of qualitative methods reported by Shekhar et al. (2019) and the prevalence of Educational Sciences doctoral programmes. The diversity of research strategies is in line with the interdisciplinary nature of EER mentioned by Borrego & Bernhard (2011).

Future research will include retrieving data from the theses integral text, for a more comprehensive analysis of qualitative and mixed research approaches and procedures, in order to deepen the knowledge of these methodological orientations.

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