# Use of Research Findings in Undergraduate Physics Education Programs in Angola

Josias da Assunção de Deus Oliveira[a], and Roberto Nardi[b]

Corresponding author: Josias da Assunção de Deus Oliveira (josias.oliveira@unesp.br)
[a] São Paulo State University (Unesp), School of Sciences, Science Education Graduation Program. Bauru, São Paulo, Brazil
[b] São Paulo State University (Unesp), School of Sciences. Department of Education, Bauru, São Paulo, Brazil

**Keywords:** teacher training in Angola, research on physics education, post-secondary education.

## Abstract

Reading, comprehending, and interpreting academic texts has a significant impact on the preparation of future educators. This article presents the findings of a pilot study that aimed to determine whether scholarly literature such as journal articles, monographs, dissertations, and theses is considered in the education of physics teachers in Angola. The research was conducted between the years of 2019 and 2021 and it was based on an examination of the pedagogical projects and course outlines in Physics education programs at three Angolan institutions. The documents examined ranged from 2016 to 2020. To do this, we relied on a qualitative approach and on Bardin's Content Analysis to collect and process data, in addition to other authors to support the discussion. The findings revealed that most pedagogical projects studied aim to incorporate research findings into their teaching, but only a small percentage of the analysed courses outlines actually did so. This study also revealed a scarcity of doctorally-educated staff in this field, as well as a lack of use of journal articles, monographs, dissertations, and theses, and proceedings of national and international scientific conferences.

## Introduction

Research plays an important part not only in the education of future academics in general but also in the education of future teachers in particular. It adds value to the ongoing pursuit of fresh information and empowers the next generation of educators to be original, imaginative, self-reflective, and updated in time to appease students' interest about learning new things. The disparity between scholarly production in the field of science education and actual classroom practices was brought to attention in research carried out by Camargo and Nardi (2011), Cortela (2011), and Jesus and Nardi (2019).

There have been a number of studies conducted in Angola, as well as elsewhere, that have pointed out the critical importance of making investments in teacher preparation programs in order to enhance the quality of education and instruction in the country (Breganha 2019; Correa Filho 2020; Kamuele 2020; Oliveira, 2021). The limited amount of research that has been published on the topic of teacher training for the teaching of physics in Angola has revealed that many of the instructors accountable for tutoring this subject do not have sufficient training (Buza 2007; Nzau, Lopes & Costa, 2012).

According to Santos (2007), the purpose of research is to understand and enhance the environment in which we live, through the science that is generated in reaction to human activities. As a result, we are of the opinion that it would be beneficial to both the teaching and learning process if those who will be teaching physics in the future were prepared to make use of the findings of relevant research to modernise and contextualise their pedagogical practices.

By the time the analyses were carried out, Angola's Education Act No. 17 of 2016 had divided the responsibility of training teachers between two ministries: the Ministry of Education, which oversees training teachers at the secondary level, while the Ministry of Higher Education, Science, Technology, and Innovation directs training teachers at the higher level. In the case of the education of physics instructors at higher levels, there was only one undergraduate course available until the conclusion of this research. Angolan Education Act No. 32 of 2020 encompasses a post-graduate level, but the conditions for the instructor in Angola to pursue an up-to-date degree of this type in the field of physics education are a reality only outside the country (Angola, 2020).

## Research Methodology

The primary objective of this qualitative research (Lüdke & André, 1986; Flick, 2009) is to determine whether physics teacher preparation programs in Angola incorporate research findings into their curriculum planning and teaching methodologies. Data were collected and analysed from the following official documents that were provided by three different Higher Education Institutions to provide an answer to the question: Do the course outlines and Pedagogical Projects of each analysed Program (PPP) show that study findings are included when teaching physics in Angola? There was a total of 15 texts, including 3 pedagogical projects and 12 course outlines. These documents were created between the years 2016 and 2020 and they were in use by these institutions of post-secondary education at the time that we requested them.

We constrained the scope of our analysis by virtue of the three pedagogical projects available. In this article, we will highlight the documents presented by Institution A, Institution B, and Institution C (code names given to protect their anonymity, as agreed with these organizations when we requested the documents from them).

We focus on documents from tertiary education courses rather than secondary education courses because we consider findings from scholarly research should be applied more widely at higher levels of training.

### Content Analysis

*Content Analysis* is an important research tool for using in qualitative research, as it seeks to determine the presence of certain words, themes, or concepts within some given qualitative data (i.e. text). According to Bardin (2002), *Content Analysis* is "a set of increasingly subtle methodological instruments in constant improvement, which apply to extremely diverse 'discourses' (contents and continents)". As an example, researchers can evaluate language used within a news article to search for bias or partiality. Researchers can then make inferences about the messages within the texts, the writer(s), the audience, and even the culture and time of surrounding the text. In our case, the data were composed of the pedagogical projects and the syllabuses of the three physics education courses of Angolan institutions.

In our research, we analyzed the documents in three stages: pre-analysis, exploration of the material and treatment of results and interpretation. In the first stage, the material was selected and skimmed read to get in touch with the documents, allowing impressions and instructions to be analyzed. In the second stage, we revisited the material for the text excerpts necessary for the analysis categorizations. In the final stage, we based ourselves on the research question:

*are there signs that research results are considered in subject syllabuses and in the initial training course program for Physics Teachers in Angola?* We define implicit and explicit evidence as analytical categories. As explicit evidences, we took into consideration words and expressions that could help to answer our questions, as research in education and/or physics teaching, dissertations, articles/papers, scientific papers, academic congresses (events) etc.

## Findings and data analysis

The data generated by the analyzed documents related to evidence of the use of research results in these physics teacher training programs in Angola were classified into two analytical categories: explicit evidence and implicit evidence. From these, sixteen subcategories emerged from the documents, as shown in the following Table.

**Table 1.** Number of citations attributed to categories and subcategories in relation to understanding evidence of use of research results in the initial (undergraduate) training of Physics teachers in Angola

| **Categories** | **Subcategories** | **Frequency** | **Percentage %** |
|---|---|---|---|
| Explicit evidences | Scientific papers/articles | 1 | 0,2 |
| | Scientific competence | 27 | 4,3 |
| | Scientific events | 4 | 0,6 |
| | Investigation | 61 | 9,7 |
| | Monography | 4 | 0,6 |
| | Research | 9 | 1,4 |
| | Scientific Publications | 5 | 0,8 |
| | Scientific Journal | 3 | 0,5 |
| Implicit evidences | Education/Science | 86 | 13,7 |
| | Knowledge | 94 | 15 |
| | Teaching-learning | 201 | 32 |
| | Training | 94 | 15 |
| | Ability | 16 | 2,5 |
| | Reading habits | 13 | 2,1 |
| | Seminars | 4 | 0,6 |
| | Use of new ICTs | 6 | 1 |
| **Total** | | 628 | 100 |

Fonte: Dados da pesquisa, 2021.

For the purpose of this study, we brought some clippings from the pedagogical projects as well as from some of the official outlines of the documents analysed. Some of the societal implications of this study of Angola's educational landscape will be highlighted as we go along with the discussion and will be explored in better detail in the end.

As describe before, we looked through the documents that were analysed to see if there was any evidence of the incorporation of scientific and scholarly publications into physics education programs.

The research that was in question was based on research in teaching. For this paper, we took into consideration how Moreira and Rizzatti (2020: p. 2) define research, which is,

> production of knowledge, search for answers to questions regarding teaching, learning, curriculum, and educational context, as well as regarding teachers and their ongoing professional development, all within a framework that is consistent and coherent on an epistemological, theoretical, and methodological level, and which always contains specific contents. The scope of research in education extends well beyond actual instruction (Moreira & Rizzatti 2020: p.2).

## Graduate Certificate in Physics for Science Teachers: Institution A

This university offers a Bachelor of Education degree with a major in Physics Teaching. The program lasts for four years and is broken up into eight semesters of 450 hours each, for a grand total of 3600 hours, which is equivalent to 240 credits. Graduates of this program are qualified to teach in middle school, upper middle school, and higher education settings.

The primary objective of the program is:

> *to educate students to the point where they can earn a degree in Education with a concentration in Physics, be able to solve problems that are inherent to their profession and job in a manner that is in accordance with the current needs of Angolan society, and have a broad conception of the world and the future that considers projections of the growth of both the country and the world.* (PPP. Institution A)

The aforementioned passage, which was provided to us by the university, not only provides evidence of the employment of the Angolan language, but also reveals a particular connection between the goals of the curriculum and the demands of the Angolan society. Since there were many teachers in that region of the country where the university is, but more than half of them did not have higher education, this fact marked the urgency in the implementation of the course because of the need to train teachers in this area of knowledge according to the educational policy of the country, which intends to raise the quality of education.

### *The Pedagogical Project Programs (PPP)*

According to this initiative, a candidate should have developed a number of characteristics, skills, and dispositions by the time they have completed their training. One of these is the ability to acquire reading routines and intellectual disquietudes to stay ‘up-to-date’ in a systematic manner. Using this snippet, we can draw the conclusion that this PPP pays attention to establishing this habit and demonstrates that the program is concerned with adding current research findings to the training of the prospective educator.

It is essential that during the training of teachers there be preparation for reading and interpretation of publications in scientific journals, chronicles, and scholarly works in the field of training. This is necessary so that teachers will have the practice of reading and stay ‘up to date’.

The PPP also emphasises that, from the first to the last year, the student should be able to both:

> *deepen in the correct use of the Portuguese language, regarding correct spelling, writing, and oral expression, as well as enrich their cultural acquisition through reading new literary works and scientific updates [emphasis added].*(PPP Institution A)

By analysing this cut, it is possible to notice that the PPP, in proposing the reading of new literary works and scientific updates, shows evidence of the valorisation of the contact that the future teacher should have permanently with new scientific productions. According to Nardi and Almeida (2007), this interaction contributes to a strengthening of the undergraduates' imaginative development.

When we examine these passages, we consider the anticipation mechanism, which is described by Orlandi (1999; p. 39): "every individual has the ability to experience, or rather, put themselves in the place where their interlocutor 'hears' their words". As a result, we can comprehend that the individual begins to have a discourse in order to satisfy the other person. Therefore, this document, and the next ones as well, with different purposes, indicate that students are advised to incorporate the findings of scholarly research in the disciplines that are covered by the course.

***The outlines for 'Didactics of Physics'***

These course outlines were written by a professor with a Master's degree. It is a required component of the third year of the program and is broken up into two semesters of 60 hours each. These two semesters are titled Didactics of Physics I and Didactics of Physics II. They consist of a rationale, general objectives, content programming, pedagogical skills, general methodological guidance, assessment, and bibliography.

The mentor chooses the following bibliographical references, among others (original spelling in Spanish):

> *Bugaev A. Metodología de la Enseñanza de la Física en la Escuela Media. Editorial Pueblo y Educación. La Habana. 1989.*
> *MINED. Programas de 8., 9., 10., 11. y 12. grados. Ed. Pueblo y Educación, La Habana 2006.*
> *Moltó E. Temas de historia de la Física Ed. Pueblo e Educación, La Habana,2003.*
> *Valdés P. y otros. La Enseñanza de la Física en las Condiciones Contemporáneas. Ed. Academia La Habana, 1999.*
> ***Publicaciones Periódicas***
> *Revista Latinoamericana de Educación en Física (www.lajpe.org.mx).*
> *Revista Electrónica de Enseñanza de la Física.*

We can infer from this extract that the expert in the field has used bibliographical references from the Spanish-speaking countries to incorporate the findings of relevant scientific research into the course.

**Graduate Certificate in Physics for Science Teachers: Institution B**

There are four years, or eight semesters, required to complete the 4800-hour degree program in Educational Sciences with a specialization in Physics Teaching at this institution. The goal is to train educators with the requisite science and psychopedagogical expertise to facilitate student learning at the secondary, technical-professional, and tertiary levels.

By the time of data collection, the course was run by a team with nine professors: one master's student, four with master's degrees, two doctoral candidates, and two with doctorates. In addition, the document states,

> *The Pedagogical Project is monitored by the Course Council, with the participation of its instructors.*

This statement reveals the presence of instructors' participation in the course's pedagogical procedures.

***The Pedagogical Project Program (PPP)***

This educational project's main objective is to prepare graduates with

> *…scientific and psycho-pedagogical competencies to engage in contextualised pedagogical practices that stimulate and promote participation in response to society's contemporary issues* [emphasis added]. (PPP Institution B)

The highlighted text in this extract clarifies that it alludes to the study and discussion of research findings in the field, as well as the local reality in which the learner lives. We believe that this goal can be achieved by including this approach in the preservice teachers' instruction from the very beginning all the way through the end.

There are also hints that indicate to a focus on incorporating studies. This is indicated, among other places, in the specific objectives, which read as follows:

> *To prepare professionals with scientific and research competences in Physics and to provide professionals with competences, abilities, and habits of research and innovation in Physics teaching, contributing to the development of society.* (PPP Institution B)

We make an effort to remain contemporary because we are conscious that to explore and develop, it is crucial to be in touch with the most recent research that is being done in the area. Nardi and Castiblanco (2018) argue that there needs to be more contact between study results and the professional education community.

***The outlines for 'Didactics of Physics'***

These outlines identify the teacher but not their academic degree. This is a 2020-dated unit in the second year of the program, and it details the topics that will be covered over the span of four hours per week (60 credits). The document covers student competencies, important subjects, other tasks, and evaluation. It does not include how the teacher will grade students, what other tasks will be created, or what sources will be used to teach the subject.

We emphasize some of the students' fundamental skills to be developed, according to it:

> *Acquiring knowledge, aptitudes, abilities, and skills; Identifying the constant goals and responsibilities of physics students; Determining the fundamentals, methods, and organisational structures of physics education; Determining the scientific content and systems of fundamental physics knowledge for school courses; Finding appropriate and effective physics teaching methods* [emphasis added]. (PPP Institution B)

There are signs of incorporating research results into teaching training when it lists the competencies that students in this course should develop; this is because it reveals sayings already certified by researchers in the field of Physics Teaching. “The reality that there is a saying that supports the very potential of every saying” (Orlandi, 1999; p. 32) is crucial to comprehending how discourse works, its connection to the subjects and their ideologies.

**Graduate Certificate in Physics for Science Teachers: Institution C**

In this institution, students can earn a degree in Education Sciences with a concentration in Physics Teaching in nine semesters, eight of which are spent on required coursework and one on capstone projects. Altogether, these nine semesters add up to 3,900 hours and qualify graduates to teach at all levels of secondary education, from elementary school through university.

The training is directed by seven educators, including one Auxiliary Lecturer, three Assistants, and three observers. In areas where there is a shortage, the course administration will seek partners from other similar fields.

***The Pedagogical Project Program (PPP)***

In this section, we will be highlighting some passages that refer to suggestions of direction for the implementation of findings of research in teaching into the curriculum of the course. These passages can be found in the PPP of the Higher Education Institution C.

> *To provide graduates of Education Sciences with a solid and up-to-date training in the Specialty of Physics Teaching, through contextualised and critical pedagogical methods, stimulating and promoting citizenship, and which is, at the same time, in line with the newly established internal and external legal requirements and the current needs of society* [emphasis added]. (PPP Institution C)

In this passage, we can notice the care in preparing teachers in an updated context. By this, we mean preparing teachers who are concerned about the environment in which they work, who reflect on their own practice, position the student at the centre of the educational process, encourage discussion, and seek to utilise the student's potential to its fullest extent possible.

Training students to “*Express scientific findings in different modes of communication, such as reports, articles for publication, workshops, and presentations*” is one of the particular objectives that the PPP has listed as one of its specific goals.

This section of the document, in the context of taking into consideration this goal, emphasises the interest in educating instructors who are prepared to disseminate the findings of their research, demonstrating interest in and concern with scientific publications.

The Course Coordination should promote the following goals:

> *Scientific Seminars for instructors and scholars, with a yearly character where they present the results of research work, and Scientific Travels where students present the results of exploratory work related to the growth of the topics in practice* [emphasis added]. (PPP Institution C)

When the PPP is orienting for the organisation of scientific seminars in which students present the results of investigative work, this excerpt encourages the student and faculty community for scientific research and publication of its results.

As a result of this, we can comprehend that the PPP is geared towards the implementation of research into the education of these aspiring instructors.

***The outlines for 'Didactics of Physics'***

According to the course outlines, the document was written by a teacher with a Master's degree. It is a topic in the second year of the program with a weekly commitment of four hours. The curriculum is divided into five sections: goals, instructional methods, evaluation standards, materials, and references.

The teacher-author provides relevant aspects that students should accomplish during the school term in the first subject, called goals. According to the document, the goal is

> *to plan the Physics teaching-learning process, demonstrating proficiency in the Physics and Mathematics content system at a secondary level, as well as the use, with originality and creativity, of scientific methods and teaching resources within their reach to enhance their students' educational development: to teach them to formulate and solve problems related to various aspects of economic, political, and social reality.* (PPP Institution C)

The teacher-author provides proof of the use of research findings in teaching in the extract, as they mirror the words of famous scholars in the field of Physics Education.

On the bibliographical references, we examined the sources in the curriculum. When compared to other fields at the same school, Institution's C uses the fewer references for these outlines. Furthermore, the same subject at the other institution chooses two journals rather than scholarly papers. Although there are few bibliography choices, we believe that this document speaks to the integration of findings in the practice of the prospective teacher, even though references from Cuba prevail.

It is possible to see that the teacher-author took the initiative to correspond to the demands established by the educational institution when selecting the syllabuses for the elementary and secondary school years, manuals of the field, and periodicals, as they seek to contemplate, among other things, the training profile present in the Pedagogical Project of the Course.

## Final remarks and insights

According to the findings of the study, the analysed Pedagogical Projects (PPP) advise the use of texts to support teaching, specialised literature, as well as scientific articles and pedagogical publications that help teach the classes, which implies the use of monographs, dissertations, and theses.

In addition to this, we identified a significant gap in the production and dissemination of national research in the field of physics education. There is a lack of standards for the use of international research by educators. There are a very small number of professors instructing the subject who hold a Doctoral degree. There are very few women getting instruction to become physics instructors, and none of them are Angolan, at least not in any of the twelve

curriculums that were looked at. The bibliographical references that were provided were quite outdated, with the most current work having been published more than ten years ago.
We found a number of limitations that need to be addressed to maximise the potential of research in Angola, specifically regarding the instruction of physics. Lack of platforms that allow for the searching of national publications, dissertations, and theses is one of them, so is the fact that the regulating materials for classes are not made available online. There are many institutions of higher education that do not have an administrative email account. There are no Master's or Doctorate degrees in Physics education available.

We came to the conclusion that the courses that were examined need to be reorganised so that the following goals can be more effectively achieved: training teachers who are able to plan and teach with expertise as well as updating their pedagogical practices, approaches to teaching, and learning processes to take into account more recent research in the field of physics education.

Our group suggests that there ought to be a greater push towards the production and dissemination of research that investigates the situation in Angola. The instruction that teachers receive in physics education needs to have its curriculum updated. It would be helpful to create a digital archive of assignments in both undergraduate and postgraduate levels. Institutions of higher education should always have institutional email addresses and make their regulating materials accessible online. Having institutional email addresses is necessary. Since there is a lack of Angolan research being published in the field of physics education, there should be some sort of recruitment process in place for the research that is carried out in other countries and then brought back for adaptation and application in Angola. Finally, degree programs at the master's and doctoral levels should be made available in this field of study, and the qualifications of teachers' educators should be scrutinised in greater detail.

We want to emphasise that during the course of this research, the only documents that were analysed were those that were retrievable at the time of the Covid-19 pandemic. If it had been feasible to conduct the research using a different theoretical-methodological lens and on a greater number of documents, it is quite conceivable that the findings would not have been the same as those that are reflected in this article.

For the purpose of preparing students to become teachers of physics, we emphasise how important it is to conduct an analysis of how often research findings are incorporated into classroom instruction.

By virtue of the evidence that was highlighted in this study, through the results that were obtained, some concerns for future analysis emerged. Two of these come up in the form of questions: How can a subject be planned in an Angolan undergraduate degree course in such a way that future teachers can use the results of research conducted in this field as an essential component in their classroom practices? What sort of a professional characteristics are appropriate for a teacher whose primary concern is the integral formation of the student?

## Acknowledgments

We would like to express our appreciation to the Ministry of Higher Education, Science, Technology, and Innovation of Angola, which supported this research in its entirety through the National Institute for the Management of Scholarships (INAGBE). In addition, we would like to extend our gratitude to the Coordination for the Improvement of Higher Education

Personnel (The Capes Foundation) and the National Council of Scientific and Technological Development (CNPq) both from Brazil, which provided partial funding. We would like to extend our thanks to the three educational institutions of higher learning that were responsible for providing all the documentation that was utilised as support for the conclusion of this study.

## References

Angola (2020). National Assembly of Angola. *Lei 32/20 que altera a Lei 17/16* - *Bases do sistema de educação e ensino* [Act No. 32/20 that amends Act No. 17/16 - Educational and pedagogical foundations], accessed in 20 February 2023.

Bardin, L. (2020). *Análise de Conteúdo*. Lisboa: Edições 70.

Breganha, M. G. S. D. (2019). *Desenvolvimento de competência de avaliação de professores de Física: contributos para a formação continua*. [PhD Thesis in Education]. Aveiro: Aveiro University.

Buza, J. L. C. (2007). *Ensino de Ciências em Cabinda/Angola: condições da prática docente, idéias de professores e desafios*. [Master's Thesis in Science and Mathematics Education]. Belém: Federal University of Pará.

Camargo, S. & Nardi, R. (2011). Formação de professores de física: os estágios supervisionados como fonte de pesquisa sobre a prática de ensino. *Revista Brasileira de Pesquisa em Educação em Ciências*, 3(3). https://periodicos.ufmg.br/index.php/rbpec/article/view/4102

Correia Filho, J. M. (2020). *O perfil do docente universitário em Angola no século XXI, suas perspectivas e desafios: um estudo exploratório em torno de concepções e de práticas*. [PhD Thesis in Science Education]. Aveiro: Aveiro University.

Cortela, B. S. C. (2011). *Formação Inicial de Professores de Física: fatores limitantes e possibilidades de avanços.* [PhD Thesis in Science Education]. School of Sciences, São Paulo State University, Bauru Campus.

Flick, U. (2009). Qualidade na pesquisa qualitative. Trad. Roberto C. Costa. Porto Alegre: Artmed.

Jesus, A.C.S. & Nardi, R. (2019). The Presence of Physics Education Research in the Curriculum of an Initial Teacher Education Programme. *Journal of Physics Conference Series* 1286(1):012045. DOI:10.1088/1742-6596/1286/1/012045

Kamuele, L. *Impacto do Plano Mestre de Formação de Professores em Angola na Formação Inicial de docentes de Matemática para o 1º. Ciclo no Namibe*. [PhD Theis in Didactics and Teachers Training]. Departament of Education and Psychology. Umniversity of Aveiro, 2020. https://ria.ua.pt/handle/10773/28353

Lüdke, M., & André, M. E. D. A. (1986). *Pesquisa em Educação: Abordagens Qualitativas*. 1. Ed. São Paulo: EPU.

Moreira, M. A. & Rizatti, I. M. (2020), Pesquisa em Ensino. *Revista Internacional de Pesquisa em Didática das Ciências e Matemática*, 1(1), 1-15.

Nardi, R.& Almeida, M. J. P. M. (2007). Investigação em Ensino de Ciências no Brasil Segundo pesquisadores da área: Alguns fatores que lhe deram origem. *Pro-Posições*, 1(52), 213-226.

Nardi, R. & Castiblanco, O. (2014). *Didática da Física*. 2.Ed. São Paulo: Escrituras.

Nzau, D. K., Lopes, J. B., & Costa, N. (2012) Formação continuada de professores de Física, em Angola, com base num modelo didático para o campo conceptual de força. *Revista Brasileira de Ensino de Física*, 34(3), 3402-1-3402-14.

Oliveira, J. A. D. (2021). *Formação de Professores de Física em Angola: considerando a pesquisa em ensino de Físca*. [Master's Thesis in Science Education]. Bauru: São Paulo State University – Unesp.

Orlandi, E. L. P. (1999). *Análise de Discurso: princípios e procedimentos*. Campinas: Pontes.

Santos, A. R. (2007). *Metodologia científica.* Rio de Janeiro: Lamparina.