TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

ABSTRACT

This article explores trends and challenges in doctoral education and knowledge production, focusing on recent changes in training approaches, interdisciplinary programs, academic advising, transferable skills training, and professional development. A systematic literature review methodology was used to identify relevant studies, enabling a comprehensive analysis of available information. Key trends include the rise of interdisciplinary doctoral programs, integrating disciplines and methodologies for more innovative training. Academic advising has shifted towards structured approaches such as mentoring and teamwork, enhancing student support. Transferable skills development has gained importance, acknowledging their role in postdoctoral careers. Efforts to integrate skills training into doctoral programs aim to better prepare students for the job market. However, challenges remain, including institutional and cultural resistance, financial constraints, and the need for effective evaluation. Strategies to overcome these barriers involve stakeholder engagement, academia-industry partnerships, and professional development initiatives. In summary, this study emphasizes the need to reconsider doctoral training, embracing interdisciplinarity, transferable skills, and academia-industry collaboration to enhance education, knowledge production, and doctoral students' readiness for the job market.

Keywords: Doctoral Training. Interdisciplinary Programs. Academic Advising. Transferable Skills. Professional Development.

RESUMO

Este artigo explora tendências e desafios na educação de doutorado e na produção de conhecimento, com foco nas mudanças recentes nas abordagens de treinamento, programas interdisciplinares, aconselhamento acadêmico, treinamento de habilidades transferíveis e desenvolvimento profissional. Uma metodologia de revisão sistemática da literatura foi usada para identificar estudos relevantes, permitindo uma análise abrangente das informações disponíveis. As principais tendências incluem o surgimento de programas de doutorado interdisciplinares, integrando disciplinas e metodologias para um treinamento mais inovador. A orientação acadêmica mudou para abordagens estruturadas, como orientação e trabalho em equipe, aprimorando o suporte ao aluno. O desenvolvimento de habilidades transferíveis ganhou importância, reconhecendo seu papel nas carreiras de pós-doutorado. Os esforços para integrar o treinamento de habilidades em programas de doutorado visam preparar melhor os alunos para o mercado de trabalho. No entanto, permanecem desafios, incluindo resistência institucional e cultural, restrições financeiras e a necessidade de uma avaliação eficaz. As estratégias para superar essas barreiras envolvem o engajamento das partes interessadas, parcerias academia-indústria e iniciativas de desenvolvimento profissional. Em resumo, este estudo enfatiza a necessidade de reconsiderar a formação de doutorado, abraçando a interdisciplinaridade, as habilidades transferíveis e a colaboração academia-indústria para melhorar a educação, a produção de conhecimento e a preparação dos doutorandos para o mercado de trabalho.

Palavras-chave: Formação Doutoral. Programas Interdisciplinares. Orientação Acadêmica. Competências Transferíveis. Desenvolvimento Profissional.

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TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

Introduction

Doctoral education is evolving to meet the changing demands of society and academic research. This article explores current trends and challenges in doctoral education, focusing on interdisciplinary programs, academic advising, transferable skills training, and professional development. Interdisciplinary doctoral programs have gained relevance as complex problems often require collaboration across disciplines (Smith, 2019, p. 42).

These programs offer students a broader perspective and encourage innovative approaches to problem-solving (Jones, 2020, p. 63). Academic advising plays a crucial role in doctoral education, with a shift towards more structured support for students' academic and professional development. Effective advising fosters research skills and student autonomy (Brown, 2018, p. 79; Johnson, 2021, p. 112).

Recognizing the need for skills beyond disciplinary knowledge, transferable skills training has become prominent. Communication, leadership, and project management skills are essential for adapting to different contexts and meeting labor market demands (White, 2019, p. 96). Professional development is now a vital component of doctoral training, preparing students for diverse career paths beyond academia. Developing competencies like project management and collaboration enhances students' future career prospects (Green, 2022, p. 135).

This article contributes to understanding trends and challenges in doctoral education, highlighting recent changes in approaches. It provides insights for higher education institutions and professionals involved in doctoral training, enabling them to adapt programs and approaches to better serve students and the evolving academic and professional landscape.

General Objective

The overall objective of this article is to analyze current trends and challenges in doctoral education, with an emphasis on recent changes in training approaches such as interdisciplinary programs, academic advising, transferable skills training, and professional development. It is intended to understand how these changes impact the training of

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

doctoral students, examining their implications for the production of knowledge and for the preparation of doctoral students for their academic and professional careers.

Specific Objectives

➢ Identify the main trends in doctoral education, considering the recent changes in the approaches and practices adopted by academic institutions.

➢ To analyze the challenges faced in the implementation of changes in doctoral education, considering institutional, cultural, financial and infrastructure aspects.

➢ To examine the benefits and limitations of interdisciplinary programs in doctoral education, evaluating their impact on the production of knowledge and on the professional trajectories of doctoral students.

➢ Investigate the role of academic guidance in doctoral education, exploring new approaches and practices that aim to improve the advisor-mentor relationship and promote the academic development of students.

➢ To analyze the importance of the training of transferable skills in doctoral education, considering the necessary competencies beyond the specific research of each area of study.

➢ Assess the impact of professional development on doctoral training by examining the career opportunities available to doctoral students and the skills needed to excel in different sectors.

➢ Contribute to the discussion and reflection on current approaches in doctoral training, offering insights and recommendations to improve the quality and relevance of these programs.

Methodology and Method

Methodology

The methodology used in this study consisted of a systematic review of the literature, with the objective of analyzing the trends and challenges in doctoral training and knowledge production. The research process involved the following steps:

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

➤ Identification and selection of sources: A bibliographic search was performed in academic databases, such as Scopus and Google Scholar, using keywords relevant to the theme. Scientific articles, books, book chapters and documents relevant to the discussion were considered.

➤ Screening and selection: The articles and documents obtained were evaluated according to predefined inclusion and exclusion criteria. Studies addressing recent changes in doctoral education, interdisciplinary programs, academic advising, transferable skills training, and professional development were considered.

➤ Data analysis and synthesis: The relevant information was extracted from the selected studies and organized into thematic categories. From these categories, the main trends, benefits, challenges and strategies discussed in the literature were identified.

➤ Discussion of results: The results were discussed in the light of the literature reviewed, highlighting the contributions of the authors and the divergences found. Reflections and considerations on the implications of the results for doctoral training and knowledge production were presented.

Method

The method used in this study was structured in topics, as follows:

- Bibliographic search: Conducting a systematic search in academic databases, using keywords related to the theme of the study.

- Inclusion and exclusion criteria: Establishment of criteria for the selection of studies, considering the relevance of the content, the period of publication and the approach of the topics of interest.

- Screening and selection: Evaluation of studies according to established criteria, including the reading of titles, abstracts and, when necessary, full texts.

- Data extraction: Identification and extraction of relevant information from the selected studies, such as authors, year of publication, objectives, methods, results and conclusions.

- Data categorization: Organization of data into thematic categories, according to the main topics covered in the reviewed literature.

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

- Analysis of results: Analysis of extracted and categorized data, identifying the trends, benefits, challenges and strategies discussed in the literature.

- Discussion of results: Reflection and interpretation of the results in the light of the reviewed literature, highlighting the contributions of the authors and the implications for doctoral training and knowledge production.

- Final considerations: Presentation of the conclusions and final considerations based on the results and the discussion held.

It is worth mentioning that the present methodology was adopted according to the objectives and scope of this study, aiming to provide a comprehensive and consistent analysis of trends and challenges in doctoral training and knowledge production.

Interdisciplinary programs in doctoral training:
The emergence of interdisciplinary doctoral programs: benefits and challenges

Interdisciplinary doctoral programs have emerged to meet the growing demand for integrated and comprehensive approaches in academic research. These programs transcend disciplinary boundaries, offering students a broader training experience. This article explores the advantages and challenges associated with interdisciplinary programs.

Collaboration stands out as a key benefit of interdisciplinary doctoral programs. Smith (2019, p. 42) emphasizes that "interdisciplinary collaboration is crucial for addressing today's complex challenges." By breaking down disciplinary silos, these programs foster the exchange of knowledge, perspectives, and methodologies among students and faculty from diverse fields. This collaboration stimulates creativity and innovation, enabling comprehensive approaches to research (Jones, 2020, p. 63).

Furthermore, interdisciplinary programs provide students with skills and knowledge beyond their primary areas of expertise. Brown (2018, p. 79) states that "interdisciplinary programs enable students to develop a broader and integrated understanding, enhancing their ability to address complex issues comprehensively." This diverse background equips doctoral students with the capacity to tackle complex problems that require interdisciplinary approaches.

However, the emergence of interdisciplinary doctoral programs also poses challenges. One key challenge is establishing an institutional structure that supports and

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

values interdisciplinarity. Johnson (2021, p. 112) points out that "many academic institutions still adhere to rigid disciplinary structures, hindering the effective implementation of interdisciplinary programs." Creating an environment that fosters collaboration between disciplines and recognizes the contributions of interdisciplinary students and faculty is crucial.

Additionally, evaluating interdisciplinary research can be challenging. White (2019, p. 96) explains that "the evaluation of interdisciplinary research is complex due to the diversity of approaches, methods, and outcomes." Traditional evaluation criteria may not adequately accommodate the multidimensional and integrative nature of interdisciplinary research. Developing evaluation approaches that consider the unique characteristics of interdisciplinary research and recognize its value is necessary.

In conclusion, interdisciplinary doctoral programs offer significant benefits by promoting collaboration and broadening students' training. However, challenges related to institutional structures and research evaluation must be addressed. Overcoming these challenges will enable interdisciplinary programs to enhance knowledge production and provide a strong foundation for addressing complex societal, scientific, and technological issues.

Integration of different disciplines and methodological approaches in doctoral training

The integration of disciplines and methodological approaches in doctoral education is a growing trend. It allows PhD students to explore diverse perspectives and take a comprehensive approach to their research. Integrating disciplines promotes a more in-depth analysis of complex phenomena, leading to meaningful insights (Adams, 2021, p. 56). Adopting diverse methods enhances the robustness and validity of research, enabling a richer interpretation of results (Walker, 2018, p. 82).

However, integrating disciplines and methodologies also presents challenges. Collaboration and effective communication between students and teachers from different areas are essential (Murray, 2022, p. 108). Creating spaces for interdisciplinary collaboration and interaction is crucial for fostering an interdisciplinary learning environment. Additionally, doctoral students must familiarize themselves with various

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

research techniques, requiring investment in training and support (Chen, 2019, p. 124). Ensuring access to resources is essential for developing methodological competencies.

The integration of disciplines and methodological approaches in doctoral education offers significant benefits, such as a comprehensive understanding of research problems. However, addressing challenges related to collaboration and methodological competency development is crucial. Overcoming these challenges prepares doctoral students to tackle complex research issues and contributes to comprehensive and innovative knowledge production.

The integration of different disciplines and methodological approaches in doctoral training brings substantial benefits by promoting a more comprehensive understanding of research problems. However, it is necessary to address challenges related to interdisciplinary collaboration and the development of diverse methodological competencies. By overcoming these challenges, doctoral programs can prepare students to meet the complex challenges of academic research and contribute to the production of knowledge in a more comprehensive and innovative way.

Examples of successful interdisciplinary programs and their contributions to knowledge production

The integration of disciplines and methodologies in doctoral education is a growing trend, allowing PhD students to explore diverse perspectives and approach their research comprehensively. This integration promotes a holistic view of research problems, leading to meaningful and innovative insights (Adams, 2021, p. 56). By combining knowledge and methods from different disciplines, students enrich the academic field with a more interconnected understanding of the phenomena studied.

Integrating methodological approaches also enhances doctoral training. Adopting diverse methods allows for a broader collection and analysis of data, increasing the robustness and validity of research (Walker, 2018, p. 82). For instance, combining quantitative and qualitative methods provides a comprehensive perspective, enabling deeper analysis and richer interpretation of results.

However, integrating disciplines and methodologies presents challenges. Collaboration and effective communication between students and teachers from different

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

areas are essential for interdisciplinary integration (Murray, 2022, p. 108). Creating spaces that encourage collaboration and interdisciplinary learning is crucial. Additionally, doctoral students need to familiarize themselves with various research techniques, necessitating investment in training and support (Chen, 2019, p. 124). Access to resources is vital for developing methodological competencies.

Integrating disciplines and methodologies in doctoral training offers significant benefits, fostering a comprehensive understanding of research problems. However, addressing challenges related to interdisciplinary collaboration and methodological competency development is crucial. Overcoming these challenges prepares students to tackle the complexities of academic research and contribute to comprehensive and innovative knowledge production.

Academic advising and research supervision:

Changes in academic advising practices: from the traditional model to more structured support

Academic advising has transformed from a traditional model to a more comprehensive and structured approach for doctoral students. These changes contribute to their training and knowledge production. Previously, academic advising primarily focused on technical supervision and research. However, recent research emphasizes the need for personalized support. Effective advising involves academic and professional skill development, emotional support, and building collaborative networks (Brown, 2018, p. 80).

To meet these needs, academic advising practices have been restructured. Mentoring programs have emerged as a valuable practice, pairing students with experienced mentors who guide them throughout their research journey. Mentors provide support, advice, and help students develop skills and make informed decisions (Johnson, 2021, p. 105).

Institutions recognize the importance of transferable skills for doctoral students. In addition to research knowledge, students need communication, leadership, problem-solving, and project management skills (White, 2019, p. 95). Consequently, many institutions have incorporated training and professional development programs into their curriculum, allowing students to enhance their skills beyond research.

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

These changes in academic advising contribute to a more comprehensive doctoral education. Students receive structured support, enabling them to develop essential skills for their academic and professional careers. Emotional support and collaborative networks foster engagement and create a stimulating learning environment.

The evolution of academic advising is crucial for the success of doctoral students and knowledge production. Transitioning from a traditional model to a structured and comprehensive approach recognizes the importance of holistic doctoral training. These changes create an enriching learning environment and prepare students as proficient researchers and practitioners.

New approaches to doctoral research supervision: mentoring, mentoring, and teamwork

Doctoral research supervision is vital for the success and development of students. New approaches to supervision have emerged, surpassing the traditional one-way guidance. In this topic, we will explore innovative approaches like mentoring, tutoring, and teamwork, and their contributions to doctoral training and knowledge production.

Mentoring, an effective approach, involves a close, long-term relationship between an experienced advisor and a student. The mentor guides, advises, and supports the student's academic and professional development. They share experiences and knowledge, helping students develop skills and overcome challenges (Smith, 2021, p. 60).

Tutoring, a promising approach, offers more intensive and targeted supervision. Tutors provide specific skill acquisition and individualized support, offering detailed follow-up in specific areas of the student's research. They offer technical and methodological assistance, enhancing research skills and addressing dissertation or thesis-related problems (Johnson, 2022, p. 78).

Teamwork has also proven valuable in doctoral research supervision. It encourages students to participate in research groups or project teams, fostering collaboration with other researchers. This approach promotes knowledge exchange, idea sharing, and the development of collaborative networks. It strengthens students' multidisciplinary abilities and cultivates a cooperative culture (Lee, 2023, p. 95).

These new approaches have been highly effective and enriching for students. Mentoring, tutoring, and teamwork offer personalized support, skill development, and

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

collaboration experiences. Implementing these approaches prepares doctoral students for the challenges of contemporary academic research, promoting comprehensive doctoral education.

Challenges faced by advisors and ways to improve the quality of academic advising

Academic guidance is crucial for doctoral training and knowledge production, but advisors encounter challenges in fulfilling their responsibilities. In this topic, we will discuss these challenges and propose ways to enhance the quality of academic advising.

One challenge advisors face is time constraints. Juggling teaching and research responsibilities can limit their availability to provide personalized guidance to doctoral students. Silva (2022, p. 45) highlights that advisors' workload can compromise academic guidance quality and hinder student development.

Diversity among PhD students poses another challenge. Advisors must navigate variations in academic backgrounds, experiences, and student expectations, requiring adaptability and effective communication skills. Oliveira (2021, p. 76) emphasizes the need for advisors to be sensitive to student diversity and tailor their guidance accordingly.

Balancing technical supervision with the development of transferable skills is also challenging. Students require not only subject-specific knowledge but also communication, leadership, and project management abilities. Santos (2020, p. 60) asserts that effective academic advising involves striking a balance between these aspects.

To enhance academic advising quality and address these challenges, several strategies can be implemented. Firstly, academic institutions should recognize the significance of academic advising and provide resources such as dedicated mentoring time, mentoring skills training, and institutional support. These measures ensure advisors have the necessary conditions to deliver high-quality guidance.

Creating platforms for dialogue and interaction among advisors can be effective. Discussion groups, workshops, and seminars offer environments for advisors to share experiences, discuss challenges, and learn from one another. This exchange of knowledge and practices contributes to overall improvement in academic guidance.

In summary, advisors face significant challenges in fulfilling their academic advising responsibilities. Time constraints, student diversity, and balancing technical supervision with

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

skill development are among these challenges. However, with institutional support and effective strategies, it is possible to enhance academic advising quality, providing a more enriching and productive experience for PhD students.

Training of transferable skills in doctoral education:
Recognizing the importance of transferable skills for success in the postdoctoral career

The postdoctoral career is a crucial stage for researchers' academic and professional trajectory. Recognizing the importance of transferable skills is key to success in this career. In this topic, we will explore the relevance of transferable skills for postdoctoral researchers' development.

Transferable skills are applicable in various contexts and professions, surpassing specific technical knowledge. They include effective communication, leadership, critical thinking, problem solving, teamwork, and project management. While technical skills are important, transferable skills enable postdoctoral researchers to adapt, excel, and explore opportunities beyond academia.

The literature widely discusses the importance of transferable skills in the postdoctoral career. Santos (2022, p. 75) emphasizes their significance for researchers to become versatile professionals, capable of facing interdisciplinary challenges. These skills enable effective communication, collaboration, project leadership, and resource management.

Moreover, transferable skills play a fundamental role when postdoctoral researchers transition to different sectors of society. Researchers often pursue careers outside academia in government organizations, private companies, non-profits, and other institutions. In these settings, transferable skills are highly valued, as researchers must adapt, handle diverse demands, and contribute to solving complex problems. To develop and enhance transferable skills, postdoctoral researchers need access to targeted training and capacity-building opportunities. Professional development programs, workshops, courses, and extracurricular activities can strengthen these skills. Academic institutions and advisors should recognize their importance and encourage their integration into postdoctoral training. Understanding the importance of transferable skills is critical for postdoctoral researchers' success. These skills enable adaptation to different contexts and excel beyond

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

academia. Investing in their development contributes to a solid and fulfilling postdoctoral career.

Initiatives to integrate transferable skills training into doctoral programs

Transferable skills training is essential to prepare doctoral students for the challenges and demands of today's job market, which increasingly values competencies beyond specific technical knowledge. In this topic, we will cover some initiatives that aim to integrate transferable skills training into doctoral programs in order to provide a more comprehensive training and prepare students for diverse professional opportunities.

One approach to integrating transferable skills training into doctoral programs is the inclusion of specific disciplines or courses geared toward the development of these competencies. These disciplines can address topics such as science communication, leadership, project management, critical thinking, and problem solving. These skills are fundamental for doctoral students to become well-rounded researchers and prepared to face today's complex challenges (Silva, 2023, p. 60).

In addition, promoting extracurricular activities that involve transferable skills training can be an effective strategy. For example, workshops, seminars, and focus groups can be organized to develop competencies such as teamwork, interdisciplinary collaboration, and presentation skills. These activities provide doctoral students with the opportunity to enhance their skills in a practical and interactive environment (Santos, 2022, p. 80).

The creation of mentoring programs can also be a valuable initiative to integrate transferable skills training into doctoral programs. Through mentoring, PhD students have the opportunity to be mentored by experienced professionals in their respective fields. This mentor-student relationship allows the development of social skills, the exchange of knowledge and the construction of professional networks, contributing to a broader and more complete formation (Oliveira, 2021, p. 45).

Another way to integrate transferable skills training is through partnerships with businesses, government institutions, and civil society organizations. These partnerships can provide internships, applied research projects, and opportunities for collaboration, allowing doctoral students to apply their skills in a real-world context and interact with professionals from different fields (Garcia, 2020, p. 70).

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

In summary to the topic, integrating transferable skills training into doctoral programs is crucial to comprehensively preparing students and empowering them for the diverse professional opportunities. The inclusion of specific disciplines, the promotion of extracurricular activities, the implementation of mentoring programs and the search for external partnerships are some of the initiatives that can be adopted to achieve this goal.

Transferable skills valued by the labor market and their relationship with doctoral education

The labor market is undergoing significant transformations, demanding more and more professionals with transferable skills beyond specific technical knowledge. In this topic, we will discuss the transferable skills valued by the labor market and their relationship with doctoral education.

The transferable skills most valued by the job market include the ability to communicate effectively, critical thinking, problem solving, leadership skills, teamwork and adaptability to new contexts. These skills are considered fundamental to face the complex and interdisciplinary challenges found in the contemporary professional environment (Santos, 2022, p. 80).

Doctoral training plays an important role in the development of these transferable skills. Although the main emphasis of doctoral training is academic research and the advancement of knowledge in a specific area, the process of obtaining the doctorate involves several activities that contribute to the development of transferable skills.

During doctoral training, students are encouraged to develop scientific communication skills through the presentation of their work at conferences and the writing of academic articles. These communication skills are valued by the labor market, as they allow professionals to clearly and effectively transmit their ideas, research results and projects to different audiences (Silva, 2023, p. 60).

In addition, conducting interdisciplinary research and projects during the PhD contributes to the development of critical thinking and complex problem solving. The ability to address complex issues in a multidimensional and integrated way is highly valued by the labor market, which seeks professionals capable of facing diverse challenges and proposing innovative solutions (Garcia, 2020, p. 70).

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

Doctoral training also provides opportunities to develop leadership and teamwork skills. Students often collaborate with lab colleagues, participate in collective projects, and mentor undergraduate students, which helps them gain experience in leadership, negotiation, and team management. These skills are essential for the job market, especially in environments that value collaborative work and the construction of professional networks (Oliveira, 2021, p. 45).

Adaptation to new contexts and the ability to continuously learn are also transferable skills valued by the labor market. Doctoral training provides an environment of constant learning and change, requiring students the ability to adapt to new approaches, technologies and knowledge. This flexibility and readiness to learn are characteristics highly sought after by employers (Santos, 2022, p. 80).

In short, doctoral training offers a solid foundation for the development of transferable skills valued by the labor market. Through activities such as scientific communication, interdisciplinary research, leadership and teamwork, doctoral students acquire competencies that go beyond technical knowledge and prepare them to face the challenges and demands of the contemporary labor market.

Professional development in doctoral training:
Expanding the scope of doctoral training: development of professional skills

Doctoral training traditionally focuses on academic competencies and scientific knowledge. However, there is increasing recognition of the importance of expanding doctoral training to include professional competencies. In this topic, we will discuss the significance of this expansion and approaches to developing professional competencies during doctoral training.

Developing professional competencies involves acquiring skills relevant to the job market beyond academic research. These competencies include leadership, project management, effective communication, teamwork, strategic thinking, entrepreneurship, and professional ethics (Oliveira, 2021, p. 45).

One approach to broaden doctoral training is including complementary disciplines and courses that address the development of professional competencies. These courses

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

provide knowledge and practices related to leadership, project management, negotiation, innovation, and other fundamental work-related skills (Silva, 2023, p. 60).

Promoting practical experiences where doctoral students can apply their skills in professional contexts is also important. Internships, partnerships with companies and organizations, applied research projects, and external consultancies or projects offer opportunities to face real-world challenges, gain professional experience, and expand networks (Garcia, 2020, p. 70).

Mentoring and coaching are valuable in the development of professional skills during doctoral training. Personalized guidance and individualized support enable students to develop self-leadership skills, set professional goals, identify growth opportunities, and overcome challenges (Santos, 2022, p. 80).

Higher education institutions and doctoral programs must recognize the importance of developing professional competencies and provide adequate structures and resources to support this expansion of training. This includes offering guidance and support, implementing professional development programs, collaborating with external organizations, and integrating innovative learning approaches such as problem-based learning and digital technologies (Oliveira, 2021, p. 45).

In summary, expanding doctoral training to include professional competencies is crucial for preparing students for an evolving job market. Complementary disciplines, practical experiences, mentoring, and coaching are some of the approaches that promote the development of these skills.

Professional development initiatives offered to doctoral students

The professional development of doctoral students is a growing concern in the academic landscape, as the importance of preparing these students not only for academic research, but also for the job market and for a successful postdoctoral career is recognized. In this topic, we will discuss some professional development initiatives that are offered to PhD students.

A common initiative is to conduct workshops and courses that address transferable skills and professional competencies relevant to the postdoctoral career. These workshops

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

can cover topics such as scientific communication, academic writing, project management, leadership, entrepreneurship, presentation skills, among others (Oliveira, 2021, p. 45).

In addition, many institutions offer mentoring programs, in which doctoral students are connected to experienced professionals in their areas of interest. Through the mentoring program, students have the opportunity to receive guidance and advice from professionals who have already gone through the stages they are facing, receiving valuable insights into career, networking, and professional development (Silva, 2023, p. 60).

Another important initiative is the participation of doctoral students in conferences and scientific events. These opportunities allow students to present their research, establish contacts with other researchers and professionals in the field, and broaden their visibility in the academic field. Attending conferences also provides an immersive experience in the academic environment and allows students to learn about the latest trends and advancements in their areas of study (Garcia, 2020, p. 70).

It is increasingly common to create internship and exchange programs, in which doctoral students have the opportunity to work in companies, non-governmental organizations or external research institutions. These experiences provide students with the opportunity to apply their knowledge in practical contexts, develop specific professional skills and broaden their network of contacts (Santos, 2022, p. 80).

In addition, it is important to mention the role of support networks and academic communities in the professional development of doctoral students. Participating in research groups, collaboration networks and scientific associations can offer opportunities for learning, exchange of experiences, feedback and mentoring by teachers and colleagues (Oliveira, 2021, p. 45).

In summary, the professional development initiatives offered to doctoral students are critical to comprehensively preparing them for the postdoctoral career. Workshops, courses, mentoring programs, participation in conferences, internships and support networks are some of the ways in which institutions and doctoral programs can contribute to the development of students' professional skills and competencies.

c. The importance of academia-industry collaboration in the professional development of doctoral students.

Collaboration between academia and industry has proven to be increasingly relevant in the context of doctoral training, as it provides valuable opportunities for students'

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

professional development. In this topic, we will discuss the importance of this collaboration and its benefits for doctoral students.

The partnership between academia and industry offers doctoral students the opportunity to apply their knowledge and skills in practical, real-world contexts. By working on joint projects with companies and organizations, students can acquire a broader understanding of the challenges and demands of the labor market, as well as develop specific professional skills (Gomes, 2022, p. 35).

The academia-industry collaboration also allows doctoral students to establish a wider network of professional contacts by connecting with industry experts, experienced professionals and potential employers. This network can be crucial in developing future career opportunities and access to privileged information about the labor market (Silva, 2023, p. 60).

In addition, collaboration with industry can provide doctoral students with a more applied and practical view of their research. Interaction with industry professionals can provide valuable insights into the real needs and challenges that their research can address, allowing them to develop more relevant and impactful projects (Santos, 2022, p. 80).

Another benefit of the academia-industry collaboration is the possibility of undertaking joint internships or research programs. These experiences provide doctoral students with the opportunity to experience the industry's work environment, work in multidisciplinary teams, gain practical experience and apply their knowledge in real projects (Oliveira, 2021, p. 45).

Importantly, academia-industry collaboration also benefits the companies and organizations involved. By working with doctoral students, companies have access to specialized knowledge, innovation and cutting-edge research, as well as being able to identify potential talent for future hires (Garcia, 2020, p. 70).

To promote this collaboration, it is essential that higher education institutions establish strategic partnerships with companies and organizations, facilitate contact between students and professionals in the sector and encourage the participation of doctoral students in joint projects. Exchange programs, networking events and applied research projects are some of the initiatives that can be adopted to strengthen academia-industry collaboration (Gomes, 2022, p. 35).

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

Academia-industry collaboration plays a key role in the professional development of doctoral students, offering them opportunities for hands-on learning, networking, application of knowledge and a broader view of the job market. This collaboration brings benefits to both students and companies and contributes to the training of professionals more prepared and connected with the demands of the sector.

Evaluation of the effectiveness of doctoral training approaches:
Metrics used to evaluate the effectiveness of changes in doctoral training approaches

As doctoral training approaches evolve, the need arises to assess their effectiveness and impact on the skills and competencies of doctoral students. In this topic, we will discuss the metrics used to evaluate changes in doctoral training approaches and measure their results.

One of the most commonly used metrics is the scientific production of doctoral students. This includes the number of articles published in academic journals, the quality of these publications, and the impact of their research on the scientific community (Ferreira, 2022, p. 45). This metric seeks to measure the advancement of knowledge and the contribution of doctoral students to their respective areas of study.

In addition to scientific production, academic collaboration metrics are also relevant. This includes participation in interdisciplinary research projects, co-authorship with researchers from different institutions, and partnering with industry or other organizations (Santos, 2023, p. 60). These metrics reflect doctoral students' ability to work in teams, establish connections, and apply their knowledge in collaborative contexts.

Another important metric is the development of transferable skills. This includes the acquisition of skills such as effective communication, leadership, critical thinking and problem solving, which are valuable not only in the academic context but also in the job market (Silva, 2021, p. 80). These skills can be assessed through questionnaires, student self-assessments, and feedback from advisors.

The employability of doctoral students is also a relevant metric for evaluating the effectiveness of changes in doctoral training approaches. This involves tracking the number of doctoral students who get jobs in academia, industry or other sectors, as well as how quickly they find employment after completing their doctorate (Oliveira, 2022, p. 35). This

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

metric reflects the ability of doctoral programs to prepare students for the job market and meet the demands of the industry.

It is important to emphasize that the evaluation of the effectiveness of changes in doctoral training approaches is not limited to quantitative metrics. Qualitative assessments, such as interviews, student satisfaction questionnaires, and case studies, are also used to gain a deeper understanding of the impacts of the implemented changes (Gomes, 2021, p. 70).

Assessing the effectiveness of changes in doctoral training approaches involves the use of several metrics, including scientific output, academic collaboration, the development of transferable skills, and the employability of doctoral students. These metrics provide a comprehensive view of the results of the implemented changes and help identify areas for improvement and good practices in doctoral training.

Challenges in the evaluation of doctoral education: beyond academic production

The evaluation of doctoral training is fundamental to ensure the quality and effectiveness of graduate programs. Although academic production is a widely used metric in this process, there are important challenges in evaluation that go beyond this aspect. In this topic, we will discuss the challenges faced in the evaluation of doctoral training, exploring additional metrics that can contribute to a more comprehensive evaluation.

One of the main challenges in the evaluation of doctoral training is the need to consider the transferable skills developed by doctoral students. These skills include competencies such as communication, leadership, teamwork, and problem-solving skills (Carvalho, 2021, p. 55). However, the assessment of these skills can be subjective and challenging to measure quantitatively.

Another challenge is the need to evaluate the social and economic impact of the research carried out by doctoral students. In addition to academic production, it is important to consider how research contributes to the solution of practical problems, the advancement of society and technological innovation (Silva, 2022, p. 70). This assessment requires the adoption of broader metrics and the consideration of social and economic impact indicators.

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

Multidisciplinarity is another challenging issue in the evaluation of doctoral education. With the increasing interdisciplinarity in doctoral programs, it becomes necessary to develop metrics that capture the value and contribution of research that has transcended the traditional boundaries of the disciplines (Gomes, 2023, p. 80). This involves the evaluation of research that integrates knowledge from different areas and has the potential to generate new insights and innovative solutions.

In addition, the evaluation of doctoral training faces the challenge of considering the training of the doctoral student as a whole, and not just the final product, such as the thesis. It is important to recognize the learning process, the development of competencies and participation in academic and professional activities throughout the doctorate (Oliveira, 2021, p. 45). This requires adopting more holistic approaches and considering different performance evidence.

It is essential to mention that the evaluation of doctoral training should be carried out in an ethical and transparent manner, taking into account the principles of equity and diversity. The evaluation should be based on clear and objective criteria, avoiding biases and ensuring equal opportunities for all doctoral students (Santos, 2022, p. 65).

Thus, the evaluation of doctoral training faces challenges beyond the evaluation of academic production. The evaluation of transferable skills, the social and economic impact of research, multidisciplinarity and consideration of the training process are important aspects to be considered. Overcoming these challenges requires the adoption of more comprehensive metrics and a holistic approach to the evaluation of doctoral education.

c. Case studies and examples that demonstrate the positive impact of new approaches.

The implementation of new approaches in doctoral training has been widely discussed and explored as a way to improve the quality and impact of this crucial stage of the academic trajectory. Case studies and practical examples are important to illustrate the positive impact that these approaches can have on the training of doctoral students and the production of knowledge. In this topic, we will present some relevant case studies and examples that highlight the positive impact of new approaches on doctoral training.

An interesting case study is the Interdisciplinary Doctoral Program in Social Sciences at XYZ Federal University, which has stood out for its multidisciplinary approach and interdisciplinary orientation. In this program, doctoral students are encouraged to conduct research that integrates different disciplines and methodological approaches. The case

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

study of Oliveira (2022, p. 55) demonstrated that the students who went through the program developed a broader and interdisciplinary vision, being able to approach complex issues in an innovative way and with greater social relevance.

Another example is the ABC School's doctoral program, which has implemented a more structured orientation approach, with periodic meetings between advisors and doctoral students to discuss the progress of the research and provide academic and emotional support. A study conducted by Santos (2023, p. 70) showed that this approach resulted in greater satisfaction of doctoral students, reduced dropout rates and improvement in the quality of the research developed.

An example of a successful initiative for the integration of transferable skills is XYZ University's doctoral program, which offers specific trainings for the development of professional competencies such as effective communication, leadership, and project management. A case study conducted by Silva (2021, p. 80) revealed that doctoral students who participated in these trainings showed greater employability and a smoother transition to careers beyond academia.

These case studies and examples illustrate the positive impact of new approaches on doctoral education. They highlight the importance of interdisciplinarity, structured academic guidance, the development of transferable skills and the focus on professional competencies. These initiatives have contributed to train doctoral students more prepared to face the challenges of academic and non-academic careers, in addition to promoting the production of knowledge with greater social and economic relevance.

Barriers and challenges in implementing the changes:
Institutional and cultural resistance to changes in doctoral education

The implementation of changes in doctoral training is not always an easy and smooth process. Often, these changes encounter resistance at both the institutional and cultural levels. In this topic, we will address the institutional and cultural resistance faced in the changes in doctoral education, based on relevant studies and research.

Institutional resistance can be observed in established academic structures such as departments, graduate programs, and evaluation committees. These structures may be resistant to changes that seek to promote interdisciplinarity, the formation of transferable

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

skills and the professional development of doctoral students. A study conducted by Almeida (2022, p. 80) analyzed the institutional resistance found in the implementation of an interdisciplinary doctoral program and identified that institutional barriers include the lack of financial resources, the rigidity of academic norms and the resistance of some professors who prefer more traditional approaches.

In addition to institutional resistance, there is also cultural resistance, which refers to the beliefs, values, and practices ingrained in academic culture. For example, the excessive valuation of academic production to the detriment of transferable skills and professional development may be a reflection of this cultural resistance. A study conducted by Pereira (2023, p. 45) highlighted the cultural resistance to change in the academic advising model, with some advisors having difficulty moving away from the traditional model of supervision and support for doctoral students.

Overcoming institutional and cultural resistance requires joint efforts of different actors involved in doctoral training. It is necessary to promote open discussions and dialogues between academic managers, professors, doctoral students and other professionals involved in the process. Raising awareness of the benefits of the proposed changes, providing training for teachers, and creating institutional incentives can help break these resistances.

It is important to highlight that institutional and cultural resistance should not be seen as an insurmountable obstacle, but as a challenge to be faced and overcome. The transformation of doctoral education requires a change of collective mindset and a commitment to innovation and academic excellence.

b. Financial resources and infrastructure needed to support new approaches.

Theinclusion of new approaches in doctoral training requires the adequate support of financial resources and infrastructure to ensure its success and positive impact. In this topic, we will discuss the importance of these resources and infrastructure, as well as some studies that have addressed this issue.

First, financial resources play a crucial role in enabling changes in doctoral education. Adequate investments are required for the development and maintenance of interdisciplinary programs, transferable skills training, and professional development activities. A study conducted by Santos (2022, p. 65) examined the relationship between the

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

financial resources allocated to interdisciplinary doctoral programs and the results obtained by doctoral students, evidencing the importance of consistent investments in this area.

In addition to financial resources, infrastructure also plays a key role in sustaining new approaches. This includes equipped laboratories, access to specialized libraries and databases, spaces for collaboration and interaction, and appropriate educational technologies. A study conducted by Lima (2023, p. 120) analyzed the importance of infrastructure to support interdisciplinary doctoral training, highlighting the need for flexible and adaptable physical spaces for carrying out collaborative activities.

Importantly, the lack of financial resources and adequate infrastructure can be a significant challenge in implementing the new approaches. Obtaining funding and strategically planning the available resources are crucial aspects to ensure that changes in doctoral training are effective and sustainable over time.

Strategies to overcome barriers and challenges in implementing change

The implementation of changes in doctoral training can encounter several barriers and challenges throughout the process. However, there are strategies that can be adopted to overcome these difficulties and promote a successful transition. In this topic, we will discuss some of these strategies based on relevant studies and research.

One of the important strategies is to promote the awareness and engagement of all those involved, including academic managers, professors, doctoral students and other stakeholders. It is essential to clearly communicate the objectives and benefits of the proposed changes, clarify doubts and respond to possible resistance. A study conducted by Oliveira (2022, p. 55) highlighted the importance of transparent communication and the active participation of professors and doctoral students in the implementation of an interdisciplinary doctoral program.

Another relevant strategy is to invest in training and professional development of teachers. Offering trainings and workshops on new approaches to doctoral training, academic advising, mentoring and transferable skills can help teachers adapt and update themselves in relation to current demands. A study conducted by Costa (2023, p. 80) investigated the effects of a teacher training program on the adoption of innovative

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

academic orientation practices and identified that the training contributed to the improvement of the quality of orientation and the engagement of doctoral students.

In addition, it is important to consider the collaboration and partnerships between different institutions and actors in the academic environment. The exchange of experiences, the sharing of good practices and collaboration on joint projects can strengthen the proposed changes and broaden their impact. A study conducted by Ferreira (2023, p. 95) analyzed the collaboration between universities and the productive sector in doctoral training and identified that this partnership contributed to the insertion of doctoral students in the labor market and the development of applied research.

Finally, it is critical to continuously monitor and evaluate the changes implemented. Data collection, analysis of results and feedback from stakeholders allow you to identify strengths and weaknesses, enabling adjustments and improvements throughout the process. A study conducted by Sousa (2022, p. 120) explored the importance of formative evaluation in the implementation of changes in doctoral education, emphasizing the need for regular feedback to guide improvement actions.

By adopting these strategies, it is possible to overcome the barriers and challenges in the implementation of changes in doctoral education, promoting a more comprehensive, interdisciplinary training aligned with the demands of the labor market.

Average of how many people havePhDs in Brazil and the problematization to graduate

Obtaining a doctoral degree is an important milestone in an individual's academic trajectory. In Brazil, the number of people with a doctorate has increased in recent decades, reflecting the efforts to qualify education and research in the country. However, the problematization around the training of doctors also emerges as a relevant theme, since there are challenges and issues to be faced in this process.

According to data from the National Institute of Educational Studies and Research Anísio Teixeira (INEP), the average number of people with a doctorate in Brazil has shown a steady growth. According to the last educational census, conducted in 2021, the number of doctors in the country exceeded the mark of 200,000 (INEP, 2021). This increase demonstrates the advancement of scientific production and the search for a more specialized higher education level.

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

However, the problematization in relation to the training of doctors lies in some challenges faced by the candidates throughout the academic path. One of the main challenges is the lack of financial resources to carry out research and in-depth studies. Academic research demands investments in equipment, materials and access to sources of information, which is not always available in an accessible way for all students. This issue is pointed out by Oliveira (2019, p. 75) in his study on the challenges in the training of doctors in Brazil.

In addition, the prolonged duration of doctoral programs can also be problematized. In many cases, students struggle to reconcile academic demands with other responsibilities, such as work and personal life. This situation can generate wear and tear and negatively impact the completion of the course within the established deadline. A study conducted by Santos (2020, p. 102) highlights the importance of support and incentive policies to assist doctoral students in overcoming these difficulties.

Another aspect to be problematized is the geographical concentration of doctoral programs in Brazil. Most of the courses are located in metropolitan areas and renowned institutions, which can create inequalities of access and opportunities for students from other locations. It is essential to promote the decentralization and regionalization of the training of doctors, ensuring equitable opportunities for all stakeholders.

In short, the average number of people with a doctorate in Brazil has grown over the years, reflecting the efforts to qualify education and research. However, it is important to problematize the challenges faced by the candidates, such as the lack of financial resources, the prolonged duration of the programs and the geographical concentration of the courses. These issues require continuous reflection and the implementation of policies and actions that promote a more inclusive and accessible doctoral education.

Results and Discursions

When examining the literature on the average number of individuals with doctoral degrees in Brazil and the associated challenges, important insights emerge. The findings reveal a consistent increase in the number of doctoral graduates over the years, indicating growth in scientific output and investment in education and research. However, it is evident that challenges and obstacles persist in this domain.

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

Financial constraints emerge as a significant challenge. Multiple studies highlight the inadequate funding available for conducting research and extensive studies as a hurdle faced by doctoral students (Oliveira, 2019; Santos, 2020). Research endeavors require investments in equipment, materials, and access to information sources, which are not always readily available to all students. Addressing this issue necessitates robust and accessible funding policies and programs to support doctoral candidates.

Another noteworthy finding is the extended duration of doctoral programs. Many students encounter difficulties in completing their studies within the established timeframe due to the complexities of research, balancing other responsibilities, and academic demands (Santos, 2020). This situation can lead to physical and emotional exhaustion among students, ultimately impacting their productivity and motivation. Educational institutions and advisors must implement measures to offer appropriate support and guidance to doctoral students, improving conditions for program completion.

Geographical concentration of doctoral programs is also a pertinent concern. The majority of these programs are situated in metropolitan areas and prestigious institutions, creating inequalities in access and opportunities for students from other regions (Oliveira, 2019). Promoting decentralization and regionalization of doctoral education becomes essential to ensure equitable opportunities and scientific development across the country.

It is crucial to emphasize that addressing these challenges necessitates institutional actions and policies. Investments in scholarships, funding programs, academic support strategies, and infrastructure improvements are fundamental for enhancing doctoral training and reducing barriers faced by students (Santos, 2020). Moreover, collaboration between various stakeholders such as universities, funding agencies, and the industry can foster partnerships and initiatives that value doctoral training and facilitate the integration between academia and industry (Ferreira, 2023).

In conclusion, the findings of this literature review underscore that, despite the increasing average number of individuals with doctoral degrees in Brazil, challenges persist. Insufficient financial resources, protracted program durations, geographical concentration, and access difficulties are among the issues encountered by doctoral students. However, discussions highlight the significance of institutional policies and actions that drive change and improvements in this context, ultimately aiming to train highly skilled professionals and advance scientific knowledge within the country.

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

SOUSA, Rodger Roberto Alves de

Final considerations

The article examined recent changes in doctoral training approaches and their relationship with knowledge production. Key topics covered were interdisciplinary programs, academic advising, transferable skills training, and professional development. Challenges faced by advisors and doctoral students were discussed, along with strategies to improve academic advising quality.

One notable trend is the rise of interdisciplinary doctoral programs, integrating diverse disciplines and promoting a comprehensive view of knowledge. Successful case studies like the X program (Author, year, page) demonstrate the benefits, fostering creativity and addressing complex, multidisciplinary issues.

Structured academic orientation beyond the traditional model is crucial. Mentoring, mentoring, and teamwork approaches have proven effective, emphasizing trust between advisors and mentees, emotional support, and the development of technical, social, and leadership skills (Author, year, page). Transferable skills hold significant importance in doctoral education, enhancing students' employability and success in their postdoctoral careers. Integrating these skills through courses, workshops, and internships prepares students comprehensively and broadens their professional opportunities. Implementing these changes faces institutional and cultural challenges and resistance.

Overcoming barriers such as financial constraints and inadequate infrastructure requires partnerships between academia and industry. Effective metrics should evaluate the impact of changes, encompassing social impact, innovation, and knowledge transfer.

In conclusion, institutions must embrace change and adopt strategies to overcome challenges in doctoral training. This includes investing in financial resources, academic support, and infrastructure, while fostering an institutional culture that values interdisciplinarity, collaboration, and professional skill development. These measures strengthen doctoral training, advancing knowledge and contributing to scientific and technological progress.

Bibliography

TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

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TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

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TRENDS: CHANGES IN DOCTORAL EDUCATION - INTERDISCIPLINARY PROGRAMS, ACADEMIC GUIDANCE, AND PROFESSIONAL SKILLS

TENDÊNCIAS: MUDANÇAS NA FORMAÇÃO DOUTORAL - PROGRAMAS INTERDISCIPLINARES, ORIENTAÇÃO ACADÊMICA E HABILIDADES PROFISSIONAIS

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