Student Research as a Means to Closing the Gap Between Theory and Practice in Education

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Abstract

Educational institutions face challenges of bridging gaps between teaching, research, and practice to ensure that students' knowledge and competencies are current and relevant to practitioner communities. Research apprenticeship is a student research model that supports students in becoming knowledgeable and competent members of the IS research community of practice. In this paper, I present the model and a survey among IS graduates to evaluate their learning outcomes based on the Researcher Development Framework. Responses are analyzed based on the concepts of "legitimate peripheral participation" and "community of practice." Results show that the model supports students in becoming legitimate members of the IS research community of practice and acquiring domain knowledge and competencies that IS practitioners value. The model thereby helps to reduce the practice-research gap. I discuss the implications and provide suggestions for both educators and practitioners.

Keywords: Student Research, Situated Learning, Legitimate Peripheral Participation, Community of Practice.

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Sune Dueholm Müller

1. INTRODUCTION

Information Systems (IS) is an applied science field (Orlikowski & Barley, 2001) that strives for practical relevance (Topi et al., 2017). It has, for example, been described as "a profession-based discipline that constantly seeks new ways to bridge the practice-research gap" (Mathiassen & Sandberg, 2013, p. 475). However, our current understanding of how to bridge the research-practice gap, especially regarding the role of "boundary spanners," is lacking (Abraham et al., 2021). However, extant research shows that the gap between teaching, research, and practice can be bridged by, among other things, involving students in projects across the institutional boundaries that separate academic research and industrial practice (Mathiassen & Sandberg, 2013). This involvement increases the likelihood of graduates having the knowledge and competencies practitioner communities demand. Motivated by an interest in better understanding how to involve students in research, facilitate their role as boundary spanners, and thereby bridge the gap, I have developed the research apprenticeship model (Müller, 2022) and evaluate it from the point of view of former students who are now practitioners and are hence capable of commenting on the model's effectiveness in reducing this gap. My research shows that allowing students to participate in research and the sociocultural practices of the community helps them eventually become knowledgeable and competent community members and makes them more skilled practitioners.

This paper is a student-centered evaluation of the research apprenticeship model introduced by Müller (2022). The purpose is to expand on that work from a student perspective. Both papers present the so-called research apprenticeship model as a framework for integrating student research into existing study programs and teaching practices. Where the Müller (2022) paper discusses the benefits of the model through personal reflections, this paper evaluates it through a graduate survey of former students' self-reported learning outcomes. The papers share a substantial amount of content and ideas. Both papers focus on student research to bridge the gap between research and practice in the IS field, discuss the concept and role of "legitimate peripheral participation" in student learning, and describe the research apprenticeship model. This overlap ensures that both are self-contained and independent papers. Despite this overlap in content, they address different aspects of student research within IS and present distinct evaluations.

The learning benefits of student research have been of scholarly interest for years (Obwegeser & Papadopoulos, 2016). Different means of involving students have been suggested, emphasizing integrating research activities into existing course structures (Tams, 2014). According to the AIS Global IS Education Report, some universities integrate student research into their educational offerings (vom Brocke et al., 2020), for example, through the Research Experiences for Undergraduates (REU) program (Granger et al., 2006), which supports undergraduate students' active participation in the areas of research funded by the National Science Foundation. However, knowledge of how to involve students in practice-relevant research and, in turn, strengthen their competencies toward becoming knowledgeable and competent practitioners is lacking. Whereas extant literature focuses on incorporating research activities into existing courses (Holland & Garfield, 2012; Mustafa, 2004; Obwegeser & Papadopoulos, 2016), this paper contributes to state-of-the-art knowledge of student research (Symonds & Cater-Steel, 2009; van Toorn et al., 2011).

Recently, educational institutions are moving from a teacher-centered educational paradigm to a learner-centered paradigm (Saulnier et al., 2008). The learner-centered paradigm is particularly important in IS education because it allows for the flexible integration of new knowledge into teaching practices (Landry et al., 2019) to bridge the gap between academic research and real-world practice. Student research allows for this integration (Saulnier et al., 2008) and encourages "faculty to participate in a community of practice centered on learner-centered, outcomes-based approaches for IS" (Landry et al., 2019, p. 178).

In (Müller, 2022), I address the need for knowledge of how to involve students in practice-relevant research by discussing my experiences with the research apprenticeship model. This model entails participation in real-world projects and master-apprentice collaboration through which students learn the ropes of research and acquire practice-relevant knowledge and competencies. In this paper, I evaluate the model from a student, i.e., a learner-centered, perspective through a survey, guided by the following research question: To what extent does research apprenticeship support the acquisition of IS practice-relevant knowledge and competencies? I present and discuss the survey results and their implications and provide suggestions for educators and practitioners. As a result, the paper has two main contributions: (1) it showcases the features of the research apprenticeship model that bridge practice and research, and (2) it expounds on the learning process, which is described as legitimate peripheral participation, which fosters knowledge and competencies relevant to both research and practice.

2. BACKGROUND

In the following, I describe (1) the practice-research gap faced by the IS research and practitioner communities, (2) "legitimate peripheral participation" as the key to becoming a member of these communities, and (3) student research as a form of legitimate peripheral participation that bridges the practice-research gap.

The Practice-Research Gap

Even though the IS discipline strives to bridge the practice-research gap (Mathiassen & Sandberg, 2013), the gap is still widely acknowledged (Farhoomand, 1987; Grover & Sabherwal, 1989; Szajna, 1994). This gap manifests itself in the lack of practical relevance of IS research (Benbasat & Zmud, 1999; Westfall, 1999), misalignment between industry competency requirements and educational content (Beckman et al., 1997; Lippert & Anandarajan, 2004), divergent interests between researchers and practitioners (Gosain et al., 1997), and lack of communication and collaboration between the two groups (Desouza et al., 2006; Glass, 2001; Moody, 2000). Differences in terminology between the groups and "different incentive systems lead to different interests and hence to a 'pragmatic knowledge boundary' between IS researchers and IS practitioners" (Abraham et al., 2021, p. 365). Boundary spanners like student researchers are needed to overcome this pragmatic knowledge boundary.

Other mechanisms to bridge the gap include publications, education, and conferences (Nevill & Wood-Harper, 2001). Whereas publications and conferences are vehicles for disseminating research-based knowledge (Gosain et al., 1997; Nevill & Wood-Harper, 2001; Szajna, 1994) and for discussing its implications, education provides students with the knowledge and competencies to be bridge-builders between research and practice (Nevill & Wood-Harper, 2001; Pearson et al., 2005).

Diverging interests between researchers and practitioners (Lippert & Anandarajan, 2004) and the turnaround time of journals (Lyytinen, 1999; Moody, 2000) challenge the effectiveness of these mechanisms. Among the suggested solutions are accelerated publication processes (Benbasat & Zmud, 1999; Chen & Hirschheim, 2004), hands-on experience in the classroom (E. Watson & Schneider, 1999), and innovative partnerships between practitioners and researchers (H. Watson & Huber, 2000). Such partnerships may involve students participating in projects that seek to bridge real-world practice and academic research (Mathiassen & Sandberg, 2013).

"Boundary encounters" between researchers and practitioners are important for knowledge exchange and learning (Wenger, 1998). "Boundary encounters" fall into three categories: one-to-one, immersion, and delegation. Whereas one-to-one encounters are meetings between two members of different communities, immersion means site visits that involve greater exposure to a community, and delegation is purposeful and agreed-upon knowledge exchange. An example of a boundary encounter is a student engaging in design science research to bridge the gap between theoretical and practical knowledge (Venter et al. 2015) and to participate in the IS researcher and practitioner communities of practice.

Legitimate Peripheral Participation

According to Lave and Wenger (1991), "a community of practice is a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice. A community of practice is an intrinsic condition for the existence of knowledge, not least because it provides the interpretive support necessary for making sense of its heritage" (Lave & Wenger, 1991, p. 98). Figure 1 (high-resolution version in Appendix A) illustrates the concept of community of practice and its three constituent dimensions (adapted from (Wenger, 1998, p. 73)).

Mutual engagement, joint enterprise, and shared repertoire constitute three dimensions of practice and sources of community coherence, hence the wording "community of practice." Participation and learning along these three dimensions are needed to become peripheral and eventually fully-fledged community members. A community of practice thus "acts as a locally negotiated regime of competence. Within such a regime, knowing is no longer undefined. It can be defined as what would be recognized as competent participation in the practice" (Wenger, 1998, p. 137).

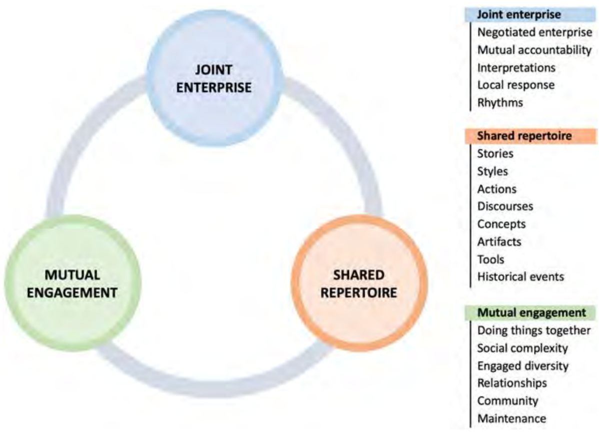

Figure 1: Communities of practice

Legitimate peripheral participation is a situated learning activity in which newcomers learn from veteran members by participating in the sociocultural practices of the community (Lave & Wenger, 1991). Consequently, legitimate peripheral participation describes learning by doing, i.e., that knowledge and competencies are acquired by a prospective community member ("apprentice" henceforth) by engaging in practice under the supervision of a domain expert (referred to as "master" in the following) who belongs to the community of practice. The quality of both learning and teaching (by the apprentice and master, respectively) depends on effectively managing "participation that provides for growth on the part of the student" (Lave & Wenger, 1991, p. 21). Through this participation, an apprentice becomes immersed in, learns, and adapts to the "culture of practice" associated with the community of practice.

Student Research as Legitimate Peripheral Participation

One way of bridging the practice-research gap is to involve students in projects across the boundaries that separate academic research from industrial practice (Mathiassen & Sandberg, 2013). This involvement may entail students engaging in research as legitimate peripheral participants and eventually becoming both knowledgeable and competent community members. Experiential learning projects help reduce the gap between academics and practitioners (Wu & Sankar, 2013), and "students are better prepared for the work-life as problem solvers, since they are familiar with a process for systematically solving problems" (Olsson et al., 2003, pp. 82–83) if they engage in research. Similarly, Bernat et al. (2000) argue that student research enables them to "develop domain expertise, gain an understanding and appreciation of the research process and its practice, and acquire team, communication, problem-solving, and higher-level thinking skills. Students with this experience are better equipped to make informed judgments about technical matters and to communicate and work in teams to solve complex problems" (Bernat et al., 2000, p. 17).

Research and teaching are mutually reinforcing learning processes (Obwegeser et al., 2016), and "students gain learning benefits when they are taught by active researchers and are engaged directly in research activities" (Obwegeser & Papadopoulos, 2016, p. 250). Integrating research components into IS curricula "can play an important role in improving student learning and refining student skills" (Moussawi & Vatanasakdakul, 2021, p. 9). Student research promotes cognitive and intellectual growth if students are intrinsically motivated (Parikh, 2002) and guided by an experienced researcher (Tams, 2014). By incorporating research into teaching, students take on an active role in their own learning, gaining opportunities to acquire domain knowledge and develop research skills (Natsis et al., 2018).

Despite its potential, extant IS literature on student research is limited. Exceptions include (1) the development of a conceptual research-to-practice framework to study the transfer of knowledge from research to practice (van Toorn et al., 2011) and (2) studies of various attempts at incorporating research elements into existing courses (Holland & Garfield, 2012; Mustafa, 2004; Obwegeser & Papadopoulos, 2016). Guidance is needed, e.g., in the form of "supportive elements added to a program to help students develop a higher level of understanding" (Holland & Garfield, 2012). More real-world examples and measures of the benefits of research-teaching integration are needed to bridge the practice-research gap (Obwegeser & Papadopoulos, 2016). This paper responds to these calls for research.

3. METHODOLOGY

The research apprenticeship model has been evaluated from the perspective of graduates through an online survey. I decided on a survey because (1) I wanted to include all 16 former apprentices I supervised over a 9-year period, many of whom are in different parts of the world. An online survey allows for easy and flexible data collection, increasing the likelihood of respondents agreeing to participate if they can complete a questionnaire at their convenience. (2) I also wanted to be able to continue data collection in the future to continually evaluate and improve the model. The purpose is not to derive statistically significant and generalizable results. The number of students engaging in research collaboration with faculty members yearly constitutes a small percentage of the entire student population. It is therefore not possible to generalize to the entire student population, but it is arguably possible to say something meaningful about those students who are actively doing research since all of them are included in the survey.

The Research Apprenticeship Model

The model targets ambitious IS students (apprentices henceforth) who want to contribute to science, undertake a research project, and write an academic paper during their final study year. Instead of writing a "normal" thesis (i.e., a monograph), I offer them a research apprenticeship during which they write a conference or journal paper. Research apprenticeship is offered to everybody but presented as very demanding, although highly educational, which ensures self-selection among prospective apprentices. It is demanding because of the imperative of knowledge creation associated with research. Meanwhile, the learning outcomes are high due to sparring and collaboration with research partners, including practitioners and myself as supervisor.

Apprentices either develop their own research ideas or join existing projects in which I am involved. They are invited to all project meetings with my research partners if they decide on the latter. The partners and I assist the students in defining their contribution to the overall project and gaining access to the selected unit of analysis (e.g., a hospital ward) and people (e.g., healthcare professionals) being investigated.

The apprentices carry out their investigation under my guidance. This investigation addresses real-world problems and often involves empirical studies and collaboration with practitioners. I advise and show them how I address similar challenges in my research practice. I am therefore involved in all phases and aspects of their project, from designing to carrying out studies. This hands-on approach involves, among other things, showing them how to conduct a literature review and collect and analyze data. In addition to individual supervision, the students participate in seminars that focus on (1) what research is and requires (in terms of, e.g., literature review and research design), (2) how to leverage the help of colleagues to advance one's research (through peer review), and (3) how to communicate the relevance and rigor of one's research (pitching results and contributions of studies).

I review draft versions of their papers 2-3 times before submission. I comment on the gradually maturing drafts at a detailed level and approach it as a normal paper review. In addition to high-level comments on the structure and content, I also provide in-depth comments at the sentence level. This communicates the requirements of a publishable paper and helps the apprentices improve the quality of their work. A pre-project agreement is made to publish the results of our collaboration in a publication with all contributing partners as co-authors. I do not edit or write on the paper before graduation to minimize conflicts of interest.

As part of their thesis, the apprentices submit a learning report reflecting on the research process, learning outcomes, and the implications of the investigations for practitioners and their future careers. The research apprenticeship model is described in detail in (Müller, 2022).

Survey

The survey (see Appendix D) is adapted from (Christensen & Tegtmejer, 2015) and consists of two parts: Motivation and competencies. The competency part is based on the Researcher Development Framework (RDF) (Vitae, 2011), which describes the competencies that researchers need. Other IS-specific frameworks include MSIS, a competency model for IS educational programs at the master's level (Topi et al., 2017). I decided, however, to rely on the RDF due to its particular focus on research-based competencies, to evaluate their relevance to practitioner communities (cf. the practice-research gap). The RDF is characterized as a professional development framework that "articulates the knowledge, behaviours and attributes of successful researchers" (Vitae, 2011, p. 1). The RDF is structured around four domains: (A) "Knowledge and intellectual abilities," (B) "Personal effectiveness," (C) "Research governance and organization," and (D) "Engagement, influence, and impact." The four domains are divided into 12 sub-domains and 63 descriptors that capture researcher competencies, including "the knowledge, intellectual abilities, techniques and professional standards to do research, as well as the personal qualities, knowledge and skills to work with others and ensure the wider impact of research" (Vitae, 2011, p. 2). Each descriptor is found at three to five stages of maturity, representing different levels of performance or development. Figure 2 (see Appendix A for a more detailed version) illustrates the RDF (adapted from (Evalueringscenteret, 1996)).

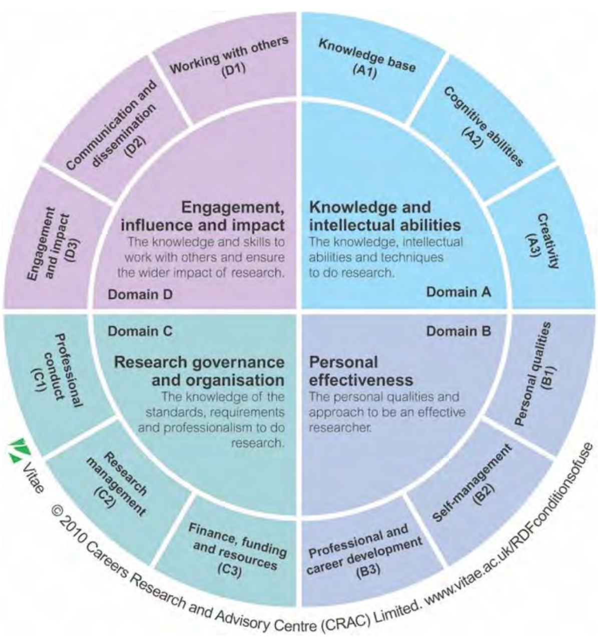

Figure 2: Researcher Development Framework

Each descriptor has been translated into one or more questions in the survey. First, each competency at stages 1-2 was summarized as one or more statements. Competencies at stages 3-5 were excluded as these are developed later in a research career. In total, 126 questions were reviewed by researchers from Aarhus University's Centre for Teaching and Learning (I developed the research apprenticeship model when I was employed there). 76 questions were selected, and a pilot test was performed on five student researchers (not part of this study). The test helped strengthen the internal validity and ensure that the questions were relevant, unequivocal, and comprehensible. The wording was carefully considered to reduce ambiguity (Olsen, 2001). Besides the test, it is worth mentioning that the motivation part of the survey has been validated previously (Herrmann et al., 2013).

For each question, respondents were asked to give two responses, one related to competency development during their apprenticeship and one related to competency use in their post-graduation employment. A Likert scale was used, but respondents could also provide qualitative comments. The motivation part of the survey includes questions regarding the background and incentive to do an apprenticeship, expectations, career plans, the research environment, and the quality and extent of supervision. The questions about expectations and motivation are inspired by (Evalueringscenteret, 1996), whereas the questions regarding the research environment and supervision are based on (Herrmann et al., 2013).

Data Collection and Analysis

The survey was distributed online. All 16 former research apprentices were contacted and asked to participate. All of them accepted and completed the survey. They were informed about the survey's purpose and length (30-45 minutes). Feedback from them indicates that they spent significantly more time because many of them provided in-depth elaborations. The survey was sent out in August 2020 and completed by October 2020. Reminders helped ensure a 100% response rate. There is a risk my close relationship with the former students may have influenced their responses. This risk has been mitigated by encouraging constructive criticism to help improve the research apprenticeship model.

To render respondents' answers measurable and comparable, each category of answers was assigned a value. For example, "to a slight degree / not at all" was assigned a value of (1), "to a lesser degree" (2), "to some degree" (3), and "to a large degree" (4). "Do not know" was coded as missing and was therefore not assigned a value. The average score of the 16 answers was then calculated for each statement with average scores potentially ranging from 1 to 4. Answers that indicate disagreement with the statement (values of 1-2) have a lower score, while answers that indicate agreement with the statement (values of 3-4) have a higher score. Regarding the competencies part of the survey, averages above three indicate respondents having acquired the competencies in question (according to their self-assessment). In addition to quantifying survey responses and calculating average scores, respondents' elaborations and explanations of their answers to the questions were analyzed. Their comments supported interpretations of survey responses and explanations of response patterns.

4. RESULTS

Below, the results are presented according to (1) motivation and (2) competencies (see Appendices B and C for details). The percentages in Table 1 and the text indicate the proportion of respondents who answered "agree" or "partially agree" to a question.

Motivation

The analysis reveals that the research apprentices are primarily motivated by the intellectual challenge associated with an apprenticeship (62.50%), the prospect of contributing new research-based knowledge (56.25%), and the possibility of doing research under the guidance of a faculty member (31.25%). They expected to publish a scientific paper (3.88), immerse themselves in a topic (3.81), acquire knowledge of research methods (3.56), gain research experience (3.44), and learn to work independently (3.13).

There is agreement among the apprentices that they feel respected as colleagues (92%), that senior researchers show an interest in their research (85%), that it is recognized as important (85%), and that there is a welcoming attitude toward questions from apprentices (73%). These numbers (Table 1; high-resolution version in Appendix A) indicate that they feel part of the IS research community.

Although all respondents receive supervision as needed on all aspects of their project, they are also encouraged to work independently (100%) and assume project management responsibility (94%). The relationship between master and apprentice is one of mutual respect (100%) and discussing challenges openly (100%). The apprentices feel acknowledged (100%) and that they are being listened to (94%).

	Disagree (1)	Partly disagree (2)	Neither / nor (3)	Partly agree (4)	Agree (5)	Do not know / not relevant (missing)	In sum	In sum minus missing	Partly agree + agree, %
1. In this place, I meet other research apprentices that I can verbally spar with.	0	2	3	7	4	0	16	16	69%
2. If one has a professional problem, one always feels welcome to ask one of the other researchers.	0	0	4	5	6	1	16	15	73%
3. I feel respected as a co-researcher in this place.	0	1	0	7	5	3	16	13	92%
4. There is a feeling of excitement around cooperating on research tasks.	0	0	3	6	5	2	16	14	79%
5. The permanent research staff is generally interested in hearing about my project.	0	0	2	3	8	3	16	13	85%
6. In this research environment, the research apprentices' research work is acknowledged even though it may not be pioneering.	0	1	1	6	5	3	16	13	85%
7. In this place, we regularly present and discuss each other's research.	1	2	3	2	1	7	16	9	33%
8. I experience that the researchers are tough and negative rather than constructive in their feedback on each other's work.	6	1	2	2	0	5	16	11	18%
9. People seem to be very competitive towards each other.	4	1	3	1	0	7	16	9	11%
10. One can speak openly about successes as well as failures with one's colleagues.	0	0	2	5	2	7	16	9	78%
11. I feel that I am part of a research community in this place.	4	1	4	2	0	5	16	11	18%
12. In this place, good arguments are welcomed no matter whether they are from an apprentice, PhD student or professor.	0	0	3	3	5	5	16	11	73%
13. Physically, I spend most of my research time outside the research environment (e.g., at home or with a company).	3	2	2	1	8	0	16	16	56%

Table 1: The research environment

The research apprentices feel ownership (94%) of their project and find it very interesting (100%). Although some of them are unsure if they are sufficiently competent (38%) and worry about whether their work is good enough (50%), they are very satisfied with the learning outcomes (100%), the product quality of their work (100%), and their supervision (94%).

Figure 3 (high-resolution version in Appendix A) provides a visual overview of the results. It shows that the research community is characterized by mutual respect, a welcoming attitude, open dialogue, cooperation among apprentices and senior researchers, and genuine interest in and acknowledgment of apprentices' work.

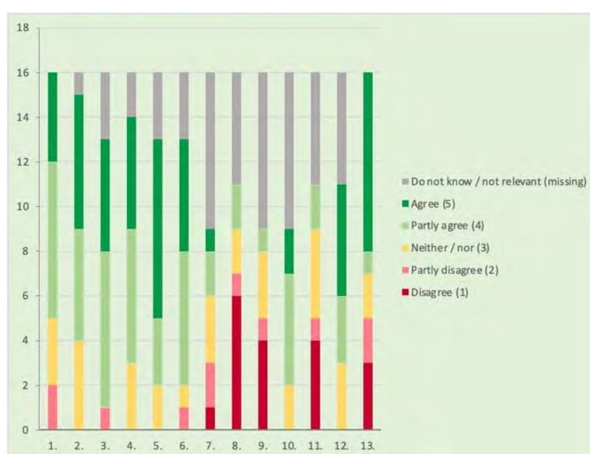

Figure 3: The research environment

Appendix B contains supplementary figures and tables related to the motivational aspects of research apprenticeships.

Competencies

Table 2 (high-resolution version in Appendix A) provides an overview of the apprentices' self-assessment of their learning outcome for each domain and sub-domain of the RDF.

Domain/sub-domain	Number of responses		Average
	Valid	Missing	
DOM A1: Knowledge base	95	1	3.56
DOM A2: Cognitive abilities	94	2	3.55
DOM A3: Creativity	57	7	3.25
DOM B1: Personal qualities	92	4	3.54
DOM B2: Self-management	87	9	3.20
DOM B3: Professional and career development	146	14	2.74
DOM C1: Professional conduct	139	21	3.40
DOM C2: Research management	41	7	2.27
DOM C3: Finance, funding and resources	13	3	2.08
DOM D1: Working with others	157	35	2.72
DOM D2: Communication and dissemination	59	5	3.10
DOM D3: Engagement and impact	88	24	2.11
DOM A: Knowledge and intellectual abilities	246	10	3.48
DOM B: Personal effectiveness	325	27	3.09
DOM C: Research governance and organisation	193	31	3.07
DOM D: Engagement, influence and impact	304	64	2.62

Table 2: Apprenticeship learning outcome

The table indicates that the apprentices have acquired the competencies of successful researchers as described by the RDF (Vitae, 2011). The average scores of 3 and above for three out of four domains and seven out of 12 sub-domains are a testament to high learning outcomes. Consequently, the apprentices have acquired (1) the knowledge, intellectual abilities, and techniques to do research; (2) the personal qualities and approach to be an effective researcher; and (3) the knowledge of the standards, requirements, and professionalism to do research. These competencies are associated with domains A, B, and C of the RDF (Figure 2). Subdomains A1, A2, and B1 are particularly noteworthy, with average scores above 3.5. These scores related to "Knowledge base" (3.56), "Cognitive abilities" (3.55), and "Personal qualities" (3.54) indicate the acquisition of particularly strong competencies in information management, critical thinking, and self-reflection. In Appendix C, Tables C-1, C-2, C-3, and C-4 reveal that sub-domain averages are being pulled down by non-relevant descriptors related to funding applications and teaching activities in which apprentices are not involved. This explains why the D domain score is below 3.

Table 3 (high-resolution version in Appendix A) shows respondents' evaluation of competencies used in their post-graduation employment (see Tables C-5, C-6, C-7, and C-8 in Appendix C for details).

Domain/sub-domain	Number of responses		Average
	Valid	Missing	
DOM A1: Knowledge base	73	23	3.10
DOM A2: Cognitive abilities	71	25	3.21
DOM A3: Creativity	42	22	3.48
DOM B1: Personal qualities	80	16	3.56
DOM B2: Self-management	76	20	3.12
DOM B3: Professional and career development	125	35	3.11
DOM C1: Professional conduct	102	58	2.74
DOM C2: Research management	33	15	2.67
DOM C3: Finance, funding and resources	13	3	2.23
DOM D1: Working with others	127	65	2.56
DOM D2: Communication and dissemination	47	17	2.40
DOM D3: Engagement and impact	84	28	2.37
DOM A: Knowledge and intellectual abilities	186	70	3.23
DOM B: Personal effectiveness	281	71	3.24
DOM C: Research governance and organisation	148	76	2.68
DOM D: Engagement, influence and impact	258	110	2.47

Table 3: Learning outcome used in practice

"Creativity" (sub-domain A3) is among the three highest-scoring sub-domains, which makes innovation a key competency. Also, "Professional and career development" (sub-domain B3) scores high, suggesting that career management and professional development competencies are seen as more relevant in the former apprentices' current employment. Finally, Table 3 reveals "missing" responses across domains and sub-domains (30 and 34% for domains C and D). The free-text elaborations indicate that not all questions are equally relevant in relation to their current employment (see Appendix C). Nevertheless, the competencies related to domains A and B ("Knowledge and intellectual abilities" and "Personal effectiveness") of the RDF are still seen as highly relevant.

5. DISCUSSION

This study confirms the learning benefits of student research and shows that the research apprenticeship model supports legitimate peripheral participation in the IS research community of practice. They acquire domain knowledge and competencies that are also needed as IS practitioners. The level of agreement between competencies learned through research apprenticeship and competencies used in the graduates' current employment shows the apprenticeship model to be a means of bridging the practice-research gap (Mathiassen & Sandberg, 2013). The contribution of the paper is twofold: (1) demonstrating the features of the model that help bridge the practice-researcher gap, and (2) explaining the learning process, i.e., legitimate peripheral participation, that results in both research and practice-relevant knowledge and competencies.

Regarding the first contribution, this paper shows student research, specifically the student apprenticeship model, as a means of closing the practice-research gap. The survey responses point to the model characteristics that are particularly instrumental in closing the gap. First, student apprenticeship is a form of immersion "boundary encounter" (Wenger, 1998). Survey responses reveal that the possibility of immersion in a topic of their own choice is a key motivation behind students' decision to do an apprenticeship. Second, the apprenticeship model increases the relevance of IS research collaborations with the industry (Benbasat & Zmud, 1999; Westfall, 1999). The survey results show that students are also motivated by the potential for conducting research with real-world impact and relevance together with industry partners. Third, as documented in Table 3, the model enables students to acquire some of the competencies needed after graduation, thereby reducing the misalignment between industry requirements and educational content (Beckman et al., 1997; Lippert & Anandarajan, 2004). Fourth, the survey responses also show that students experience commitment from industry partners because of the model's emphasis on engaged research that involves both researchers and practitioners, which helps ensure alignment of interests (Gosain et al., 1997). Most of the students report having access to their research partners whenever needed. Fifth, the model also fosters communication and collaboration between the students as researchers and their industry partners (Desouza et al., 2006; Glass, 2001; Moody, 2000). The students see industry partners as co-supervisors who provide input and feedback on their projects. They all have regular, scheduled meetings (monthly, weekly, or even daily) with these co-supervisors. Finally, the survey reveals the value of hands-on learning experiences (E. Watson & Schneider, 1999). The responses show that the apprenticeship raises awareness among students of how to develop and apply their competencies in academic and non-academic areas. In summary, the paper contributes to state-of-the-art knowledge of bridging the practice-research gap. The research apprenticeship bridges this gap in the form of a tailorable model that provides access to the IS research and practitioner communities of practice. Through legitimate peripheral participation, students become members of the IS research community of practice and learn *how to learn* about real-world practice and what members of the IS practitioner community care about.

Regarding the second contribution, this paper demonstrates how the research apprenticeship model as a form of legitimate peripheral participation enables apprentices to acquire knowledge and competencies needed by both researcher and practitioner communities of practice. Revisiting the three dimensions of communities of practice (Figure 1), this study shows that research apprenticeship facilitates the required learning to become a community member (Wenger, 1998). Regarding "mutuality of engagement," survey responses point to the value of a research environment that supports student projects, which suggests an "ability to engage with other members and respond in kind to their actions, and thus the ability to establish relationships in which this mutuality is the basis for an identity of participation" (Wenger, 1998, p. 137). In terms of "accountability to the enterprise," the sparring and close working relationships provide apprentices with an entry point that helps them "understand the enterprise of a community of practice deeply enough to take some responsibility for it and contribute to its pursuit and its ongoing negotiation by the community" (Wenger, 1998, p. 137). Finally, in relation to "negotiability of the repertoire," research apprenticeship is a means of learning the language of IS practice. Apprentices' research commitment and their engagement with the history of IS practice (manifested in the literature and the people they work with) provide them with "the ability to make use of the repertoire of the practice to engage in it" (Wenger, 1998, p. 137).

From the perspective of situated learning, the apprenticeship model allows for legitimate peripheral participation. The model is consistent with the movements from a teacher-centered to a learner-centered educational paradigm (Saulnier et al., 2008). The model succeeds in including apprentices in the IS researcher community of practice in the sense that they feel accepted as part of that community, they learn the language and methods of the trade, and they acquire domain knowledge and competencies that are also valued by IS practitioners. Students can be motivated to engage in research by the promise of learning and the prospect of publishing an article that contributes to state-of-the-art knowledge. In addition, the possibility of defining their own research projects and the apprentices' feeling of ownership motivate their engagement and foster learning (Parikh, 2002). Thus, the study confirms that research and teaching reinforce learning (Obwegeser et al., 2016), and student research in the form of research apprenticeship catalyzes students' cognitive and intellectual growth (Tams, 2014). Survey responses indicate that, e.g., research guidance, project ownership, and continuous sparring stimulate learning and growth. Moreover, not only does the study confirm that students acquire team, communication, intellectual, and problem-solving skills (Bernat et al., 2000; Olsson et al., 2003), but it also breaks them down into very specific competencies, cf. domains, sub-domains, and descriptors (Figure 3, Tables 3-4, and Appendix C).

In terms of practical implications, I suggest that IS faculty members wanting to adopt the model (1) articulate high expectations and underscore the demanding though rewarding nature of research apprenticeship to promote self-selection among students. This helps ensure that only ambitious, hardworking, and able-minded students opt in. (2) Dictate and steer the process but allow for flexibility and foster ownership on the part of students by having them draft and commit to project plans. The model needs to be tailored to each student and project while maintaining the need for project oversight and management by the supervisor. (3) Be generous with your time. The model blurs the boundary between teaching and research, but learning to become a community member takes time and supervision.

Despite its strengths, questions about the research apprenticeship model remain unanswered. This study evaluates the model by focusing on input (motivation) and output (competencies) rather than the learning process itself. Consequently, a study that follows apprentices from start to finish to evaluate the individual activities associated with the apprenticeship model is suggested. To supplement the survey reported here, such a study may draw on qualitative methods and data sources like interviews and documents to investigate the process and the associated learning benefits and obstacles. A study employing qualitative interpretive methods or grounded theory could potentially provide a significant theoretical contribution, particularly when exploring a small sample of students that limits the potential for statistical generalization. Other studies should look at student research to build broader IS competencies, for example, in the context of course-based undergraduate research (Dolan & Weaver, 2021). Among the unanswered questions are: To what extent can student research promote the competencies "that enable graduates to contribute to the positive transformation of various goal-oriented human activities through digitalization" (Topi et al., 2017, p. MSIS-1)? The MSIS competency model for IS educational programs may be used as a point of departure (Topi et al., 2017). Another related research topic is student research as a means of learning about practice. Whereas the apprenticeship model aims at teaching students about research with the added benefit of acquiring knowledge and competencies that are valued by IS practitioners, there is a need for students to learn about real-world practice, because most graduates are employed in the industry rather than academia.

6. CONCLUSION

In this paper, I present and evaluate "research apprenticeship," a student research model that supports so-called legitimate peripheral participation and students becoming knowledgeable and fully-fledged members of a community of practice. The model's learning outcomes are evaluated through a survey based on the Researcher Development Framework (Vitae, 2011), which draws heavily on learning theory to focus on competencies and motivation. The results show that it supports students in acquiring the domain knowledge and competencies valued by IS practitioners. Survey responses are analyzed and discussed based on concepts of legitimate peripheral participation and community of practice, and the paper contributes to state-of-the-art knowledge by providing a model that bridges the practice-research gap (Mathiassen & Sandberg, 2013). The model supports legitimate peripheral participation in the IS research community of practice and helps them become knowledgeable and competent members and IS practitioners.

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APPENDICES A - D

Appendices A through D are available by contacting the author or online at https://u.pcloud.link/publink/show?code=XZyEOz0ZkNxaj67O6pVYAzXRJyOzdXusDQMX