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## ***Research Publication Trends and Topics in the Journal of Industrial Technology***

*By Dr. Richard Gebken, Dr. Shawn Strong & Dr. Steven McCrary*

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# Research Publication Trends and Topics in the Journal of Industrial Technology

By Dr. Richard Gebken, Dr. Shawn Strong & Dr. Steven McCrary

## Abstract

This paper investigates publication trends and topics covered in the National Association of Industrial Technology's (NAIT) *Journal of Industrial Technology (JIT)* over the past decade. Starting with the online availability of *JIT* in 1998, this paper examines all articles published in Volumes 15, Number 1 through Volume 24, Number 1 and analyzes both the bibliographic data and the content of those articles. Findings reveal several areas for concern including: a lack of detail within *JIT*'s mission/purpose, decreases in the number of articles published each year, a high percentage of one-time authors (greater than 70 percent), and a high percentage of low contributing institutions (greater than 60 percent).

## Introduction

Periodic reviews of research trends and topics are common in many academic fields. From social work (Tripodi, 1984, p. 3) and education (Tsai & Wen, 2005; Youngmin et al., 2004) to mass communication (Kamhawi & Weaver, 2003) and civil engineering (Abudayyeh et al., 2004; Abudayyeh et al., 2006), examining the history of published research is one way to assess developments within a discipline, expose strengths and weaknesses in the existing body of knowledge, and to seek out possible areas for future investigation.

The *Journal of Industrial Technology (JIT)* is the sole research publication of the National Association of Industrial Technology's (NAIT). In 1984, the *JIT* was formed as an outgrowth of a quarterly newsletter that was published by NAIT since 1969 (Chin, 1992). After publishing 14 volumes of quarterly print journals, *JIT* became a completely on-line peer-refereed journal in Novem-

ber 1998 with the start of Volume 15. As the end of 2008 approaches, *JIT* will mark the conclusion of ten years, 10 volumes (Volumes 15 through 24), and 40 issues of *JIT* published online. Over this decade of time, there has been no published review or analysis of the publication's trends and/or topics. In fact, over the near 25 year history of the journal, the only analysis of *JIT* content was performed by Chin (1992), who examined the first five volumes.

As the entire NAIT organization searches for a new strategic direction (Wright, 2007) and the journal begins to celebrate ten years of on-line availability and 25 years of publications, it is important to look back and understand the research history within the industrial technology field. The purpose of this paper is to examine both the bibliographic data and the general content of the online *JIT* articles, Volume 15-issue 1 through Volume 24-issue 1, in an effort to identify trends, uncover areas for journal improvement, and to provide a snapshot of the journal's publication record.

## Background

To undertake this investigation, the authors began with the role of *JIT* – its *raison d'être*. Below, the authors include a brief synopsis of the journal's mission, aim, and scope establishing a context for this study. In addition, investigating the journal's background enables the authors not only to develop a framework for classifying and grouping published articles congruent with *JIT* standards but also to evaluate the extent to which *JIT* is fulfilling its guiding principles based upon its publication history.

### **Journal Mission**

A mission generally helps an organization define who or what they aspire to become. Most mission statements include major products/services, target audience/customers, geographical focus, among other things (Gray & Larson, 2006). The NAIT–JIT website offers the best insight into the mission of the journal by stating, “The *JIT* publishes peer-refereed scholarly articles involving research and applications, along with non-refereed informational articles. [The] audience is Industrial Technology and other Technology Management-oriented faculty, students and professionals in both industry and academia (NAIT, 2008).”

Interestingly, the mission of the journal is spelled out neither in the *JIT* Bylaws (NAIT, 2007b) nor in the Constitution and Bylaws of the NAIT organization (NAIT, 2007a). Rather, the *JIT* Bylaws identify the purpose of the *JIT* Board and then go on to state that, “The *JIT* is a research-based journal focused on the interests of industrial technology, technology management, and closely related fields (NAIT, 2007b, p. 1).” The *JIT* Bylaws do go on to clarify its intended focus by stating, “No topic, setting, function, research methodology, or other category is given preference or excluded given that the submission fits accepted definitions of research and pertains to industrial technology (NAIT, 2007b, p. 3).” Given this definition, it is necessary to further explore the terms “research” and “industrial technology” to fully understand the mission/purpose of the journal.

The *JIT* Bylaws state that it follows the definition of industrial technology established by NAIT. According to NAIT, industrial technology is defined as, “a field of study designed to prepare technical and/or management oriented professionals for employment in business, industry, education, and government (NAIT, 2007b, p. 3).” Furthermore, the *JIT* Bylaws provide a definition for research established by the U.S. government. The Bylaws define research as, “the systematic investigation, including research, development, testing and

evaluation, designed to develop or contribute to knowledge that can be generalized (NAIT, 2007b, p. 3).”

Unfortunately, these definitions in and of themselves are not enough to build a framework for this study. To add further detail and to help understand *JIT*'s role within the discipline's body of literature, the authors explore other particulars including the journal's aim and scope.

### **Journal Aim and Scope**

The journal's aim and scope is paramount to understand not only *JIT*'s background but also the contextual approach of this study. Unfortunately, the *JIT* Bylaws do not state the aim and scope of the journal by itself; rather, specifics about the types of articles are elaborated to build a picture of what should be published. These descriptions are divided into two categories – refereed and non-refereed submissions. Refereed submissions add the following language to the earlier stated mission:

*Whereas much research done in these fields is applied in nature, relevant basic research and other types of disciplined inquiry will also be considered. The recognized quantitative and qualitative methods of investigation for manuscripts considered for inclusion in the JIT will be categorized as follows: (1) applied papers; (2) research papers; (3) pedagogical papers; and, (4) perspective (meta-analysis) papers (e.g., sound literature reviews to update the state-of-the-art). (NAIT, 2007b, p. 3)*

Non-refereed submissions are also discussed within the NAIT Bylaws. They state the aim and scope of non-refereed submissions are, “broader than that for *JIT* refereed articles. [Non-refereed submissions] focus on non-research pieces of importance to the readership. Appropriate content includes book reviews, opinion pieces, curricula, accreditation and certification information, and other topics of interest (NAIT, 2007b, p. 3).”

Pairing the journal's purpose with the aim and scope of published articles, it is possible to begin building a framework to analyze the journal's content in a rigorous fashion using bibliometric analysis. The framework, used below, includes the following:

- Refereed versus non-refereed articles,
- Research topics (Keywords),
- Meta-data, and
- Research categories.

### **Methodology**

This study utilizes bibliometric analysis to examine articles published within *JIT*. Bibliometric analyses are not only common within the library and information science fields but also used widely in other disciplines in the form of citation and content analyses. In fact, bibliometric analysis has even been previously utilized on *JIT* articles by Chin (1992). Briefly, bibliometric analysis is a quantitative approach to characterize or describe written communications. For a full description of bibliometric analysis techniques, readers are encouraged to examine Osareh (1996) and Nicholas and Ritchie (1978).

This study, like that of Chin (1992), analyzes *JIT* article data to describe a narrow set of published work rather than ascertain relationships and/or interdependencies among a larger body of literature. The focus of this study is all *JIT* articles published between 1998 and 2008. The unit of analysis for the study is a single article that includes refereed and non-refereed papers, as well as book reviews. All articles were accessed through the *JIT* website (<http://www.nait.org/JIT/JIT.html>) and relevant information, including authorship (both individual and institutional), keyword data, referee status, and method of investigation, was compiled and analyzed.

### **JIT Data and Findings**

Over the study period, specifically *JIT* Volume 15 (issue 1) through Volume 24 (issue 1), 37 issues were published containing a total of 218 papers. Nearly 400 authors and 80 institutions helped contribute articles to the journal during

that time period. The following five sections will further explore and discuss these papers.

**Number of Articles**

To compare the different volumes of *JIT* equally, the data subset was limited only to complete volumes (four full issues). Based upon this subset, there were a total of 217 articles published in *JIT*. That calculates to be a mean of 24.1 articles per volume. Interestingly, Chin (1992) found that there was a similar number, 25 articles, in *JIT* Volumes one through five.

Another observation can be made when plotting the number of articles published versus the journal volume. Figure 1 shows a downward trend, more than two fewer each year ( $R^2 = 0.399$ ), in the total number of articles published per volume during the study period. While future volumes will inevitably show whether this is a permanent trend, it is important to note that Volume 23 contains the fewest amount of articles ( $n = 13$ ) published in *JIT* history. Volume 24 may break (be lower than) this record as only four articles have been published through the first two of four issues.

**Refereed vs. Non-Refereed Articles**

The study also examined the number of refereed versus non-refereed articles published over the study period. Again examining only complete volumes (Volumes 15 through 23), there were a total of 191 refereed and 26 non-refereed articles. Figure 2 shows both the percentage of referred articles and the number of non-refereed articles published per *JIT* Volume.

Based upon these data, it is evident that *JIT* currently publishes refereed articles predominantly. This penchant for publishing refereed articles is in stark contrast to the data presented by Chin (1992). Table 1 shows a statistically significant increase in the percent of refereed articles published between Volumes 1 through 5 and Volumes 15 through 23.

Figure 1. Number of published articles per *JIT* Volume.

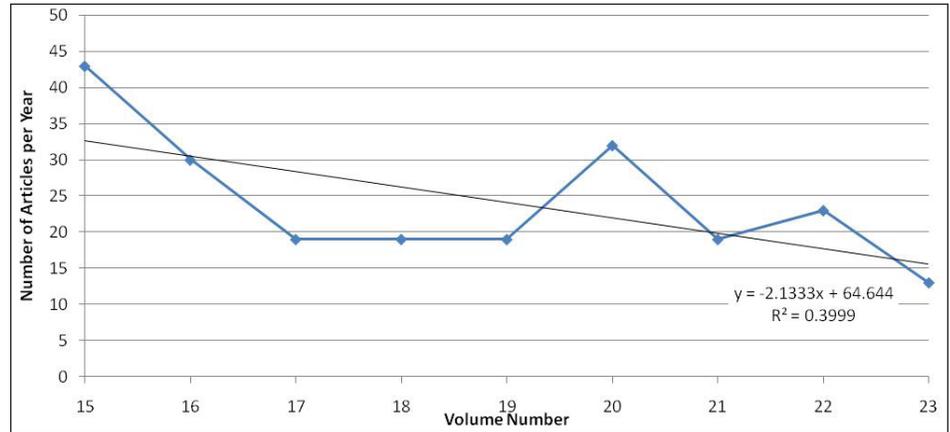


Figure 2. Analysis of refereed vs. non-refereed articles published in *JIT* Volumes 15-23.

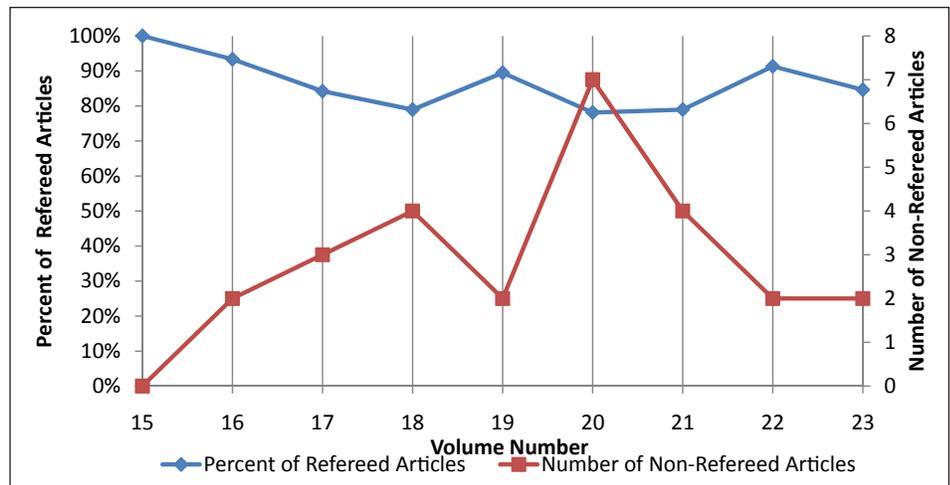


Table 1. A comparison of refereed and non-refereed journal articles between Volumes 1-5 (Chin, 1992) and Volumes 15-23.

Volumes	Number of Articles			Percent of Articles Refereed
	Refereed	Non-Refereed	Total	
1 through 5	57	68	125	45.6%
15 through 23	191	26	217	88.0%

Publishing more refereed articles is a possible indicator that *JIT* has narrowed its focus as a scholarly journal. This strategy is even outlined in the *JIT* By-laws which state, “The *JIT* Board may, at its discretion, determine that non-reviewed articles shall be published in a different publication than the *JIT*, such that the publication known as the *JIT* may contain only peer-refereed articles (NAIT, 2007b, p. 3).”

**Authors**

There were a total of 397 authors cited on articles published during the study period. This calculates to an average of 1.82 authors per article. According to Chin (1992), the percentage of articles with sole authorship was 76.8 percent for the first five volumes of *JIT*. The same value for the study period of this research was 41.3 percent. The decrease in sole authorships could be

related to several factors including a decrease in non-refereed articles. Other possibilities identified in the literature include an increasing trend towards multi-disciplinary research (Katz & Martin, 1997), an increased emphasis on publications in tenure and promotion decisions (Shapiro et al., 1994), or, simply, to the pursuit of increasingly complex research more appropriate for collaborative publications (Melin & Persson, 1996).

As secondary investigation into the authors of *JIT* articles looked at the frequency by which a particular individual appeared anywhere within the byline. Based upon this investigation, the total number of unique journal authors was 251. Table 2 shows a breakout of the number of times an individual appeared on the byline of a *JIT* article, in any position, versus the total number of unique authors over the study period. According to these data, the vast majority of authors, 72.1 percent, have only published once in *JIT*. The maximum number of articles published by a single individual was 17.

**Institutions**

Of the 218 total articles published during the study period, there were a total of 255 institution-articles. An institution-article is defined as the number of times an institution was listed by an author on the byline. Papers that are co-authored by individuals at a single institution are counted only once, while papers that are co-authored by individuals at multiple institutions are counted once for each different institution. This method of tabulation not only encourages multi-institution collaboration but also alleviates the confusion of trying to attribute partial credit for an article to multiple institutions.

There were a total of 76 different institutions that made contributions to the *JIT*. Twenty-seven institutions, those publishing three or more institution-articles, contributed almost 77% (196 articles) of the total institution-articles. The top ten contributing institutions by institution-articles are shown in Table 3. In addition, of the 255 institution-articles,

**Table 2. Number of *JIT* appearances by an author.**

Number of Appearances	Authors	
	Number	Percentage
1	181	72.1%
2	41	16.3%
3	12	4.8%
4	7	2.8%
5	4	1.6%
6	2	0.8%
7	3	1.2%
More than 7	1	0.4%
Total	251	100.0%

**Table 3. Top ten contributing institutions to *JIT* articles.**

Institution	Number of Articles
Iowa State University	31
Illinois State University	21
Bowling Green State University	13
University of Southern Maine	11
Indiana State University	10
Southern Illinois University	9
Purdue University	8
Missouri State University	8
University of Wisconsin-Stout	7
University of Northern Iowa	7

14 were from outside the United States. The number of institutions publishing 2 or less articles is 49 or just under 65 percent of all institutions.

**Research Topics**

In line with the objectives of this research, it was important to examine the broad range of topics identified by the journal’s mission, scope, and aim to see if there was any preference to any particular scholarly area or topic. To accomplish this, the researchers catalogued the keywords associated with each paper and performed various analyses on these data. Keyword data were selected as a representation of the research topic, since the articles’ authors select their own keywords as opposed to the researcher of this study arbitrarily classifying each paper. *JIT* has established a list of less than 80 dif-

ferent keywords which allows for some uniformity and consistency in their selection.

Over the study period, there were a total of 75 different keywords used in the 218 journal articles. Keyword frequencies were counted equally for each article irrespective of the number of keywords used to describe a single paper. As such, there were a total of 959 different keyword entries; however, 27 keywords (those cited ten or more times) were present over 80 percent of the time. These top 27 keywords and their frequencies are listed in Table 4.

Based upon these data, it can be concluded that *JIT* is publishing articles on a variety of subjects related to industrial technology including manufacturing, quality, CAD, and other computer

related areas. However, it appears that the most common area for investigation is related to academic research – either pedagogical or administrative. This finding should be examined further to assess the value of *JIT* towards academics and practitioners to ensure the intended audience is being adequately addressed.

**Research Trends**

Again in line with the objectives of this study, an analysis of research topics over the past ten years was performed to see if any trends were present. Utilizing the keyword data described previously, frequencies of keyword citing were plotted versus the publication year of the specific article as shown in Figure 3.

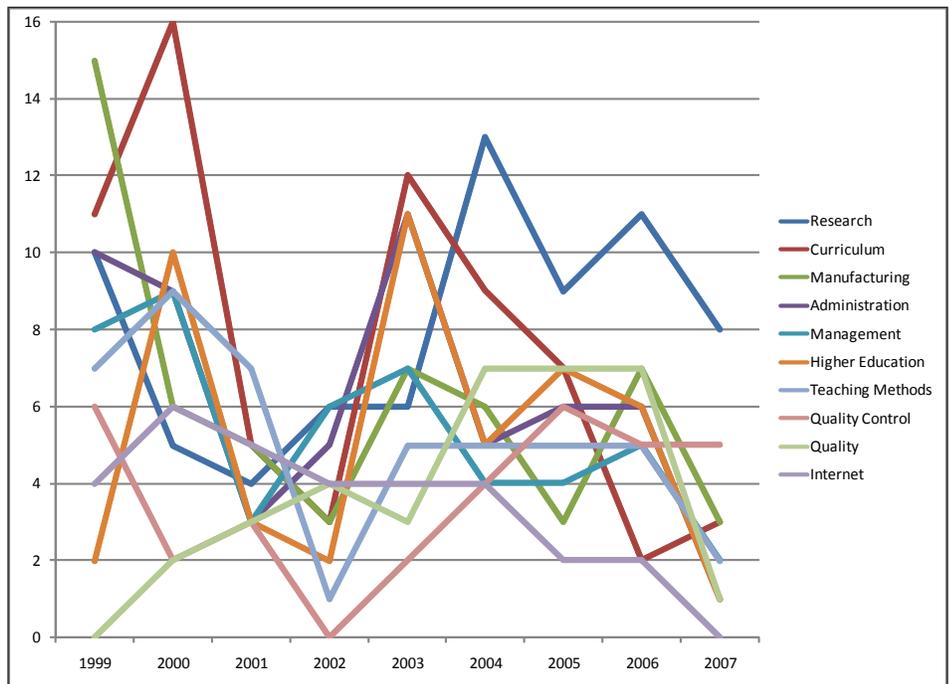
Examining the research topic data at first glance, it is difficult to identify any discernable trends. Part of this may be caused by the wide fluctuations in keyword selection by authors, but is more likely caused by the broad focus of the journal and the extent to which it can publish on a particular topic without creating a bias towards one area of industrial technology. Nevertheless, there are some trends that can be observed in the research topics of *JIT* papers.

First, papers focusing on the Internet, as defined by keyword selection, appear to be on the decline. Since 2000, the keyword Internet has been on a steady decline to the point that no articles were published using this term in 2007.

Second, there is a high correlation between the number of papers that select the keyword terms curriculum and higher education. This observation makes common sense as virtually all curriculum-related publications with *JIT* focus on the higher education arena. What is less inherent is the fact that both curriculum and teaching methods research appear to be on the decline from publication highs in both 1999 and 2000. This trend may be related to author preference for pedagogical publishing venues; however, more research is needed before a definitive conclusion can be made about this finding.

**Table 4. Keywords cited ten or more times by *JIT* articles.**

Topic	# of Articles	Topic	# of Articles
Research	76	Design	18
Curriculum	70	CIM	17
Manufacturing	58	Electronics	17
Administration	57	Information Technology	15
Management	53	Printing	13
Higher Education	48	Production	13
Teaching Methods	47	Computer Programming	12
Quality Control	35	Machine Tools	12
Quality	34	NAIT	12
Internet	31	CAM	11
Materials & Processes	26	Electricity	11
Leadership	25	Visual Communication	11
CAD	21	Human Relations	10
Graphic Communication	19		



**Figure 3. Research topic trends of articles published in *JIT* between 1999 and 2007.**

Lastly, it is interesting to note that the only research topic that appears recognizably increased in presence is the keyword term “research”. This inclination to list research as a keyword term is perplexing as it does little to define the actual subject of the paper being published. By definition, *JIT* publishes

refereed articles that fit into one of four methods of investigation (discussed in the next section) that all qualify as “research. Refinement of the keyword list may be necessary to better classify and organize articles within the overall *JIT* publication schema.

### Methods of Investigation

Using the four different methods of investigation defined within the *JIT* Bylaws as a starting point, the authors refined these categories based primarily upon *JIT*'s Review Criteria for Peer-Refereed Articles (NAIT, 2007c) and by work done by Tsai and Wen (2005), Kamhawi and Weaver (2003), and Tripodi (1984). In the end, the final four categories to identify the method of investigation were applied, basic, pedagogical, and perspective/meta-analysis research.

Using these four categories, the researcher began to classify the articles. After an initial training session where the definitions were reviewed and discussed, individual categorization was completed by two researchers. An assessment of interrater reliability revealed 81 percent agreement on the 218 articles. Discrepancies were later discussed and classified upon consensus. The number of articles classified in each method is shown in Table 5. Not surprisingly, the principal method of investigation was applied research as the nature of industrial technology is applied. Pedagogical papers were the second most frequent method of investigation – a reflection of the earlier keyword investigation.

### Conclusions

The *JIT* provides a much needed outlet for Industrial Technology professionals representing a number of different constituents. This study reflects these diverse interests with regards to the *JIT* article topics; however, this study also reveals concerning trends with the journal's publication record.

First, there are a decreasing number of articles being published each year. While this trend may be an indicator of rising publication standards, it may also be a cause for reduced interest in the journal itself. Second, the vast majority of individuals who contribute to the journal only publish once and the percentage of institutions publishing twice or less is over 60 percent of all contributing institutions. The *JIT* may need to conduct some marketing

Table 5. *JIT* Article method of investigation classification.

Method of Investigation	Number of Articles
Applied	98
Basic	3
Pedagogical	66
Perspective/Meta-Analysis	51

efforts focusing on an explanation of both of these findings. Next, there are a significant number of *JIT* articles that cover pedagogical topics. Creation of a separate journal for pedagogy may give more space to all research methods of investigation while maintaining or increasing the quality of each publication. Lastly, this study shows that the *JIT* keyword pool may also need reconsideration. Based upon the number of papers that are either utilizing ambiguous terms like “research” or confusing related terms like “quality” versus “quality control”, the process and variety of keyword selection should be reviewed.

There is much evidence that the *JIT* has undergone many changes since the first bibliographic study data was published by Chin (1992). Many of these changes, including examples such as the launch of indexing and abstracting services (currently offered by H. W. Wilson Company) and a revised editorial review processes (establishment of a 3-member editorial panel), are aimed at improving the quality of the journal; however, there are still areas where improvement efforts can be made. As NAIT looks to redefine itself in the wake of lagging membership, the *JIT* should consider performing a similar self-reflective investigation based, in part, on the findings of this study. The authors believe a clear mission/purpose will likely be the key to sustaining a respectable number of published articles while improving publication quality and utility. In the end, these findings are merely a starting point. A discipline-wide discourse on both the journal and the implications of changes to the publication should be undertaken as the *JIT* moves on to its second quarter century.

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