

## Abstract

There are claims that a close relationship between teaching and research would improve students' learning, since it promotes deep learning and positive academic outcomes (Brew, [2006](#), [2012](#); [Spronken-Smith & Walker, 2010](#)). Brew ([2010](#)) notes that this link fosters creative, critical and reflective skills among students. These benefits would come from students' involvement in research or research like activities. At the same time, a growing use of digital technology for research is reorganising and transforming how knowledge is created and disseminated in academic disciplines (Jankowski, 2007, [2009](#); [Schroeder & Fry, 2007](#); [Yang, Wang, & Jie, 2011](#)). Despite this, investigations explicitly addressing what implications this may have for the teaching-research nexus are as yet rare. As part of a broader research project, this paper proposes a conceptual model for understanding how the teaching-research nexus may be related to the use of digital tools for research. Our aim is to use this model for curricular innovations in the near future.

## Framework

### *The teaching- research nexus*

There are different conceptualisations of the teaching-research nexus. In a grid proposed by Healey and Jenkins ([2009](#)), some approaches emphasize the research content or the research processes, and some situate students more as audience while others emphasize the students as creative and agentic. It is possible, accordingly, to identify four approaches: research-led, research-tutored, research-oriented, and research-based. Spronken-Smith and Walker ([2010](#)) distinguished structured, guided and open inquiry and concluded that the last one offers the most powerful manner of linking teaching and research. A different distinction is proposed by Levy and Petrulis ([2012](#)) in relation as to who frames the inquiry (student or tutor) and the student's relationship with knowledge (production or acquisition). From these different conceptualisations, it is evident that scholars tend to agree that more open and more active forms of student-led inquiry tend to be of more benefit to students.

### *Digital research*

University academics are increasingly employing digital technology to support their research projects ([Jankowski, 2009](#); [Yang et al., 2011](#)) and produce knowledge. Different uses have been associated with different disciplinary areas. In the sciences, what has been called 'e-science' refers to the use of digital technology mainly for collaboration at a distance through the employment of electronic networks and high-speed computers (Jankowski, 2007). In social sciences, there has been interest in social simulations, web harvesting of data and grid computing, among others ([Barjak et al., 2009](#); [Fielding, 2008](#)). In the humanities, there is a growing movement called digital humanities associated with

digitising collections of documents, artworks and the like to make them available for inquiry ([Anderson & Blanke, 2012](#)). To classify these different types of tools, Jankowski (2009) proposes a model that distinguishes three clusters: one associated with *research organisation* (e.g. virtual learning environments, video-conferencing, discussion boards), one associated with *research processes* (e.g. web based survey tools, web annotation tools, data repositories) and one associated with *scholarly communication* (e.g. online bibliographic databases, blogs and wikis). Such technologies are changing academic research practices and the ways in which scientific knowledge is created, so it seems both proper and desirable to introduce students to these new research technologies and practices. The literature on the teaching-research nexus claims that students benefit when they get involved in research activities so using the tools that their disciplines are currently employing is important for students to understand how knowledge advances in their fields.

#### *Promoting the teaching-research nexus through digital research tools*

We employ Jankowski classification and Healey and Jenkins grid of the teaching-research nexus to map how this nexus may be promoted by using digital tools for research (see figure 1).

In the first quadrant *-research-led teaching-* students learn about current content in their disciplines by accessing online formal or informal processes of knowledge dissemination. For example, formal online scholarly communication can be accessed through online bibliographic databases or conference web sites; and informal communication can be accessed through relevant blogs and website collecting working papers, among others. In this case, the cluster of digital tools identified as *scholarly communication* appears as the closest to the type of activities associated with *research-led teaching*. In the second quadrant *-research-oriented teaching-* students are expected to develop research skills and techniques, such as framing questions, selecting appropriate research designs, data gathering methods, and analysis techniques. The cluster of digital tools closest to this mode of linking teaching and research are those related to *research processes*. The teaching-research nexus can be enhanced, by students using web based survey tools, web annotation tools, analysis applications, data repositories. These two first modes of linking teaching and research situate students mainly as relatively passive in their disposition to research since they are encountering research in a second-hand mode.

In the third quadrant *-research-tutored teaching-* students are involved mainly in discussions about research with their tutors and classmates and elaborate papers and essays. The cluster of digital tools which appears closer to this mode of linking teaching and research is Jankowski's *research organisation*. The tools that can be used according to this cluster quadrant are: email, instant messaging, video-conferencing, discussion forums, wikis and the like. These may be employed in supplementing face-to-face interaction but also for communications amongst distributed teams of researchers. This is particularly powerful for students because they may use them not only for expanding possibilities of discussion with their peers and tutors, but also to communicate with 'real' research communities, for example, in established discussion forums. In these activities, students approach research mostly in an active manner.

In the fourth quadrant *-research-based teaching-* students participate in research in an active way. Usually, they are involved in the complete research cycle, from question formulation to presentation of results. This form of linking teaching and research involves the three clusters of digital tools proposed by Jankowski (2009). Students participating in this type of experience will need *scholarly communication* tools for knowing what is being done in their area and building upon it, as well as to disseminate their findings; *research process* tools will be required for supporting the entire research cycle; and *research organisation* tools will be needed to manage the projects as well as to communicate in relation to their activities. In these two last quadrants, students actually *carry out* research themselves.

## Conclusion

Disciplinary research and knowledge production have been affected and, in some cases, transformed by the progressive use of digital tools for research. If we want to engage students in research or research like activities, as suggested by authors on the teaching-research nexus area, these activities should mirror researchers' practices and tools. The model proposed here offers new ways in this direction and can be used to design curricular activities for students that incorporate digital research tools as part of inquiry based activities. We shall examine this in practice in the near future as part of an ongoing research project.

## References

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**Figure 1: Jankowski's digital research tools clusters embedded in Healey and Jenkins' teaching-research nexus model**

