An Exploration of the Literature of Instructional Technology through Citation Analysis

Prospectus for dissertation research
Bill Dueber
23 October 2004

The field of Instructional Technology/Educational Technology (IT) is at a crossroads with respect to how to define itself. An AECT panel (the Definitions and Terminology committee, chaired Al Januszewski) was formed in 2002 to replace the current definition, dating from 1994. Robert Reiser’s (1997) excellent history of formal definitions in the field shows a wide range of ideas about “what we are,” with various definitions including or excluding explicit references to specific media, systematic processes, and management as part of the core of the field.

Purpose and Relevance of this Study

I propose that a first step in formulating a framework for discussing the parameters of the IT field is to identify “camps” within the IT community through an examination of the literature on which our research is based. By identifying the current (and evolving) state of these “invisible colleges” (Crane, 1972), it becomes possible to both provide names for and (perhaps) show common ground between groups working from different — or even rival — theoretical and methodological bases.

This research is being driven by an overall desire to identify the most influential ideas and sources in IT, their relationships to each other, and if/how this landscape has changed in the recent past. To address this larger agenda, this study will attempt to answer five more specific questions: three that look at overall influence of journals, authors, and individual articles, and
three that explore clusters of items, labeling them based on their content and relationships to each other.

1. What authors exert the most influence (as measured by how often they are cited) in each of several time periods? Do a small number of authors represent a large percentage of authorship or references, as is true in many fields?

2. What individual articles exert the most influence (as measured by how often they are cited) in each of several time periods? How does this influence rise and fall?

3. How (based on co-citation analysis) are referenced works clustered? What are the topical categories of these groups? What do these clusters, and the relationships between them, indicate about the different (and possibly competing) methodological and epistemological ideas driving the field?

4. How (based on Author Co-Citation Analysis) are highly-cited authors grouped? What are some possible reasons for those groupings (e.g., date of most cited works, where they got their degrees, where they work, etc.).

5. How (based on bibliometric coupling) are articles published in the last three years of the corpus grouped? What are the topical categories of these groups? What do these clusters, and the relationships between them, indicate about the different (and possibly competing) methodological and epistemological bases of the field, and how do they differ from those derived in step 3?

The study is, then, primarily a review of the IT literature, but one driven by data derived from citation analysis and focusing on structures revealed through the construction of co-citation graphs.
I hope to advance the field primarily in two ways. First, by exploring the common theoretical underpinnings (as reflected in the citation lists) of groups of research papers, it may be possible to provide a common vocabulary and set of starting points from which people can continue their discussion of what is and is not central to the field of IT. Second, by discovering how the authors of this research can be grouped (through their citing behavior) and then distributing this information to the scientists in question; this will offer them another source of information with which they can look for potential colleagues and collaborators.

**Research Methodology**

The proposed study is a citation analysis (Börner, Chen, & Boyack, 2003) of the field of Instructional Technology for the years 1991–2002, broadly following the methods explained by McCain (1990; 1991) and used by many others (e.g., Chen & Carr, 1999; Lin & Kaid, 2000; Paisley, 1990; White & McCain, 1998) to explore the structure of research fields.

**Data Sources and Collection**

The choice of a corpus of articles to include in the citation analysis has far-reaching consequences not only on the scope of the research, but on arguments for the validity of any conclusions about the underlying structure of the field as well. The set of articles chosen is the operational definition of “the field” as carried throughout the rest of the analysis, so it is important to choose data that provide both depth (good coverage of the core discipline) and breadth (inclusion of peripheral research which influences future directions). These data, along with the accompanying analysis, “…defines the scholarly landscape being mapped” (McCain, 1990, italics in original).
The data source requirements for a citation analysis are fairly specific. One must have not only a list of articles to include (the initial corpus), but a well-formed list of all the references found in each of these articles. Practically speaking, the singular source of data for a citation analysis of any significant size is the Web of Knowledge data provided by Thompson/ISI (formerly the Institute for Scientific Information)\(^1\) via their *Social Science Citation Index*.

For this research, articles to be subjected to cocitation analysis will be drawn from two collections:

1. A *source-based corpus* consisting of all research articles from the journals *ETR&D*, *Journal of Educational Computing Research*, and *Instructional Science* during the twelve-year period from 1991 though 2002, and *Performance Improvement Quarterly* from 2000 through 2002. The first three journals were chosen because they rank highly in surveys of academics (Holcomb, Bray, & Dorr, 2003; Maushak, Price, & Wang, 2000; Price, 2000), are available from ISI, and focus (albeit not exclusively) on significant ongoing research; the latter is the flagship journal of ISPI, figures prominently in the list generated by Maushak *et. al.*, and is included to allow at least a brief comparison between IT and Human Performance Technology literatures. The start date of 1991 is convenient in that it corresponds to the endpoint of an earlier citation analysis of the field (Anglin & Towers, 1992), the beginning of user-friendly Internet interfaces in the form of Gopher (Nickerson, 1992), and the first full year of Educational Technology Research and Development available in the ISI database.

---

\(^1\) Thompson/ISI (http://www.isinet.com/) has products that encompass both citation indexing (SSCI, Web of Science, Patent database) and citation management (Endnote, Procite).
2. A search-based corpus created by searching on common synonyms for the phrase “instructional technology” in the ISI database, restricted to works in English between 1991 and 2002.

The resulting set of articles will then be subjected to a variety of bibliometric and citation analyses as described below.

Data Analysis

The data will be partitioned by date of publication into 3-year quarters (and hence 6-year halves) of the full 12-year period; other dimensions of partition include citing journal publication year of the cited work. These partitions will then be subjected to both bibliometric (non network-based) analysis and network (co-citation) analysis.

The bibliometric characteristics for each partition that will be computed will include most cited works and authors, distribution of journals cited and author affiliation, journal and author self-citation, and the “citation overlap” of different partitions — the number of articles referenced in one that is also referenced in another, as a very rough measure of the similarity of the two partitions.

Each major partition will also be subjected to both co-citation analysis and author co-citation analysis (ACA). For this, the top 125 or so cited works/authors will be used to create a network based on raw co-citation counts. This network will be run through the Pathfinder algorithm (Schvaneveldt, Dearholt, & Durso, 1988; White, 2003), with the resulting PFnet visualized using a spring-embedded placement algorithm in the freeware Pajek program. (Batagelj & Mrvar, 2004).
Cluster analysis, both algorithmic (Steinbach, 2000) and through visual inspection of the resulting visualizations will provide “clusters of interest” (of articles or authors, depending on the network) for further inspection. The articles that correspond to each interesting node will be inspected and emergent categorization using a constant-comparative methodology (Lincoln & Guba, 1985) will be used to assign meaningful labels to the various clusters. These labels, when recombined with the visualizations, will serve to give a graphical “bird’s eye” view of the literature that most informs the field with the connections between various approaches visible.

Relevant Literature

In addition to literature specific to the methods being employed (citation analysis) and examples of its application in other fields, there are four major literature bases from which this research will need to draw.

History and Definitions of the Field of IT

IT is a relatively young field, but exploring the varied origins from which it sprung may provide insight into the variation in conceptions held by its practitioners today. The history of the field (Ely & Plomp, 2001; Eraut, 1994; Reiser, 1987; Saettler, 1990) gives insight into its growth from different bases, while formal definitions crafted throughout this short history (Reiser & Ely, 1997; Seels & Richey, 1994; Winn, 1986) provide a glimpse into the evolution of the field’s collective self-concept, as do predictions, state-of-the-field reports, and “calls to arms” about research in IT (e.g., Hannafin, 1995; Molenda & Sullivan, 2000; Reeves, 2000)
History and Philosophy of Science with Regards to Scientific Consensus

The idea and ideal of consensus, especially as embodied in Kuhn’s (1970) famous paradigm, has played a major role in how disciplines are thought to mature (Fuchs, 1993; Laudan & Laudan, 1989). Lewis (1980) connects ideas of consensus to the “conceptual development” of a field, her interest being to compare fields and try to map the stages a field must pass through as it goes from its beginnings to its relative stagnation.

Similar Debates in Other Fields

Other fields — Sociology (Cole, 1994; Collins, 1986, 1994) and Organizational Science (Cannella & Paetzold, 1994; Pfeffer, 1993) to name two — have gone through debates about their purpose and boundaries in the recent past. Feelings of stagnation are, after all, normal in many social-science fields (Hargens & Kelly-Wilson, 1994; Kuhn, 1970) and a study of these issues as reflected in fields similar to IT (i.e., fields that concern themselves with use-inspired basic research --- see Stokes, 1997) can surely be instructive.

Previous Literature Analyses within the Field of IT

There is a small but interesting set of literature analyses focusing on IT research (Al-Saleh, 2000; Anglin & Towers, 1992; Caffarella, 2000; Klein, 1997; Wedman, 1987) as well as a tangentially-related exploration of the learning- and cognitive-style literature (Desmedt & Valcke, 2002) and older analyses of instructional development (Braden & Sachs, 1983; Sachs, 1984) and computer-based instruction (Wedman, 1987). These will both inform the current study and provide a basis for the development of taxonomies (i.e., labels for the discovered invisible colleges and underlying differentiating factors) to describe the field and its research. In addition, ongoing debates in the IT literature — over methodological practices, epistemological underpinnings, etc.
(e.g., Howe, 1992; Kozma, 1994; Saloman, 1991) — may provide evidence of individual topics that drive the different conceptions of the field.

References


