

INPLASY PROTOCOL

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None declared.

INTRODUCTION

Review question / Objective: Main question: What is the current state of the art, on practical work, in science teaching at the pre-university level? Subquestions: a) What aspects are integrated into the concept of practical work? b) What are the advantages attributed to the development of practical work in science teaching? c) What types/strategies of assessment are

Practical work in science education: A systematic literature review

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Review question / Objective: Main question: What is the current state of the art, on practical work, in science teaching at the pre-university level? Subquestions: a) What aspects are integrated into the concept of practical work? b) What are the advantages attributed to the development of practical work in science teaching? c) What types/strategies of assessment are carried out in the development of practical work? d) What are the disadvantages attributed to the development of practical work in science teaching?

Eligibility criteria: Inclusion criteria: Complete and Open Access documents; Peer-reviewed studies; Studies developed on the teaching of science in pre-university teaching establishments; Publications written in English. Exclusion criteria: Systematic literature reviews; Graduation dissertations; Master's dissertations; Publications prior to 2011.

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carried out in the development of practical work? d) What are the disadvantages attributed to the development of practical work in science teaching?

Rationale: In general, it is possible to verify that the quality of the practical work developed in the context of science teaching depends not only on the frequency with which it is used but also, essentially, on the quality with which it is

carried out. Based on this framework, this systematic literature review aims to present the state of the art in the development of practical work in science teaching. This type of literature review becomes advantageous insofar as it suggests the adoption of explicit and systematic procedures in its implementation, making the emergence of biases introduced by the authors less likely (Bryman 2012). In this line, we can understand that if the process of including studies in the literature review is not explicit, it is not possible to assess the suitability of this selection, nor to determine if this process was carried out in a rigorous and consistent manner, as demonstrated by Gough et al. (2012).

Condition being studied: The systematic review will address the state of the art in science teaching practical work.

METHODS

Search strategy: B-on: “Practical work in science education” AND “secondary schools” ERIC: “Practical work” AND “science education” AND “secondary schools” Google Scholar: Allintitle: “practical work” “science education” OR “secondary schools” Scopus: “Practical work” AND “science education” AND “secondary schools” Web of Science: “Practical work” AND “science education” AND “secondary schools”.

Participant or population: The systematic review will address the practical work performed in secondary school science lessons. It involves secondary science teachers, secondary science students and researchers on the implementation of science practical work.

Intervention: The systematic literature review, developed under the guidelines of the PRISMA statement, will assess the type of practical work in science education that is developed at pre-university levels, as well as its concept, its advantages, disadvantages, and its evaluation methodologies.

Comparator: The investigation will cross data from quantitative, qualitative and mixed methods research studies. It aims to characterize the state of the art of practical work according to the perception of students, teachers and researchers in secondary education.

Study designs to be included: The systematic review will include qualitative research studies, quantitative research studies and mixed methods research studies.

Eligibility criteria: Inclusion criteria: Complete and Open Access documents; Peer-reviewed studies; Studies developed on the teaching of science in pre-university teaching establishments; Publications written in English. Exclusion criteria: Systematic literature reviews; Graduation dissertations; Master's dissertations; Publications prior to 2011.

Information sources: B-on Database aggregator; ERIC - Education Resources Information Center; Google Scholar; Scopus; Web of Science.

Main outcome(s): 1 - Evidence about the concept of practical work; 2 - Evidence about the advantages of practical science work according to secondary-level teaching students, teachers, and researchers; 3 - Evidence about the main assessment methodologies/typologies of science practical work; 4 - Evidence about the main limitations regarding science practical work.

Quality assessment / Risk of bias analysis: The search in the four databases and the selected database aggregator (ERIC; Google Scholar; Scopus; Web of Science and B-on) was carried out on July 20, 2021. After applying the defined keywords, using appropriate descriptors, employing specific boolean operators, and fulfilling the criteria established in the designed investigation protocol, the initial result of data collection included 163 publications with potential interest.

In a subsequent step, duplicate publications were removed (n=14) before

moving on to the screening phase, where 149 publications were now contemplated. In the initial phase of the screening process, some publications were excluded after an analysis of the title's suitability (n=20), leaving the remaining ones identified for recovery (n=129). Of these last records, a small number were not retrieved, after an analysis of the abstract suitability (n=10). After that, 119 records were thus evaluated for eligibility, some of which were inaccessible (n=13), others corresponded to bachelor's or master's theses (n=3) and others to publications outside the scope of research (n =50), which means that they did not clearly and unequivocally address one or more of the following dimensions under analysis: the concept of practical work; the advantages of practical work; the methodologies/typologies of evaluation of the practical work; the limitations of practical work. Therefore, at the end of the screening process, 53 studies were selected to constitute the corpus of this systematic literature review.

Strategy of data synthesis: After obtaining the absolute number of studies to be considered, the corpus was created. The studies' analysis, characterization and organization were carried out with the support of bibliographic management software, in this case, Mendeley from Elsevier (PDF visualization and analysis functionality). Finally, the data were synthesized and the quality of the evidence was evaluated through the triangulation of the information, integrating it into a holistic view of state of the art on practical work in the last 10 years, with a view to promoting the dissemination of the obtained results through its publication.

Subgroup analysis: After carrying out the research on practical work in science teaching, the content analysis of four subgroups was carried out, corresponding to the structuring dimensions of this teaching methodology: the concept of practical work; as advantages of practical work; as methodologies/typologies of evaluation of practical work; as practical work. All the results were recorded for

further analysis and information triangulation.

Sensitivity analysis: The analysis of the distribution of investigations that make up the corpus reveals that most studies have a qualitative research approach (f = 31; 58.5%), followed by studies with a quantitative nature (f = 18; 34%), and lastly, studies that adopted a mixed methods research approach (f = 4; 7.5%).

Language restriction: The research has contemplated only English language studies.

Country(ies) involved: Portugal.

Keywords: science education, practical work concept, practical work advantages, practical work assessment, practical work disadvantages, systematic review.

Contributions of each author:

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