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The Research-Teaching Nexus in Information Systems Education: A case study

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THE RESEARCH-TEACHING NEXUS IN INFORMATION SYSTEMS EDUCATION: A CASE STUDY

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Abstract

Creating a link between research and teaching activities in higher education is a common and recurring challenge for many academics. Especially in practice-driven areas like Information Systems (IS), educators as well as students can benefit substantially from well-designed course curricula that facilitate research-driven learning processes. With this paper, we build on a review of extant literature to propose a research-driven course design in the case of a graduate IS course. The suggested approach includes a set of different techniques that allow for a successful integration of research-based content and activities throughout the whole course lifecycle. In order to validate our design empirically, we conduct a survey among course participants and present the results. Our findings provide initial support for the proposed design, which can be basis for future research and guide the composition of research-driven courses in the IS field.

Keywords: Information systems education, curriculum design, information systems development, research-based learning

1 Introduction

The need to link research with teaching is a common challenge for many academics. Research from various disciplines has over time contributed to an extensive and ongoing discourse on this topic, ranging from motivational aspects of educators and students, to particular tools and methods that facilitate research-driven education. Similar to many other domains, Information Systems (IS) educators are confronted with a twofold challenge, relating to both pedagogy and curricula.

First, in terms of pedagogy, technological and instructional developments have contributed greatly to the development of new types of education, in formal, informal, and non-formal settings. Massive open online courses (MOOCs) and flipped classroom approaches are only two examples that have spread across the educational landscape recently. IS educators, bound by the nature of their field, have to stay on top of these developments while ensuring the quality of student learning.

Second, in relation to IS curricula, the rise of the digital society, characterized by ubiquitous connectedness and new forms of technological interaction often pushes the boundaries of established IS teaching plans. Working in academic environments in which resources (structural, organizational, financial, etc.) are often limited, IS educators experience the need to carefully design curricula including both basic domain knowledge as well as recent developments. Moreover, as digital innovations follow a more rapid, often disruptive pattern, IS educators face increased risks of falling behind current advancements.

The role of integrating research outcomes and processes into higher education courses has recently attracted increased attention of academics. With this research, we aim to build on this growing volume of literature to inform the research-driven design of IS education. Doing so holds the promise to support both aforementioned challenges, by integration of contemporary research outputs to stay connected with ongoing developments, as well as by active engagement and discussion of research processes and problems.

The remainder of this article is structured as follows. First, we introduce the reader to the state-of-the-art of the ongoing scientific debate on the link between research and teaching in higher education. Second, in order to apply the theoretical approach into practice, we present a case study of a graduate IS course to propose a course design that integrates teaching and research to a high degree. Third, we present empirical results to validate the proposed course design and discuss its benefits and limitations. Finally, we conclude the article and point to future research areas.

2 Research and teaching in higher education

Scholarly interest into how to integrate research into teaching has gained momentum recently, with a steady increase of related literature in the field (e.g., Barnett, 2005; Brew, 2001, 2006; Jenkins et al., 2003; Kreber, 2006). The issue of the research-teaching nexus is multifaceted, as it affects several aspects of higher education, but also relates in many ways to policy making, pedagogy, academic teaching, and research. Eventually, it can be traced back to the philosophical question of how we as a society understand the role of academia, or the "university". While this question has been discussed for quite some time - most notably by Aristotle and Humboldt - a unified understanding is yet to be established. As such, the literature on how this nexus should be conceptualized and implemented holds diverging and, at times, conflicting views.

Although we focus our attention in this paper on the academic consensus that bringing research and teaching together offers significant benefits for the students, it is important to note that balancing research and teaching is not always an easy journey for the teacher. For example, while reviewing the literature, Hattie and Marsh (1996, 2002) found no significant correlation between research out-

put and teaching performance. In addition, Healey and Jenkins (2003) noted that the domain in which the research-teaching nexus is being established is an important mediator of success, since research and teaching may vary significantly between domains. Similarly, (Robertson & Bond, 2001) point out that "in disciplines where there is a large body of technical knowledge organised hierarchically and being taught in huge lecture theatres […] a relationship [between research and teaching] is difficult to sustain or nurture" (p.15).

However, from a pedagogical point of view, Jenkins (2004) states that "there is clear evidence from a range of studies in different types of institutions of the students valuing learning in a research based environment" (p. 29). Research and teaching can thus be viewed as mutually reinforcing learning processes (Brew, 2002, 2003). Becker and Kennedy (2005) considered imparting knowledge (teaching) and creating knowledge (research) as complementary activities. There are a growing number of academics who find that students gain learning benefits when they are taught by active researchers and are engaged directly in research activities (e.g., Healey, 2005; Jenkins et al., 2003; Lee, 2004).

Based on the above, our focus on this paper is not on the debate whether or not the research-teaching nexus should be formally established in higher education, but on how to help the IS educator in establishing this link through different approaches that would provide learning gains for the students.

2.1 Types and benefits of research-informed pedagogies

The ways in which research and teaching can be linked together is an interesting topic of discussion amongst academics, especially since each implementation of the research-teaching nexus is expected to offer different learning benefits to the students. Several studies have shown that students gain more from the integration of research in their classes, when they participate in activities that allow them to develop their research skills (e.g., Brew, 1999; Elton, 2001; Healey, 2005). The learning design of providing students with research opportunities in their classes is often founded on the paradigm of inquiry-based learning (Elton, 2001; Healey, 2005). Through a wider lens, engaging students into research activities is a type of problem-solving, anchored into a real-life context (Coombs & Elden, 2004). As such, following the constructivist line of thought (e.g., Jonassen, 1999; Schank et al., 1999), we argue that student-researchers have more opportunities to develop critical thinking, ownership of learning, and problem-solving skills. Through research activities, students are required to understand the domain landscape, formulate valid research questions, establish paths to gather evidence, and evaluate the degree this evidence sheds light on the issue. In addition, integrating research into teaching can foster interdisciplinary and encourage collaboration between students, and between students and teachers (Le Heron et al., 2006). The benefits of linking research and teaching inside the classroom are also visible to the students. Focusing on the students' perspective, Healey et al. (2010) reported that students felt that having an active researcher as a teacher helped better understand the domain, adding that it also stimulated their interest and enthusiasm for the subject. Equally important is students' association of research-active teachers to up-to-date knowledge (ibid.).

There are, as mentioned, several shades of combing research with teaching, with academic discussion going a step further analyzing both the concepts of "teaching" and "research" in different contexts (Healey, 2005). Griffiths (2004), for example proposes a distinction of research types based on the subject areas, linking empirical science to Science, interpretative investigation to Humanities and Social Sciences, and applied inquiry to vocational fields. In addition, Barnett (2005) distinguishes between (a) the use of current or past research into the syllabus, and (b) research that was conducted by the teachers themselves or by colleagues in the same or other institutions. In this paper, we base our course design and analysis on the works of Griffiths (2004) and Healey (2005), suggesting a generally accepted model on the four ways the research-teaching nexus can be implemented in a course (Figure 1).

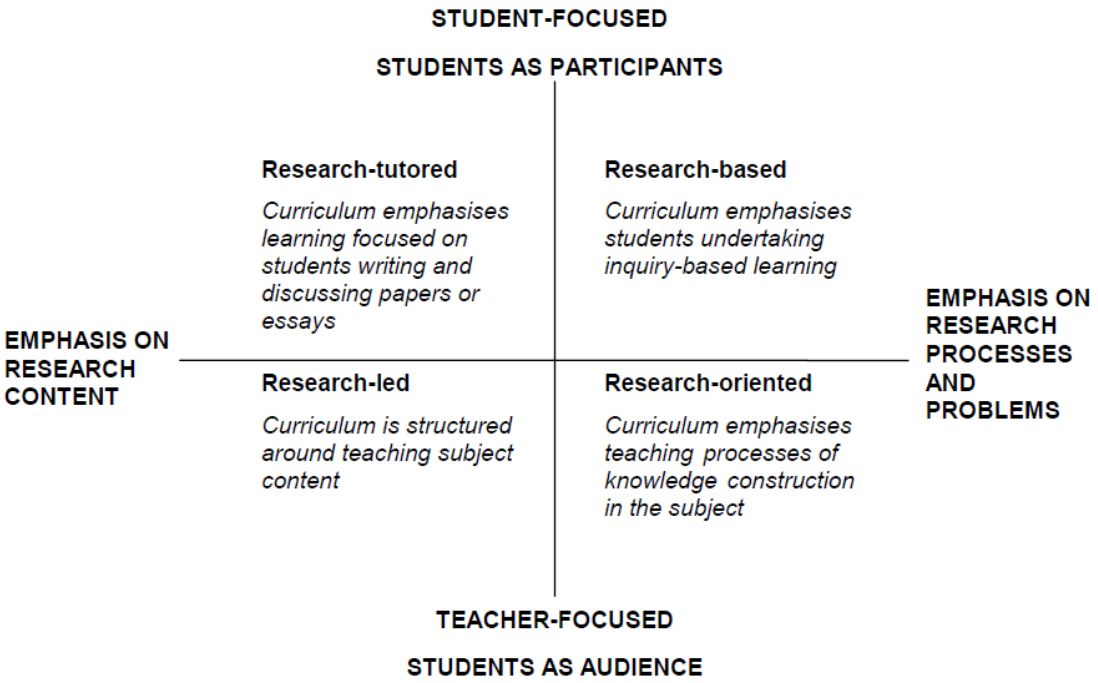

Figure 1. Curriculum design and the research-teaching nexus (Healey, 2005).

Healey et al. (2010) describe the role of students and the role of research in the course as follows (p. 237):

- Research-led: where students learn about research findings, the curriculum content is dominated by faculty research interests, and information transmission is the main teaching mode.
- Research-oriented: where students learn about research processes, the curriculum emphasises as much the processes by which knowledge is produced as learning knowledge that has been achieved, and faculty try to engender a research ethos through their teaching.
- Research-based: where students learn as researchers, the curriculum is largely designed around inquiry-based activities, and the division of roles between teacher and student is minimised.
- Research tutored: where students learn in small group discussions with a teacher about research findings.

As Healey (2005) stated, only a few curricula fit entirely in one quadrant, with most traditional modes of teaching taking place in the Research-led quadrant. However, as it was already mentioned, the discipline in which the research-teaching nexus is implemented has a significant role. Thus, it is also common to have curricula that would cover more than one quadrant based on set of intended learning goals and competences. Specifically in our course, the learning design is purposefully designed to cover a wide area, since students are engaged in activities that can be linked to all four quadrants.

3 Case study

We use the case of a real course called "Information Systems Development and Implementation in a Business Context" (ISDI) to apply our theoretical approach into practice. In this section, we present the course background and environment, followed by the proposition of an adapted course design and curriculum, aimed to allow for a successful integration of research into the teaching domain.

3.1 Course format and curriculum

ISDI is a 10 ECTS (European Commission, 2016) course that runs over 11 weeks, with a total of 120 teaching hours. Course language is English, including all teaching, assignment, and examinations. The course generally attracts somewhere between 50 and 100 students and is offered once a year in autumn.

3.2 Course content and intended learning outcomes

The aim of ISDI is to give students an understanding of the diverse challenges, risks and complexities of developing and/or implementing IS in organizational environments. The course is not a technical course, i.e., students are not required to have any knowledge about topics like software development or database design, but rather takes a project management perspective, and addresses the special aspects of IS projects. As part of the course, a number of theories, methods, and techniques are introduced that can help to understand, plan, and execute the processes in which information systems are developed, implemented, and maintained. The intended learning outcomes are stated in the course description as follows:

After successful completion of the course, the students will be able to:

- Describe and analyse challenges of IS development, acquisition and implementation in business based on theory covered by the course.
- Describe, analyse, evaluate and reflect upon IS development and implementation practice applying the theoretical frameworks of the course.
- Evaluate and compare different IS development and implementation methods based on lifecycle models and other frameworks of the course.

3.3 Context and environment

Students that participate in the course can have various backgrounds and prior educations. Many attendants (approx. 50%) take the course as a mandatory part of the study program "Information Management" (IM), which is a graduate degree program focusing predominantly on topics related to the "management of information resources and information technology (IT)" . ISDI is one of the first courses offered to IM degree students, with "Introduction to IS -Management" and "Organizational Theory" running before or in parallel.

The second largest group of students (approx. 30%) is studying in the graduate program "Business Intelligence" (BI), which focuses on teaching the "concepts and methods to improve business decision making by using fact-based support systems". ISDI is a mandatory part of the first semester of the BI program alongside other courses such as "Data Warehousing", "SAS and SQL" and "Applies Econometric Methods".

Third, around 10 to 20% of students are either local students from other programs or faculties (including computer science and the humanities) taking ISDI as an elective, or incoming international students from various European and Non-European countries.

3.4 Integration of research and teaching in ISDI

We follow the proposed dimensions by Griffiths (2004) that was further developed by Healey (2005) to help us include a research perspective in the ISDI course design. However, we argue that a course design does not necessarily have to fall into one unique category, but should rather make use of the variety of different tools and techniques, when appropriate, for different aspects of the course. This is especially true for long and broad courses such as ISDI that cover a wide range of topics over an extended period of time. Moreover, prior research suggests that a combination of different teaching/learning methods is helpful to address diverse student audiences, often comprising different cognitive learning styles (Cegielski, Hazen, & Rainer, 2011). Thus, we have dissected our course curriculum into logical parts and decided based on topics and/or other factors which of Healey's (2005) categories and related activities would be most useful for each part. In the following, we present the methods applied in the course and describe the intended outcome.

3.4.1 Research-led activities

To address this category, the teachers present their own research activities, often in the form of distribution of publications or working papers with additional presentation of anecdotal evidence and rich, personal experience. The underlying rationale of such activities is that research carried out by the teachers themselves can be presented in a more tangible and involved way then just reiterating somebody else's publication.

3.4.2 Research-tutored activities

In this category, we use case-studies and tutorial sessions to facilitate the active engagement of students with research outcomes and publications. Students, working in groups of 2-4, are given a set of two publications on a specific topic (e.g., boundary objects in IS development) and asked to critically engage with the topic. To do so, students are given a few, relatively open guidance questions (e.g., *Is the research design appropriate to answer the specific research questions/objectives?* or *How does this topic/concept relate to other topics within ISDI?*) and asked to prepare a 1-hour presentation and discussion session in front of their peers.

3.4.3 Research-oriented activities

As most attendants take the course as part of their first semester graduate programs, students have little or no prior knowledge about research and/or knowledge creation processes. To understand the particularities of IS research, the students are asked to critically reflect and discuss the research design and methods of seminal IS papers. That way, students come into contact with predominant research design within IS (e.g., variance based research models or case studies) (Benbasat, Goldstein, & Mead, 1987; Gregor, 2006). Moreover, the students are provided with learning material on IS research methods, theories, and a 4-hour tutorial discussing the need for appropriate research designs.

3.4.4 Research-based activities

The final exam of the course is conducted orally in a form similar to a thesis defence, based on a group report that students have to hand-in a month before. The group report has a length of 15 pages per student and requires the students to conduct an independent research project related to the topics of the ISDI course. The timeframe for this assignment is approximately 8 weeks. While each group can decide the actual topic and research design by themselves, around 85% of the groups decide to do a case study on ISD topics within local companies. That includes establishing contact with the company, gaining access to relevant information in the form of interviews, documents, observation, etc., as well as analysis and discussion of their findings. Around 15% of the groups decide to conduct

a literature-based study, i.e. reviewing and synthesizing a specific topic related to the course. Students are given a limited amount of supervision (1-hour per group) to discuss their research questions and designs, but are largely required to make decisions independently within the group.

4 Empirical validation

We were particularly interested in student feedback to find evidence for the effectiveness or limitations of our proposed course design. As part of the university's policy, all courses are subject to a standardized evaluation scheme that students have to complete after or during the last lecture. Due to the rigidity and limited flexibility of the standardized evaluation form, we collected additional data for the purpose of particularly measuring the research integration techniques implemented in the course. In the following, we will first give a short overview of the general course feedback received and then introduce the design and results of the survey developed specifically for this project.

4.1 General course feedback

Since the standardized evaluation process of the university has been subject to change over the last years, we can only present data from 2015. However, we can expect some transferability of results to the previous years as the course design has not changed. The feedback process is based on an online survey comprising both closed and open questions regarding the core aspects of the course, including course design, learning process, as well as student and teacher performance. Students participation in the feedback process is voluntary and resulted in 27 (of 86) responses, in 2015.

In relation to the various forms of research integration, some responses to open questions were particularly relevant. Being asked to formulate "*Which parts of the course have been particularly beneficial for your learning?*" a number of students pointed to the group-work elements of the course. In particular, they positively mentioned the need to critically assess research content and present it in front of their fellow students (research-tutored), as well as the requirement to engage in their own research processes (writing a group report) to generate new knowledge in the field (research-based). Interestingly, some students made negative remarks about the presentations of their fellow students regarding their quality, while others asked for more such activities. Moreover, some students found the number of different topics covered in the course too broad and therefore overwhelming.

4.2 Survey design

To validate specifically the effectiveness of research integration in new course design empirically, we chose to conduct an online survey among students that had participated in the ISDI course after its redesign. The course was taught three times during the last three academic years with a total number of n=194 participants (48+60+86).

It is important to point out that the survey targeted to measure the breadth of different techniques and methods employed to make the course more research driven. That is, we were not aiming to elicit the students perception of which of the four categories the course follows predominantly. In terms of survey design, this resulted in the development of two independent items for each of Healey's (2005) four categories. To measure the single most-predominant design of a course, a continuous scale along the same dimension (e.g., student as passive versus student as active audience) will be more appropriate.

A full overview of the constructs and items used is given in Table 1. The survey was conducted via an online form. The order of questions was randomized for each student, while attendants were solicited via direct email from the course instructor. No credits or other form of reward was given.

Construct	Code	Items
Research-led	Q1	The teacher presents content based on scientific publications (e.g., journal and/or conference articles).
	Q2	The topics presented focus on current research issues/areas.
Research-oriented	Q3	The course curriculum includes different research methods of the domain.
	Q4	Students learn how to conduct research in Information Systems, as part of the course.
Research-based	Q5	Students are required to explore course topics through their own research.
	Q6	The curriculum includes new knowledge creation in the form of research activities.
Research-tutored	Q7	Students are encouraged to engage critically with the scientific publications used in the course.
	Q8	Student activities include presentations and discussion of scientific publications.

Table 1. Overview of survey constructs and items.

Participants were asked to indicate their level of agreement to each statement independently on a 5-point Likert scale ranging from 5 - "Strongly disagree" to 1 -"Strongly agree", while "Neutral" (3) indications were also allowed.

4.3 Survey results

We received a total of 54 complete responses. This translates to a response rate of 28%. More than half of the respondents attended the course in 2015, and around one quarter in 2014 and 2013, respectively. Studies taking place in university context are often prone to certain types of response biases (e.g., acquiescence bias or social desirability bias). However, we expect the fact that the course(s) were finished and graded, and no relationship of dependence between the instructor/researcher and the participants was given at the time of the survey to be moderating factors for any potential bias. Table 2 shows the mean results per question (standard deviation in parenthesis) as well as the means per category.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
4.49 (0.53)	3.76 (0.83)	3.96 (0.88)	3.68 (1.09)	4.31 (0.64)	3.86 (0.84)	3.82 (0.92)	4.35 (0.76)
Research-led		**Research-oriented**		**Research-based**		**Research-tutored**	
4.13 (0.79)		3.82 (1.00)		4.09 (0.78)		4.09 (0.89)	

Table 2. Overview of survey questions and average response (incl. standard deviation).

To better visualize the results of our survey, we plotted the mean result per question, category, and dimension (active versus passive teaching, and research content versus research process) onto the matrix proposed in (Healey, 2005) (Figure 2). The radar plot uses the same scale (1-5) as the survey questions.

For each quadrant of the matrix, the average of the category (two items each) was calculated. Horizontally, we used the average of Q(1,2,7,8) to indicate the perceived degree of content-based teaching, and the average of Q(3,4,5,6) to depict the degree to which research- and knowledge-generation processes were discussed. Vertically, the average of Q(5,6,7,8) shows the degree of active student involvement, while the average of Q(1,2,3,4) depicts activities with students as passive audience.

The survey result analysis shows that our course design scored high (average scores around 4), in all four categories. This suggests that, based on students' perspective, our aim for the course design, not aiming for one particular category, but rather for a broad and diverse combination across categories of research-integration, was indeed successful.

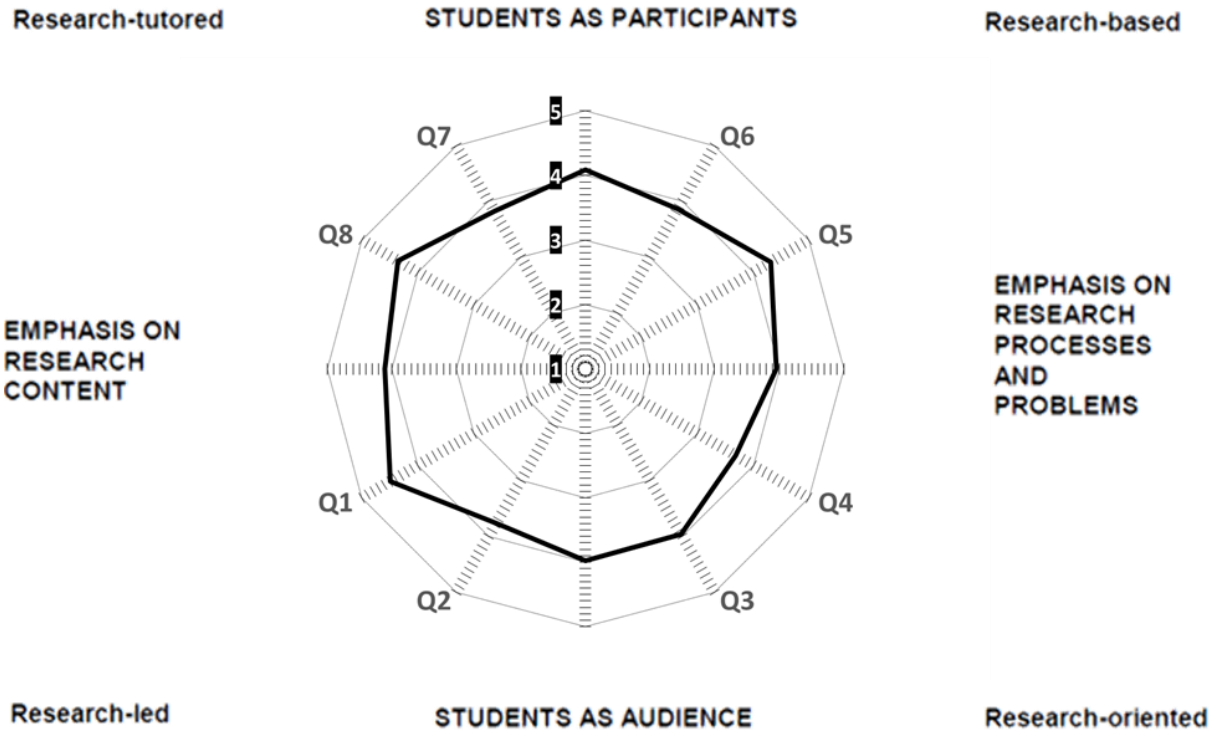

Figure 2. Survey results plotted on categorization scheme as proposed by Healey (2005).

5 Discussion

The survey result analysis shows that the four different research-teaching links of the proposed course design were also clearly identified in the course by the students, as confirmed by the relatively high scores in all areas. In the open-ended course evaluation report of 2015, students mentioned explicitly research-tutored aspect of the course, mentioning research critique and discussion of research findings with their peers. Furthermore, students appeared appreciative of research-based activities that engage them in conducting their own research activities.

The above paint a picture showing that our approach to offer complimentary learning activities that would enhance the research-teaching nexus was well-received by the students. We maintain that it is especially important for large and diverse courses that focus on various areas of a domain to include variations in course design. More specialized courses (e.g., "Philosophy of research" or "Database design") will likely be easier to categorize in one specific category (Steenkamp & McCord, 2007). The variations in the course design and the range of research-related activities could accommodate better the learning needs of the participants, related to personal traits and learning styles.

As such, our argument is that aligning research-integration with both content and teaching/learning style could be beneficial for the students. Of course, a fit between the type of research-integration and the content of the specific lecture has to be found, to support an optimal learning environment. As prior research in Information Systems Education found, moving from a teacher-centred to a

learner-centred paradigm can be beneficial for both student learning experience and appropriateness of assessment methods (Saulnier, Landry, Longenecker Jr, & Wagner, 2008). In our course, assessment was based on a research-based approach, requiring the students to engage in their own research by writing a report on an actual research problem, which was then part of their assessment. By using this research-teaching link, the students were given a certain degree of freedom in designing their own learning experience, and additionally encouraged to engage actively with the topics of the course.

6 Conclusion, limitations and future research

The integration of research and teaching in IS education holds great benefits, both from student's and teacher's perspectives. In our course, we have followed a well-known and widely used categorization of the research-teaching nexus (Healey, 2005). We presented a case study of a graduate course on IS development and implementation to translate the theoretical discussion into practical application and propose a new course design with various elements of research integration. Specifically, we designed the course as to include elements of all categories, along the dimensions of active versus passive audience, and emphasis on teaching research outcomes (content) or research processes and problems.

This paper contributes to the ongoing debate on research-teaching integration, particularly in the field of Information Systems. We reviewed extant literature and proposed a practical approach on how to implement the research-teaching nexus in different ways. The methods proposed include a variety of research-teaching links that are complementary in nature and aim at supporting students with varied backgrounds and learning styles. Empirical data confirms the effectiveness of our proposed design.

Of course, there are certain limitations that need to be mentioned. First, as the debate on research-teaching integration is taking place in various domains and based on different underlying theoretical paradigms, our research is limited to the field of Information Systems and does not necessarily apply to other domains. This is in line with previous researchers, who found that successful relationships between research and teaching depend on the field/discipline and student level (Coate, Barnett, & Williams, 2001; Jenkins, 2003). Second, the empirical part of our study is following a single case study design. Thus, we are limited to analytical generalization within similar contexts and cannot draw on inferences from statistical sampling (Yin, 2009).

While our contribution makes a first step towards practical design propositions for teachers, we acknowledge that the limitations in domain and context boundaries call for further research. Specifically, we think that the practical field would benefit from more single and multiple case studies, within and across domains, in order to generate a rich theoretical base. More insights into course design principles are needed, in order to provide situation and context specific guidelines, not only at course and/or domain level, but also at the level of individual learning styles and activities.

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