DEVELOPMENT ARTICLE

Citations of *ETR&D* and related journals, 1990–2004

**James E. Gall · Heng-Yu Ku · Keyleigh Gurney · Hung-Wei Tseng ·
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Abstract   Scientific communication in the field of educational technology was examined
by analyzing references from and citations to articles published in *Educational Technology
Research and Development* (*ETR&D*) for the period 1990–2004 with particular emphasis on
other journals found in the citation record. Data were collected on the 369 core articles found
in the 60 issues published during that time period, their reference lists (containing over
14,805 individual items), and citations of those articles in other journals (1,896 entries). The
top cited and citing journals during that time period are listed. Nine symbiotic journals (i.e.
those that are most cited by *ETR&D* and frequently cite it) were identified: *Contemporary
Educational Psychology*, *Educational Psychologist*, *Instructional Science*, *Journal of
Computer-Based Instruction* (no longer published), *Journal of Educational Computing
Research*, *Journal of Educational Psychology*, *Journal of Educational Research*, *Journal of
Research in Science Teaching*, and the *Review of Educational Research*. The results provide
an in-depth, quantitative view of informal connections within the field via the citation record.
Implications for further research and the potential influence of new technologies on scientific
communication are also discussed.

Keywords   Citation research · Bibliometrics · Scholarship · Scientific communication

Sixty years ago, Vannevar Bush wrote "The investigator is staggered by the findings and
conclusions of thousands of other workers—conclusions which he cannot find time to
grasp, much less remember, as they appear ... A record, if it is to be useful to science, must
be continuously extended, it must be stored, and above all it must be consulted." (p. 102,
1945).

   Fortunately, the digital distribution and indexing of peer-reviewed research has made it
easier to examine the bibliometric aspect of scientific communication (see for example,

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Bjorneborn and Ingwersen 2004). Knowing what scientific resources others are reading and citing creates a useful context for the both the casual reader and serious researcher.

The purpose of this study was to examine the connections of *Educational Technology Research and Development* (*ETR&D*) with other journals as evidenced by citation data. An extensive database of citation information was created. This report focuses solely on the most cited journals in *ETR&D* and the journals that most cite its articles for the period 1990–2004. Earlier work with this data set reported on the most cited works in *ETR&D* by publication type (Gall et al. 2004).

This report addresses the following research questions: (1) What journals are most cited in *ETR&D*? (2) What journals most frequently cite *ETR&D*? (3) Can the journals be classified as input (cited, but not citing), output (not cited, but citing), and symbiotic (frequently cited and citing)?

Method

Datasets

The journal *Educational Technology Research and Development* (*ETR&D*) was examined over a 15-year publication period, 1990–2004. This journal was selected because of its reputation in the field (see for example, Reiser and Dempsey 2002). A number of researchers have previously focused on the content of *ETR&D* and related journals (Anglin et al. 2003; Dick and Dick 1989; Klein 1997). Kirby et al. (2005) used citation analysis to examine the relationship of instructional systems and learning sciences publications.

ETR&D has been in publication since 1989. It was the result of a merger of the *Journal of Instructional Development* (*JID*) and the *Educational Communication and Technology Journal* (*ECTJ*). Both had been published for ten years. From 1953–1977, *ECTJ* was published under the title *Audio-Visual Communication Review* (*AVCR*). References to all four titles (*ETR&D*, *JID*, *ECTJ*, and *AVCR*) appeared in our data and were treated as self-citations.

During 1990–2004, 60 issues were published containing 359 journal articles. Introductions to special issues and commentaries on other articles were excluded in our analysis.

This research was done in two stages and the results are presented as two data sets. The first set, representing 1990–1999, was initially selected because it represented a substantial contribution to the field (i.e. 10 years was an arbitrary but reasonable time period). Also, the articles were old enough to have been cited more frequently in other sources. The second set, from 2000–2004, was collected and analyzed after all initial work was completed on the first set. Although the citing record for this data set is truncated, it is more current and serves as a basis of comparison for the earlier data.

Procedures

For the first data set (1990–1999), copies of the tables of content and reference lists of the 260 articles were created. Due to the large number of references (over 10,000), a number of individuals entered this reference data into a computer spreadsheet. One individual reviewed the spreadsheet in consultation with the printed record to ensure consistency and correct minor errors.

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The online version of the Social Science Citation Index (SSCI) was used to find citations to each *ETR&D* article. This information was entered into a second spreadsheet. To control for history, citations for each year were retrieved during the same session. Because this information was retrieved in November 2003, four years of citation data were available for 1999 articles and 13 years of data were available for 1990 articles.

For the second data set (2000–2004), the tables of content for the issues were also copied and used to identify each of the 99 articles. In the case of this data set, the references were downloaded from SSCI and entered into the appropriate spreadsheet. Unlike the previous data set, they did not have to be manually coded and entered by the researchers.

The online version of SSCI was again used to locate each *ETR&D* article and record information on each citation into a second worksheet. To control for history, citations for each year were retrieved during the same session. Because this information was retrieved in March 2007, roughly 2 years of citation data were available for 2004 articles and 6 years of data were available for 2000 articles.

Results

Basic description of references in *ETR&D*

In the first data set (1990–1999), there were 260 articles. The average number of references for each article was 38.67 (s.d. = 25.58). Of the 10,055 references cited by the articles, 53% were to journal articles (5,257 citations). For the second data set (2000–2004), there were 99 articles. The average number of references was 47.98 (s.d. = 21.05). SSCI listed 4,750 references for these articles. Journals comprised 48% of the total (2,300 citations).

Journals cited in *ETR&D*

The 7,557 citations to journal articles were analyzed to determine the journals that were most cited in *ETR&D*. In the 1990–1999 data set, 750 distinct journals were cited; in the 2000–2004 data set, 567 titles were cited. The most cited journals for each data set are presented in Tables 1 and 2. The 28 journals listed for 1990–1999 account for 2,919 (or 56%) of the journal citations; the 28 journals listed for 2000–2004 account for 1,198 (or 52%) of the journal citations from that data set. *ETR&D*, *JID*, *ECTJ,* and *AVCR* were all considered self-citations (for a total of 14.76% of journal citations in the first set and 13.09% in the second).

Citation of *ETR&D*

The 260 core articles from the 1990–1999 data set were queried in the SSCI in late 2003 to determine in which journals these articles were cited. This resulted in 1,553 citations from 266 journals (because SSCI does not index all journals in the field, this figure is only a subset of total citation of the journal in all academic sources). The 99 articles from the 2000–2004 data set were queried in the SSCI in early 2007. This resulted in 341 citations from 95 journals. Although referenced works provide a static record of what the author considers relevant research (i.e. once published, it does not change), the citing record is always being extended. Therefore, this data must be treated more cautiously.

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Table 1 Journals most frequently cited in *ETR&D*, 1990–1999

Journal name	# of citations
Educational Technology Research & Development*	*494 (9.40%)*
Educational Technology	346 (6.58%)
J. of Educational Psychology	323 (6.14%)
Review of Educational Research	177 (3.37%)
Educational Researcher	170 (3.23%)
J. of Computer-Based Instruction	139 (2.64%)
J. of Instructional Development*	*120 (2.28%)*
Educational Communication and Technology J.*	*116 (2.21%)*
Educational Psychologist	116 (2.21%)
Instructional Science	91 (1.73%)
J. of Educational Computing Research	85 (1.62%)
Performance Improvement Quarterly	71 (1.35%)
American Educational Research Journal	64 (1.22%)
Contemporary Educational Psychology	51 (0.97%)
The American J. of Distance Education	49 (0.93%)
Cognitive Science	47 (0.89%)
Audio-Visual Communication Review*	*46 (0.89%)*
Educational Leadership	46 (0.88%)
J. of Technology and Teacher Education	45 (0.86%)
J. of Educational Research	44 (0.84%)
American Psychologist	42 (0.80%)
Psychological Review	40 (0.76%)
Cognition and Instruction	39 (0.74%)
J. of Research on Computing in Education	39 (0.74%)
Performance and Instruction	38 (0.72%)
Child Development	37 (0.70%)
J. of Research in Science Teaching	36 (0.68%)
Human Factors	35 (0.67%)
Journals from 2000–2004 most cited list**	
J. of Personality and Social Psychology	27 (0.51%)
J. of the Learning Sciences	23 (0.43%)
Educational Psychology Review	11 (0.21%)
J. of Computing in Higher Education	2 (0.04%)
J. of Experimental Psychology	2 (0.04%)

* The two journals, Journal of Instructional Development and Educational Communication and Technology Journal, were merged into Educational Technology Research and Development. Audio-Visual Communication Review was a prior name of the Educational Communication and Technology Journal

** In order to make comparisons easier, those journals from the other data set that did not appear in this list have been added with their corresponding numbers from this data set

The top citing journals of *ETR&D* are presented in Tables 3 and 4. The 22 journals listed for the 1990–1999 data set account for 67% of its citations. The 24 journals from the 2000–2004 data set account for 74% of its citations.

Discussion

The descriptive research questions (What journals are most cited in *ETR&D*? What journals most frequently cite *ETR&D*?) were easily answered. Tables 1 and 2 provide the top journals in both categories. Visual inspection of the lists indicates that they are

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Table 2 Journals most frequently cited in *ETR&D*, 2000–2004

Journal name	# of citations
Educational Technology Research & Development*	245 (10.73%)
Educational Technology	130 (5.69%)
J. of Educational Psychology	114 (4.99%)
Educational Researcher	81 (3.55%)
Review of Educational Research	57 (2.50%)
Educational Psychologist	53 (2.32%)
Performance Improvement Quarterly	38 (1.66%)
J. of the Learning Sciences	37 (1.62%)
Contemporary Educational Psychology	33 (1.45%)
Educational Leadership	33 (1.45%)
J. of Educational Computing Research	32 (1.40%)
American Educational Research J.	30 (1.31%)
J. of Research in Science Teaching	29 (1.27%)
Cognitive Science	28 (1.23%)
Cognition and Instruction	27 (1.18%)
Instructional Science	25 (1.10%)
J. of Educational Research	22 (0.96%)
J. of Instructional Development*	22 (0.96%)
The American J. of Distance Education	22 (0.96%)
American Psychologist	21 (0.92%)
Audio-Visual Communication Review*	18 (0.79%)
J. of Experimental Education	17 (0.74%)
Educational Communication and Technology J.*	16 (0.70%)
Educational Psychology Review	14 (0.61%)
J. of Experimental Psychology	14 (0.61%)
J. of Computing in Higher Education	14 (0.61%)
J. of Personality and Social Psychology	13 (0.57%)
Psychological Bulletin	13 (0.57%)
Journals from 2000–2004 most cited list**	
J. of Technology and Teacher Education	12 (0.53%)
Psychological Review	12 (0.53%)
J. of Computer-Based Instruction	9 (0.39%)
J. of Research on Computing in Education	9 (0.39%)
Human Factors	7 (0.31%)
Performance and Instruction	6 (0.26%)
Child Development	2 (0.09%)

* The two journals, Journal of Instructional Development and Educational Communication and Technology Journal, were merged into Educational Technology Research and Development. Audio-Visual Communication Review was a prior name of the Educational Communication and Technology Journal

** In order to make comparisons easier, those journals from the other data set that did not appear in this list have been added with their corresponding numbers from this data set

relatively stable with regard to membership. Obvious exceptions include journals that ceased publication (such as the *Journal of Computer-Based Instruction*) and those that are newer publications (such as the *Journal of the Learning Sciences*).

Classifying journals as input (cited, but not citing), output (not cited, but citing), and symbiotic (frequently cited and citing of *ETR&D*) was more difficult. First, the journals cited were a matter of record, but the data on journals citing *ETR&D* (according to SSCI) represented only a subset. Many journals in the field (such as *Educational Technology*) were not indexed in SSCI at the time of this research. Second, determining a metric of

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Table 3 Journals most frequently citing *ETR&D* articles, 1990–1999

Journal name	# of citations
Educational Technology Research & Development	475 (30.59%)
J. of Educational Computing Research	100 (6.44%)
Computers in Human Behavior	59 (3.80%)
Instructional Science	51 (3.28%)
British J. of Educational Technology	50 (3.22%)
Computers & Education	40 (2.58%)
J. of Computer Assisted Learning	37 (2.38%)
J. of Educational Psychology	28 (1.80%)
J. of Educational Research	26 (1.67%)
J. of the American Society for Information Science & Technology	23 (1.48%)
Educational Psychology Review	19 (1.22%)
J. of Computer Information Systems	17 (1.09%)
Review of Educational Research	16 (1.03%)
Library and Information Science Research	14 (0.90%)
Contemporary Educational Psychology	13 (0.84%)
Educational Psychologist	13 (0.84%)
J. of Research in Science Teaching	12 (0.77%)
Communication Research	11 (0.71%)
International J. of Science Education	11 (0.71%)
J. of Computer-Based Instruction	11 (0.71%)
Library Trends	11 (0.71%)
Technical Communication	10 (0.64%)
*Journals from 2000–2004 most citing list**	
Applied Cognitive Psychology	7 (0.45%)
J. of the Learning Sciences	7 (0.45%)
Learning & Instruction	4 (0.26%)
Science Education	4 (0.26%)
Teaching and Teacher Education	3 (0.19%)
Interactive Learning Environments	2 (0.13%)
Medical Teacher	2 (0.13%)
Behaviour & Information Technology	1 (0.06%)
International J. of Human-Computer Studies	1 (0.06%)
Research in Higher Education	1 (0.06%)
Educational Technology & Society	0 (0.00%)

* In order to make comparisons easier, those journals from the other data set that did not appear in this list have been added with their corresponding numbers from this data set

similar cited and citing values was problematic. Although percentages were used in both tables, the research team could not agree on a numeric solution for equivalent performance on both measures. We have chosen to suggest that inclusion on both lists (with the predetermined cutoffs) is good evidence for a symbiotic pattern. Third, the 2000–2004 data of citations to *ETR&D* is too preliminary for inclusion in this analysis. Thus, only the 1990–1999 data has been used for this research question.

With these limitations in mind, we were able to identify nine symbiotic journals from the 1990–1999 data: *Contemporary Educational Psychology, Educational Psychologist,*

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Table 4 Journals most frequently citing *ETR&D* articles, 2000–2004

Journal name	# of citations
Educational Technology Research & Development	69 (20.23%)
Computers in Human Behavior	27 (7.92%)
British J. of Educational Technology	21 (6.16%)
Instructional Science	20 (5.87%)
J. of Computer Assisted Learning	16 (4.69%)
Educational Technology & Society	14 (4.11%)
Computers & Education	13 (3.81%)
Interactive Learning Environments	7 (2.05%)
Educational Psychologist	6 (1.76%)
Educational Psychology Review	6 (1.76%)
Information Society	5 (1.74%)
J. of Research in Science Teaching	5 (1.47%)
Behaviour & Information Technology	4 (1.17%)
British J. of Educational Psychology	4 (1.17%)
J. of the Learning Sciences	4 (1.17%)
Learning & Instruction	4 (1.17%)
Science Education	4 (1.17%)
Teaching and Teacher Education	4 (1.17%)
Applied Cognitive Psychology	3 (0.88%)
Contemporary Educational Psychology	3 (0.88%)
International J. of Human-Computer Studies	3 (0.88%)
J. of Computer Information Systems	3 (0.88%)
Medical Teacher	3 (0.88%)
Research in Higher Education	3 (0.88%)
*Journals from 2000–2004 most citing list**	
International J. of Science Education	2 (0.59%)
J. of the American Society for Information Science & Technology	2 (0.59%)
Library and Information Science Research	2 (0.59%)
Library Trends	2 (0.59%)
J. of Educational Computing Research	1 (0.29%)
J. of Educational Psychology	1 (0.29%)
J. of Educational Research	1 (0.29%)
Communication Research	0 (0.00%)
J. of Computer-Based Instruction	0 (0.00%)
Review of Educational Research	0 (0.00%)
Technical Communication	0 (0.00%)

* In order to make comparisons easier, those journals from the other data set that did not appear in this list have been added with their corresponding numbers from this data set

Instructional Science, Journal of Computer-Based Instruction (no longer published), *Journal of Educational Computing Research, Journal of Educational Psychology, Journal of Educational Research, Journal of Research in Science Teaching*, and the *Review of Educational Research*. From the viewpoint of citation data, symbiotic journals are one way to operationalize the concept of a peer journal.

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These results provide the reader with practical information on the context of the research in *ETR&D* in terms of citation data. Although self-reports, such as surveys, are often used to gauge the influence of journals or other readings in a field (see for example, Reiser et al. 2005), the use of citation data provides a different, authentic assessment of influence.

Future research

A similar analysis is planned for the next five-year window of *ETR&D* data (2005–2009). In addition, the authors of this research have not exhausted the potential of this data set. For example, a factor analysis has been conducted to group cited journals into clusters according to the co-citation data, but is excluded from this article due to space constraints. Also, network visualization techniques provide an additional way to view complex interrelationships (see for example, Carmi et al. 2007). The researchers will present these analyses in future work, in addition to exploring other aspects of scientific communication within the field.

Changes in technology will continue to affect how we view, access, and cite the academic record. For example, Lin et al. (2003) describe a prototype system that would allow co-citation information to be considered while performing article searches. Rather than merely searching on author names or keywords, future researchers will likely have real-time access to visual depictions of the interlinking of co-authors, journals, and research topics.

The use of references is not just good scholarly practice, but a form of social cognition that could be aided and amplified (Cronin 2004; Palmer 2005). Just as the advent of computers has led to greater ease in performing complex statistical analyses, the ability to make bibliometrics an explicit part of online digital distribution and access could provide a tremendous boost to scholars and lay users in determining the veracity and context of information.

References

Anglin, G. J., Cain, J. J., Whitehouse, D., Cunningham, A., Newcomer, R., & Cunningham, K. (2003). An analysis of trends and issues in four instructional technology journals. In *Association for Educational Communications and Technology (AECT) 2003 Conference*, Anaheim, CA, October 22–26, 2003.

Bjorneborn, L., & Ingwersen, P. (2004). Toward a basic framework for webometrics. *Journal of the American Society for Information Science and Technology, 55*(14), 1216–1227. doi:10.1002/asi.20077.

Bush, V. (1945). As we may think. *Atlantic Monthly, 176*(1), 101–108.

Carmi, S., Havlin, S., Kirkpatrick, S., Shavitt, Y., & Shir, E. (2007). A model of Internet topology using k-shell decomposition. *Proceedings of the National Academy of Sciences of the United States of America, 104*, 11150–11154. doi:10.1073/pnas.0701175104.

Cronin, B. (2004). Bowling alone together: Academic writing as distributed cognition. *Journal of the American Society for Information Science and Technology, 55*(6), 557–560. doi:10.1002/asi.10406.

Dick, W., & Dick, W. D. (1989). Analytical and empirical comparisons of the journal of instructional development and educational communication and technology journal. *Educational Technology Research and Development, 37*(1), 81–87. doi:10.1007/BF02299048.

Gall, J. E., Ku, H. Y., Gurney, K., Tseng, H. W., & Yeh, H. T. (2004). An analysis of citation patterns in *ETR&D*. In *Association for Educational Communications & Technology (AECT) 2004 Conference Proceedings*, Chicago, IL, October 19–23, 2004.

Kirby, J., Hoadley, C. M., & Carr-Chellman, A. A. (2005). Instructional systems design and the learning sciences: A citation analysis. *Educational Technology Research and Development, 53*(1), 37–48. doi: 10.1007/BF02504856.

Klein, J. D. (1997). ETR&D-Development: An analysis of content and survey of future direction. *Educational Technology Research and Development, 45*(3), 57–62. doi:10.1007/BF02299729.

Lin, X., White, H. D., & Buzydlowski, J. (2003). Real-time author co-citation mapping for online searching. *Information Processing and Management, 39*, 689–706. doi:10.1016/S0306-4573(02)00037-7.

Palmer, C. L. (2005). Scholarly work and the shaping of digital access. *Journal of the American Society for Information Science and Technology, 56*(11), 1140–1153. doi:10.1002/asi.20204.

Reiser, R. A., & Dempsey, J. V. (Eds.). (2002). *Trends and issues in instructional design and technology.* Upper Saddle River, NJ: Merrill Prentice Hall.

Reiser, R. A., Mackal, M., & Sachs, S. G. (2005). Textbooks used in graduate programs in instructional design and technology: Changes over the past twelve years. *Educational Technology, 45*(5), 53–61.

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