

A review of work-integrated learning for PhD students

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Work-integrated learning (WIL) has been suggested as a potentially beneficial addition to modern doctoral education. However, there is little research outlining the specificities of WIL aimed at PhD students. This paper explores the range of WIL opportunities available to PhD students through a review of secondary data. The findings indicate that WIL opportunities are non-homogenous and vary widely across their structure and implementation. Patterns emerge to indicate that WIL opportunities tend to be optional, paid, short-term, focused on horizontal learning development, and provide opportunities for boundary crossing outside of academia. These findings imply that WIL has the potential to complement doctoral education by providing opportunities to experience cross-sector or cross-discipline learning and development. However, higher education institutes might consider becoming more involved in the design and implementation of WIL for PhD students. Additional research is required to understand how WIL opportunities fit into doctoral education and to evaluate existing WIL opportunities.

Keywords: Doctoral training, PhD training, internship, work placement

Work-integrated learning (WIL) has been suggested and referenced in existing literature as a justified addition to doctoral education (Department of Education Skills and Employment, 2021; Diamond et al., 2014; European University Association-Council for Doctoral Education [EUA-CDE], 2016; McGagh et al., 2016; Porter & Phelps, 2014). WIL is touted as an opportunity for students to:

- Practice their transversal skills (Chatterjee et al., 2019; Jones & Warnock, 2015; Stamati & Willmott, 2023; Valencia-Forrester, 2019).
- Improve employability (EUA-CDE, 2016; McGagh et al., 2016).
- Expand their networks (Schnoes et al., 2018; Stamati & Willmott, 2023).
- Become more familiar with other sectors for future work (Jones & Warnock, 2015; Paschke & Zurgilgen, 2019; Schnoes et al., 2018; Stamati & Willmott, 2023) or collaborations (Pym et al., 2014; Stamati & Willmott, 2023).
- Extend doctoral knowledge to society outside of academia (Pym et al., 2014; Stamati & Willmott, 2023).
- Transfer and share knowledge between academia and industry (Olsson et al., 2020; Thune, 2009, 2010).

Despite the potential benefits of WIL, it is not prevalent in doctoral education today. For example, only 10% of doctoral programs in Europe report to always, or to a great extent include WIL in the form of internships or work placements (Hasgall et al., 2019), while just 9% of a sample of 35 UK universities offer examples of work placements or internships with external employers (Minocha et al., 2017), and 17% of doctoral graduates in Ireland report to have completed a work placement or internship during their degree (Harvey, 2022). It follows then that WIL in the context of postgraduate education, including doctorates, has not been comprehensively studied (Lyons et al., 2022; Valencia-Forrester, 2019). While there is a limited number of case studies about specific WIL opportunities in post graduate education (see, e.g., Chatterjee et al., 2019; Hodgson et al., 2013; Jones & Warnock, 2015; Pym et al., 2014;

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Romasanta et al., 2020; Schnoes et al., 2018; Stamati & Willmott, 2023), there is a gap in understanding how WIL is implemented at the doctoral level. To address the gap, this paper will explore, through a framework approach and secondary research, the variability and range of possibilities found in the WIL opportunities available to PhD students.

This paper comprises four sections. First, a background to the study is provided, highlighting key literature about the inclusion of WIL at the doctoral level. Second, the methodology is discussed and the rationale for and nature of the study is outlined. A thematic framework is introduced to discuss how the WIL opportunities are indexed and charted. Third, the WIL opportunities are reviewed against the thematic framework and examined based on the focus of the WIL opportunity, the involvement of the higher education institution (HEI), and the practicalities of the WIL opportunity. Finally, the findings are examined, and the paper concludes with a summary of the variability and range of possibilities found in the WIL opportunities available to PhD students today and the potential implications for doctoral education.

BACKGROUND TO THE STUDY

Work-Integrated Learning

WIL describes the tasks and experiences that give students the opportunities to put their academic learning into practice and employers the opportunities to engage with education (Jackson et al., 2017). WIL may include work placements or internships where students work in a specific workplace or authentic learning experiences such as project work, simulations, or consultancy work where students are not necessarily situated in a specific workplace (Jackson, 2018). It provides opportunities for students to develop work experience, gain transferable skills, and improve employability (Sheridan & Linehan, 2013). There is debate over what qualifies as WIL, and some argue that WIL must be linked to a specific curriculum and include assessment (Campbell et al., 2021). However, in the context of this paper, WIL is used as an umbrella term to describe any formalized opportunities for PhD students to spend time working with a non-academic partner, such as a private firm, nonprofit, government body, or another academic research lab or group, on a topic or piece of work that is either related or unrelated to their academic research for a specific period of time during their doctoral education.

Doctoral Education and Work-Integrated Learning

Doctoral education today is increasingly focused on ensuring that graduates develop useful skills and capabilities to ensure employability after graduation (Cardoso et al., 2022). This focus is influenced by the increase in PhD graduates working outside of HEIs (Sharmini & Spronken-Smith, 2019), the limitations of the academic job market, and the shift towards a knowledge economy (Cardoso et al., 2022). The knowledge economy emphasizes the importance and value of research, innovation, expertise, and skills to contribute to an economy's success (Hancock, 2019; Harman, 2002). As such, investment in doctoral education is viewed by policymakers as an investment into the economy and future productivity (Balaban, 2020; Cuthbert & Molla, 2015). Since a functioning knowledge economy requires knowledge to be transferred across sectors, students play a key role in creating bridges for knowledge transfer by working across sectors, either during their education or after graduation (Tavares et al., 2020; Thune, 2010). As such, it is increasingly important for all PhD students, including those who intend to work in HEIs after graduation, to understand how other sectors work and be able to communicate and cooperate with them (Hancock, 2019; Thune, 2007). Participating in WIL during doctoral studies is highlighted as important to improve employability (EUA-CDE, 2016; McGagh et al., 2016), address future employers' expectations of relevant work experience (Diamond et al., 2014;

McGagh et al., 2016), provide clarity on the type of work that the student is interested in pursuing (Diamond et al., 2014; EUA-CDE, 2016), and to highlight what researchers may offer to other sectors (EUA-CDE, 2016; McGagh et al., 2016).

Examples of Work-Integrated Learning in Doctoral Education

There is limited literature focusing on specific WIL opportunities for PhD students in social science (Stamati & Willmott, 2023), the humanities (Hodgson et al., 2013; Pym et al., 2014), and science (Chatterjee et al., 2019; Jones & Warnock, 2015; Romasanta et al., 2020; Schnoes et al., 2018). Of the seven papers sourced, six reported primarily positive outcomes from the WIL opportunities.

One research study reported inconsistent outcomes across eight case studies of work placements. While five of the placements were deemed successful, two were considered failures, and one had mixed results. Miscommunication and misunderstandings about the purposes and objectives of the WIL impacted the success of some of the placements (Pym et al., 2014). Despite the challenges, Pym et al. (2014) reported benefits for students including furthering their research, improving personal networks, obtaining experience and certifications to improve employability, and gaining insight into different career opportunities.

Of the six research studies with primarily positive outcomes, two focused on the initial pilot of WIL opportunities (Hodgson et al., 2013; Jones & Warnock, 2015). In both pilots, resources and working knowledge from existing WIL programs at the undergraduate level were effectively utilized to speed up the implementation. While Hodgson et al. (2013) published their research study before the pilot was completed, Jones and Warnock (2015) reported a successful pilot where students reported improved transversal skills and awareness of different career opportunities.

The WIL opportunities that Stamati and Willmott (2023), Schnoes et al. (2018), and Chatterjee et al. (2019) studied also reported improved employability, transversal skills, and awareness of different career opportunities as the main benefits of participation for students. Additionally, Stamati and Willmott reported improved subject-specific knowledge and opportunities for students to practice research in a new context while Chatterjee et al. and Schnoes et al. reported improved confidence in choosing a career path. Further, Schnoes et al. reported no significant impact on time-to-degree for students who engaged in the WIL opportunities compared to students who did not participate in the program. This finding may alleviate some concerns that participation in WIL could lead to delays in obtaining a doctoral degree.

Finally, Romasanta et al. (2020) looked at an innovative training network (ITN) where students participated in academic or industry-based secondments. The WIL was reported as the most helpful component of the ITN and benefits included broadening overall knowledge and improving specific knowledge based on exposure to best practices (Romasanta et al., 2020).

While this research has further advanced understanding of WIL opportunities for PhD students, it is limited to WIL opportunities that are organized by universities or research centers and excludes WIL opportunities organized by other sectors. Fortunately, details about other WIL opportunities for PhD students are available online and grey literature can be reviewed to better understand how WIL is implemented for PhD students.

The remainder of this paper will seek to answer the exploratory research questions:

RQ1: What are the specificities of WIL aimed at PhD students?

RQ2: Are there any patterns found across the variability and range of possibilities for WIL opportunities aimed at PhD students?

METHODS

This paper focuses on reviewing literature and grey literature to begin to understand the scope of WIL opportunities aimed at PhD students. The aim of the research was not to provide a conclusive analysis of all WIL opportunities but, instead, to explore and learn about a range of WIL opportunities available to PhD students. It forms part of the initial stage of a larger research study focusing on understanding and evaluating WIL opportunities in research-based doctorates in Ireland. This paper is constrained by the scope of the larger research study and, as such, the data collection excluded WIL opportunities that were aimed at doctoral students in professional practice fields, such as medicine, dentistry, or social work and industrial doctorates, where a primary focus of the degree is cross-sector collaboration. Additionally, the data included only English-language content from Europe, North America, Australia, and New Zealand. The type of data collected ranges from academic research to grey literature, governmental and industry-funded reports, guidelines, placement advertisements, and websites from HEIs, employers, and funders.

Keyword searches were used to search databases in Google Scholar and EBSCOhost Collections as well as general web searches using Google Advanced Search. The keywords were selected after reading several papers about the general topic. The searches were constructed by concatenating the keywords with the Boolean operators, "OR" and "AND". Table 1. shows the keywords used in this search.

TABLE 1: Keyword search.

Topic	Keywords
WIL:	work placement, work-integrated learning, practicum, placement, internship, professional practice, secondment, work experience, experiential learning, apprenticeship, co-op, collaboration, partnership
PhD:	PhD, doctorate, doctoral, research degree

Additionally, hand-picking was used by seeking out programs mentioned in academic research and browsing HEI, funder, and employer websites for relevant information. However, no requests for additional information were made. In total, 56 WIL opportunities were identified and, after further review and indexing, 54 WIL opportunities were included in the analysis.

The data was analyzed using the five-stage Framework approach, comprising of familiarization, identifying a framework, indexing, charting, and mapping and interpretation (Spencer & Ritchie, 1994). This approach was selected because it is oriented towards pragmatic policy research, allows for changes and amendments throughout the analysis, and is systematic and comprehensive (Spencer & Ritchie, 1994). Zotero was used to track the collected data and tables were created to store and review the data in Microsoft Word and Excel. During the familiarization stage, all the identified WIL opportunities were reviewed, and preliminary headings were created from *a priori* basic information about opportunities, important concepts specific to doctoral education mentioned in the literature, such as type of learning development, including if a student strengthens existing knowledge or creates new knowledge as discussed by Jones and Warnock (2015), border crossing, including if a student crosses

sector or discipline boundaries as mentioned by Enders (2005), and themes that emerged from the data. Next, a thematic framework was identified based on the data available across the opportunities and an index was created to label and code the opportunities. The preliminary headings were updated and indexes under each heading were added according to expected information based on existing knowledge about the topic and the information that was seen most frequently across the WIL opportunities. Table 2. shows the index that was used to code the data.

TABLE 2: Index for work-integrated learning opportunities.

Headings	Indexes					
Border Crossing:	Across sector	Across discipline	Either (open to border crossing or not)	No border crossing		
Optionality:	Mandatory (part of graduation requirements)	Optional credited (credited, optional within program)	Optional uncredited (uncredited, not a requirement or credit option within program)			
Relation to thesis:	Related directly (work aligns with research topic and may potentially contribute to thesis)	Related indirectly (work is related to research topic but probably will not contribute to thesis)	Unrelated (work is unrelated to research topic and probably will not contribute to thesis)	Any/open	Not specified	
Type of work:	Academic research	Non-academic research	Any other type of work	Any/open	Not specified	
Type of Learning Development:	Vertical (contributes to existing knowledge, deepens it)	Horizontal (creates new knowledge, cross-discipline, new)	Both vertical and horizontal	Not specified		
Length:	Less than three months	Three months to six months	Over six months to twelve months	Over twelve months	Varies/open-ended	Not specified
Partner:	Partner organized through HEI (students may not choose own)	Partner organized by student (HEI does not provide potential partners)	Flexible partner organization (HEI offer potential partner opportunities or students may find own partner external to HEI)	Not specified		
Timing:	Anytime during doctorate	After thesis is submitted	During first year	During second year or later	Not specified	
Full-time:	Full-time	Part-time	Either full-time or part-time	Not specified		
Compensation	Paid	Unpaid	Dependent on placement partner	Not specified		
Location:	In-person	Virtual	Hybrid (both in-person and virtual components)	Not specified		

Next, indexing was completed by applying the thematic framework to the data and assigning alpha-numerical codes to each index for tracking. Two WIL opportunities were eliminated from the analysis as there was not enough information found to index them to most of the headings. Then, the data was charted and reviewed. Finally, mapping and interpretation was completed to gain an overall understanding of the WIL opportunities available to PhD students and what they look like in practice.

FINDINGS

The findings are broken into four sections. First, an overview of the most common indexes for each heading are described to give a broad picture of the findings. Secondly, the focus of WIL is highlighted, and the WIL opportunities are reviewed against whether they promote border crossing. Third, the involvement of the HEIs is considered in the context of optionality and how the partner is selected. Finally, the practicalities, such as length, timing, and compensation are considered.

Overview

The following are the most common indexes, where specified, for each heading found across the 54 WIL opportunities:

- Border crossing: Yes, across sectors (n = 38)
- Optionality: Optional uncredited (n = 29)
- Relation to thesis: Unrelated (n = 12)
- Type of work: Non-academic research or Any other type of work (n = 18)
- Type of Learning development: Horizontal (n = 23)
- Length: 3 months to 6 months (n = 25)
- Partner: Partner organized through HEI (n = 18)
- Timing: During 2nd year or later (n = 23)
- Full-time: Yes full-time (n = 14)
- Compensation: Paid: Paid (n = 35)
- Location: In person (n = 18)

From this an overall picture emerges of WIL opportunities for PhD students that are noncompulsory and provide students with opportunities to engage in relatively short-term, paid work outside of academic research.

Focus of Work-Integrated Learning

The WIL opportunities were reviewed based on whether they promote border crossing to students as part of the WIL opportunity. Border crossing involves the PhD student crossing sector or discipline boundaries (Enders, 2005) to engage in a WIL opportunity outside academia (cross-sector) or in a different discipline from the student's research area (cross-discipline). The results indicate that border crossing is a key aspect of WIL opportunities. The majority, 74% (n = 40), of the WIL opportunities promoted border crossing. Of the opportunities that promoted border crossing, the majority (n = 38) promoted cross-sector border crossing rather than cross-discipline border crossing (n = 2).

Table 3. groups together relation to thesis, type of work, and type of learning development and compares them across WIL opportunities that promote border crossing across either sector or discipline (n = 40), opportunities that allow for border crossing but do not require it (n = 11), opportunities that do not allow for border crossing (n = 2), and opportunities that are not specified (n = 1).

TABLE 3: Focus of work-integrated learning.

	Border Crossing- Across sector or discipline (n = 40)	Either- Open to border crossing or not (n = 11)	No Border Crossing (n = 2)	Not specified (n = 1)
Relation to thesis:	Related directly (n = 3) Related directly or indirectly (n = 3) Related indirectly (n = 2) Related indirectly or unrelated (n = 6) Unrelated (n = 12) Any/open (n = 7) Not specified (n = 7)	Related directly or indirectly (n = 2) Related indirectly or unrelated (n = 2) Any/open (n = 3) Not specified (n = 4)	Related directly (n = 1) Related directly or indirectly (n = 1)	Not specified (n = 1)
Type of work:	Academic research (n = 1) Academic research or non-academic research (n = 3) Non-Academic research (n = 4) Non-academic research or Any other type of work (n = 16) Any other type of work (n = 10) Any/open (n = 4) Not specified (n = 2)	Non-academic research or Any other type of work (n = 2) Any/open (n = 8) Not specified (n = 1)	Academic research (n = 2)	Not specified (n = 1)
Type of learning development:	Vertical (n = 1) Horizontal (n = 20) Both vertical and horizontal (n = 18) Not specified (n = 1)	Horizontal (n = 3) Both vertical and horizontal (n = 3) Not specified (n = 5)	Vertical (n = 2)	Not specified (n = 1)

According to Guile and Griffiths (2001), WIL encompasses two distinct types of learning called vertical development and horizontal development. Vertical development involves developing and deepening existing knowledge and skills while horizontal development involves crossing boundaries of knowledge by moving into a different realm of knowledge such as a new sector or using transferable skills in a new way. This concept of learning development types was utilized by Jones and Warnock (2015) to decipher between the two types of internships available in doctoral programmes. It is hypothesized that if a WIL opportunity promotes vertical development, it will be related to the student's thesis while if a WIL opportunity promotes horizontal development, it will be unrelated to the student's thesis.

If border crossing is promoted, the WIL opportunity is more likely to be unrelated to the student's thesis, involve non-academic research or any other types of work over academic research, and promote horizontal or both horizontal and vertical learning development. These types of opportunities include both WIL opportunities organized by external providers such as the World Bank's Bank Internship Program (BIP) and Pinterest Careers Internship PhD programs, and WIL opportunities organized by HEIs such as the University of Illinois Urbana at Champaign Humanities Without Walls Summer Bridge Program and the White Rose Mechanistic Biology Doctoral Training Partnership (DTP) Professional Internships for PhD Students (PIPS). In these WIL opportunities, the benefits of applying academic skills to new settings (HWW Humanities Without Walls, 2023), exploring new careers (HWW Humanities Without Walls, 2023; White Rose Mechanistic Biology DTP, n.d.), skills development, and gaining work experience (HWW Humanities Without Walls, 2023; White Rose Mechanistic Biology DTP, n.d.; World Bank, n.d.) are emphasized.

Opportunities that are flexible and allow for border crossing but do not require it, are similarly flexible regarding whether the WIL opportunity is related to the student's thesis, the type of work undertaken, and the type of learning development. This type of flexibility is exemplified in the FRAGNET secondments where students could either enhance and deepen their existing knowledge on the subject of their thesis with a secondment in the same field or directly-related to their thesis or could broaden their overall knowledge and engage in new learning with a secondment in a different field or topic to their research (Romasanta et al., 2020). Similarly, the Science Foundation Ireland (SFI) Centre for Research Training in Advanced Networks for Sustainable Societies (ADVANCE) purports to be student-led and allows students to choose what type of WIL opportunity is most appropriate to their career goals and educational journey.

Conversely, opportunities that do not promote border crossing are more likely to be related to the student's thesis, involve academic research, and promote vertical learning development where existing knowledge is strengthened. The focus is on furthering original academic research and research-related skills in both the United Nations University UNU-WIDER Visiting PhD Fellowship Program and the CWI Centrum Wiskunde & Informatica Internships for PhD Students.

Involvement of Higher Education Institutions

Optional uncredited (n = 29) opportunities were, overall, most prominent across all WIL opportunities. Table 4 considers the impact of optionality on whether the host partner in a WIL opportunity is organized by the HEI or if the students choose partners.

TABLE 4: Involvement of higher education institutions.

	Mandatory (n = 18)	Optional credited (n = 7)	Optional uncredited (n = 29)
Partner	Partner organized through HEI (n = 10) Partner organized through student (n = 2) Flexible partner organization (n = 2) Not specified (n = 4)	Partner organized through HEI (n = 2) Partner organized through student (n = 2) Flexible partner organization (n = 3)	Partner organized through HEI (n = 6) Partner organized through student (n = 12) Flexible partner organization (n = 9) Not specified (n = 2)

If a WIL opportunity is mandatory, it is assumed that it has been included in the PhD for a reason and will, in some way, contribute to the aims and objectives of the PhD program. As such, it is expected that HEIs will also want to influence other aspects of these WIL opportunities, including choice of host partners. Table 4 shows that mandatory WIL opportunities tend to have the partners organized by the HEI. Examples of mandatory WIL opportunities where the partners are organized by the HEI include Marie Curie ITNs in The Post-Crisis Legitimacy of the European Union (PLATO) and QUADRAT Doctoral Training Partnership (DTP) Collaborative Awards in Science and Engineering Studentships (CASE).

Conversely, Table 4 shows that in the optional uncredited WIL opportunities, which would be expected to have less oversight from HEIs, students tend to select partners. This is expected as many of the optional uncredited WIL opportunities are organized by external providers, such as Twitter and Norges Bank, and are outside of the remit of HEIs. However, HEIs do organize some optional and uncredited WIL opportunities too. In these WIL opportunities, the partner selection varies with partners organized by the HEI in the case of the Boston University PhD Internships in the Humanities and flexible partner organization through an internship portal or the student's own connections and research in the case of Western University Graduate Student Internship Program. Other optional uncredited WIL opportunities providers work closely with HEIs but are, ultimately, external providers and unable to provide credits themselves such as Australian Postgraduate Research Intern and Mitacs Accelerate. In these two cases, partner organization is flexible. Students can source their own partners, with guidance from the HEI, or apply to posted projects and partners.

Finally, Table 4 indicates that optional credited WIL opportunities tend to have partners organized by either the HEIs or the students. Optional credited WIL opportunities have HEI input, but participation is not required for graduation and students self-select to participate. Examples include Karolinska Institutet Internship Projects for PhD students where the partners are organized by the HEI, University of California San Francisco (UCSF) Internships and Experiential Learning Course where the students organize their partners (although networking opportunities are provided by the HEI), and McGill University Doctoral Internship Program (DIP) where students either organize their own partners or apply to opportunities posted by the HEI.

Practicalities of Work-Integrated Learning

The indexes created around the practicalities of the WIL opportunities, including length, compensation, timing, location, and full-time basis, are less comprehensive than the other indexes of this study. As seen in Table 5, Not specified is used when there was insufficient data to provide an index for a particular WIL opportunity. However, Table 5. may still be helpful to understand some of the other features and variability of WIL opportunities.

TABLE 5: Practicalities of work-integrated learning.

Length:	Less than three months (n = 10)
	Three months to six months (n = 25)
	Less than six months (n = 7)
	Three months to twelve months (n = 3)
	Three months to over twelve months (n = 2)
	Six months to over twelve months (n = 1)
	Varies (n = 6)
Compensation:	Paid (n = 35)
	Dependent on placement partner (n = 2)
	Not specified (n = 17)
Timing:	Anytime during PhD (n = 17)
	During first year (n = 2)
	During second year or later (n = 23)
	Not specified (n = 12)
Location:	In-person (n = 18)
	Virtual (n = 2)
	Hybrid (n = 4)
	Not specified (n = 30)
Full-time:	Full-time (n = 14)
	Part-time (n = 8)
	Either full or part time (n = 10)
	Not specified (n = 22)

Table 5 shows that the majority of WIL opportunities are 3 to 6 months in length (n = 25). In terms of compensation, the majority of WIL opportunities indicated that they were paid, either through the student's existing stipend such as in the Cambridge Biosciences Doctoral Training Partnerships (DTP) Professional Internships for PhD Students (PIPS) (although exceptions exist if the host partner has a conflicting policy on payments), by the placement partner such as in Microsoft PhD internships, or through a mixture of placement partner and program funding such as in the Mitacs Accelerate Program. The most common timing for the WIL opportunities was during second year of the PhD or later (n = 23) followed by anytime during the PhD (n = 17). Limited data was found for both location and full-time basis. However, if data was available, location was most likely to be in-person (n = 18) and the opportunity was likely to be on a full-time basis (n = 14).

DISCUSSION

The context surrounding the inclusion of WIL in doctoral education points to concerns that the type of knowledge and experience that PhD students develop during their education is inadequate for the job market that awaits them post-graduation. PhD students are expected to excel at original research in addition to a variety of other requirements aimed at creating graduates for the future who are capable of working across subject matter, sector, and geographic boundaries (Balaban, 2020). However, there is a risk that PhD graduates are too academically focused, removed from real-world issues, and lacking the skills needed for employment outside of HEI (Cuthbert & Molla, 2015; Tavares et al., 2020). One potential solution is to mitigate this risk through the inclusion of opportunities that promote mode 2 knowledge production in doctoral education. While mode 1 knowledge refers to the type of disciplinary knowledge generally associated with academic research, mode 2 knowledge encompasses

all of the transdisciplinary knowledge that emerges through application and stresses the importance of context (Gibbons et al., 1994). The type of knowledge used in the workplace and across disciplines tends towards mode 2 knowledge (Tennant, 2004) and, therefore, the inclusion of WIL in doctoral education may better prepare PhD students for their future after graduation by enhancing employability (EUA-CDE, 2016; McGagh et al., 2016), providing work experience (Diamond et al., 2014; McGagh et al., 2016), introducing students to different career paths (Diamond et al., 2014; EUA-CDE, 2016), and enhancing cross-sector collaboration (EUA-CDE, 2016). However, policies that advocate for the development of mode 2 knowledge through WIL opportunities, are not clear enough regarding the specifics of how the WIL opportunities should be designed and implemented to maximize these potential benefits. This lack of clarity may be related to the limited literature and research currently available on the specificities of WIL for PhD students.

Research surrounding the inclusion of WIL in doctoral education generally explores the benefits and challenges of implementing or participating in WIL. This current research differs in that it uses a framework approach to review and analyze existing WIL opportunities in the context of doctoral education. It provides a wide view of the WIL opportunities available to PhD students and, specifically, how opportunities vary. While this research identified border crossing as a core feature of WIL at the doctoral level, it also found that PhD WIL opportunities vary widely. A wide range of differences were found relating to the focus of the WIL opportunities, the involvement of the HEIs in the implementation of the WIL opportunities, and the practicalities, such as timing and length, of the WIL opportunities. These factors have the potential to impact how immersed students become in the WIL and the role the WIL opportunity has within their overall doctoral education. As such, generalizations about how WIL, overall, could be a beneficial addition to doctoral education should be avoided unless referring to specific instances of WIL which have been evaluated by stakeholders.

Fewer than half of the 54 opportunities reviewed were mandatory or credited WIL opportunities ($n = 25$) or had the placement host partner solely organized by the HEI ($n = 18$). This suggests that while WIL opportunities provide opportunities to engage in mode 2 knowledge, HEIs might not be adequately involved in their design or implementation to ensure that they align with and compliment other aspects of doctoral education. Both attitude changes across HEIs about the potential role of WIL in doctoral education as well as quality assurance may be needed to ensure that WIL is appropriate and meaningful for PhD students. A number of different frameworks for quality assurance exist for evaluating WIL (Campbell et al., 2021; McRae et al., 2018; Simper et al., 2018) that could be amended to apply to WIL at the doctoral level. While this is out of the scope of this paper, the variety of WIL opportunities reviewed in this research indicate a need for quality assurance and a common definition of doctoral-level WIL.

CONCLUSION

WIL is assumed to be beneficial in all education programs, but little research is available detailing the structure or impact of WIL at the doctoral level. This paper seeks to address a gap in understanding the range and variability of practical implementations of WIL at the doctoral level. The findings suggest that, while WIL opportunities vary widely, overall patterns emerge to indicate that WIL opportunities tend to be optional, paid, relatively short-term, focused on horizontal learning development, and boundary crossing outside of academia. These features indicate that the addition of WIL may enhance doctoral education by providing opportunities for mode 2 knowledge production, transferable skills training, and enhanced cross-sector collaboration. However, as the WIL opportunities were found to be largely optional, there is room for HEIs to consider making them more integral parts of doctoral

education. While this preliminary research showcases the range of existing WIL available to PhD students, further research is needed to understand how the different features of WIL opportunities impact participants and stakeholders and to evaluate which features are most beneficial to the type of learning development being sought. The features identified in this research will inform future stages of a larger research study, including empirical research, focused on WIL opportunities in research-based doctorates in Ireland.

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REFERENCES

- Balaban, C. (2020). Diversifying the missions and expectations of doctoral education: Are we losing the distinctive 'added value' of the PhD? In S. Cardoso, O. Tavares, C. Sin, & T. Carvalho (Eds.), *Structural and institutional transformations in doctoral education: Social, political and student expectations* (pp. 325–345). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-38046-5_11
- Campbell, M., Russell, L., & Thomson, K. (2021). The construction and testing of a framework to assure the institutional quality of work-integrated learning. *International Journal of Work-Integrated Learning*, 22(4), 505–509.
- Cardoso, S., Santos, S., Diogo, S., Soares, D., & Carvalho, T. (2022). The transformation of doctoral education: A systematic literature review. *Higher Education*, 84(4), 885–908. <https://doi.org/10.1007/s10734-021-00805-5>
- Chatterjee, D., Ford, J. K., Rojewski, J., & Watts, S. W. (2019). Exploring the impact of formal internships on biomedical graduate and postgraduate careers: An interview study. *CBE—Life Sciences Education*, 18(2), Article 20. <https://doi.org/10.1187/cbe.18-09-0199>
- Cuthbert, D., & Molla, T. (2015). PhD crisis discourse: A critical approach to the framing of the problem and some Australian "solutions." *Higher Education* (00181560), 69(1), 33–53. <https://doi.org/10.1007/s10734-014-9760-y>
- Department of Education Skills and Employment. (2021). *Growing industry internships for research PhD students through the research training program—Implementation paper*. Australian Government. <https://www.education.gov.au/research-block-grants/resources/growing-industry-internships-research-phd-students-through-research-training-program-implementation>
- Diamond, A., Ball, C., Vorley, T., Hughes, T., Moreton, R., Howe, P., & Nathwani, T. (2014). *The impact of doctoral careers: Final Report*. CFE Research.
- Enders, J. (2005). Border crossings: Research training, knowledge dissemination and the transformation of academic work. *Higher Education*, 49(1–2), 119–133. <https://doi.org/10.1007/s10734-004-2917-3>
- EUA-CDE [European University Association-Council for Doctoral Education]. (2016). *Doctoral education—Taking Salzburg forward: Implementation and new challenges*. European University Association. <https://eua.eu/resources/publications/354:doctoral-education-taking-salzburg-forward-implementation-and-new-challenges.html>
- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The new production of knowledge: The dynamics of science and research in contemporary societies*. SAGE Publications.
- Guile, D., & Griffiths, T. (2001). Learning through work experience. *Journal of Education and Work*, 14(1), 113–131. <https://doi.org/10.1080/13639080020028738>
- Hancock, S. (2019). A future in the knowledge economy? Analysing the career strategies of doctoral scientists through the principles of game theory. *Higher Education* 78, 33–49. <https://doi.org/10.1007/s10734-018-0329-z>
- Harman, G. (2002). Producing PhD graduates in Australia for the knowledge economy. *Higher Education Research & Development*, 21(2), 179–190. <https://doi.org/10.1080/07294360220144097>
- Harvey, V. (2022). *Graduate outcomes :Where to next? Employment outcomes for doctoral graduates 2017, 2018 and 2020*. Higher Education Authority. <https://hea.ie/assets/uploads/2022/04/Info-Byte-III-Doctoral-Graduates-Info-Byte.pdf>
- Hasgall, A., Saenen, B., & Borrell-Damian, L. (2019). *Doctoral education in Europe today: Approaches and institutional structures. Survey*. European University Association.
- Hodgson, E., Potter, T., & Walchli, J. (2013). Making it work: Piloting co-operative education for English PhD students at UBC. *ESC: English Studies in Canada*, 39(4), 9–12. <https://doi.org/10.1353/esc.2013.0044>
- HWW Humanities Without Walls. (2023, March 1). *Summer bridge program call for applications*. Humanities Without Walls University of Illinois at Urbana-Champaign. <https://www.humanitieswithoutwalls.illinois.edu/summer-bridge-program/summer-bridge-program-call-applications>

- Jackson, D. (2018). Challenges and strategies for assessing student workplace performance during work-integrated learning. *Assessment & Evaluation in Higher Education*, 43(4), 555–570. <https://doi.org/10.1080/02602938.2017.1378618>
- Jackson, D., Rowbottom, D., Ferns, S., & McLaren, D. (2017). Employer understanding of work-integrated learning and the challenges of engaging in work placement opportunities. *Studies in Continuing Education*, 39(1), 35–51. <https://doi.org/10.1080/0158037X.2016.1228624>
- Jones, H. M., & Warnock, L. J. (2015). When a PhD is not enough: A case study of a UK internship programme to enhance the employability of doctoral researchers. *Higher Education, Skills and Work-Based Learning*, 5(3), 212–227. <https://doi.org/10.1108/HESWBL-05-2014-0013>
- Lyons, K., Seini, M., West, C. C., Rashidi, P., Freeman, C., Ryall, G., Chen, S., & Vu, C. (2022). Postgraduate work-integrated learning: Using diversity to prepare graduates for a messy and uncertain world. *International Journal of Work-Integrated Learning*, 23(4), 595–605.
- McGagh, J., Marsh, H., Western, M., Thomas, P., Hastings, A., Mihailova, M., & Wenham, M. (2016). *Review of Australia's research training system: Final report*. Australian Council of Learned Academies.
- McRae, N., Pretti, T. J., & Church, D. (2018). *Work-integrated learning quality framework, AAA*. University of Waterloo, Centre for the Advancement of Cooperative Education. https://cewilcanada.ca/common/Uploaded%20files/Public%20Resources/Resource%20Hub/wil_quality_framework_ - aaa - for posting.pdf
- Minocha, S., Hristov, D., & Reynolds, M. (2017). From graduate employability to employment: Policy and practice in UK higher education. *International Journal of Training and Development*, 21(3), 235–248. <https://doi.org/10.1111/ijtd.12105>
- Olsson, A. K., Bernhard, I., Arvemo, T., & Lundh Snis, U. (2020). A conceptual model for university-society research collaboration facilitating societal impact for local innovation. *European Journal of Innovation Management*, 24(4), 1335–1353. <https://doi.org/10.1108/EJIM-04-2020-0159>
- Paschke, M., & Zurgilgen, K. (2019). Science-policy boundary work by early-stage researchers: Recommendations for teaching, internships and knowledge transfer. *GAIA - Ecological Perspectives for Science and Society*, 28(3), 310–315. <https://doi.org/10.14512/gaia.28.3.13>
- Porter, S. D., & Phelps, J. M. (2014). Beyond skills: An integrative approach to doctoral student preparation for diverse careers. *Canadian Journal of Higher Education*, 44(3), 54–67. <https://doi.org/10.47678/cjhe.v44i3.186038>
- Pym, A., González Núñez, G., Miquel-Iriarte, M., Ramos Pinto, S., Teixeira, C., & Tesseur, W. (2014). Work placements in doctoral research training in the humanities: Eight cases from translation studies. *Across Languages and Cultures*, 15(1), 1–23. <https://doi.org/10.1556/Acr.15.2014.1.1>
- Romasanta, A. K. S., van der Sijde, P. C., Smit, M. J., de Esch, I. J. P., Jahnke, W., & van Muijlwijk-Koezen, J. E. (2020). Career development in fragment-based drug discovery. *Drug Discovery Today: Technologies*, 37, 107–116. <https://doi.org/10.1016/j.ddtec.2020.10.001>
- Schnoes, A. M., Caliendo, A., Morand, J., Dillinger, T., Naffziger-Hirsch, M., Moses, B., Gibeling, J. C., Yamamoto, K. R., Lindstaedt, B., McGee, R., & O'Brien, T. C. (2018). Internship experiences contribute to confident career decision making for doctoral students in the life sciences. *CBE – Life Sciences Education*, 17(1), Article 16. <https://doi.org/10.1187/cbe.17-08-0164>
- Sharmini, S., & Spronken-Smith, R. (2019). The PhD – is it out of alignment? *Higher Education Research & Development*, 39(4), 821–833. <https://doi.org/10.1080/07294360.2019.1693514>
- Sheridan, I., & Linehan, M. (2013). *A partnership approach to work placement in higher education*. REAP: National Network for Enterprise Engagement.
- Simper, N., Gauthier, L., & Scott, J. (2018). Student learning in the workplace: The Learning Evaluation and Reflections Narrative (LEARN) framework. *Journal of Workplace Learning*, 30(8), 658–671. <https://doi.org/10.1108/JWL-04-2018-0060>
- Spencer, J., & Ritchie, L. (1994). Qualitative data analysis for applied policy research. In A. Bryman & R. G. Burgess (Eds.), *Analyzing qualitative data* (pp. 173–194). Taylor & Francis.
- Stamati, K., & Willmott, L. (2023). Preparing UK PhD students towards employability: A social science internship programme to enhance workplace skills. *Journal of Further and Higher Education*, 47(2), 151–166. <https://doi.org/10.1080/0309877X.2022.2102411>
- Tavares, O., Sin, C., & Soares, D. (2020). Building bridges between industry and academia: What is the profile of an industrial doctorate student? In S. Cardoso, O. Tavares, C. Sin, & T. Carvalho (Eds.), *Structural and institutional transformations in doctoral education: Social, political and student expectations* (pp. 347–373). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-38046-5_12
- Tennant, M. (2004). Doctoring the knowledge worker. *Studies in Continuing Education*, 26(3), 431–441. <https://doi.org/10.1080/0158037042000265971>
- Thune, T. (2007). University-industry collaboration: The network embeddedness approach. *Science & Public Policy (SPP)*, 34(3), 158–168. <https://doi.org/10.3152/030234207X206902>
- Thune, T. (2009). Doctoral students on the university-industry interface: A review of the literature. *Higher Education*, 58(5), 637–651. <https://doi.org/10.1007/s10734-009-9214-0>

- Thune, T. (2010). The training of “triple helix workers”? Doctoral students in university-industry-government collaborations. *Minerva: A Review of Science, Learning & Policy*, 48, 463–483. <https://doi.org/10.1007/s11024-010-9158-7>
- Valencia-Forrester, F. (2019). Internships and the PhD: Is this the future direction of work-integrated learning in Australia? *International Journal of Work-Integrated Learning*, 20(4), 389–400.
- White Rose Mechanistic Biology DTP. (n.d.). *What are PIPS?* Retrieved December 22, 2021, from <https://www.whiterose-mechanisticbiology-dtp.ac.uk/pips/>
- World Bank. (n.d.). *Internship - The bank internship program (BIP)*. Retrieved November 27, 2022, from <https://www.worldbank.org/en/about/careers/programs-and-internships/internship>