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A DISCIPLINE-SPECIFIC JOURNAL SELECTION ALGORITHM†

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Abstract—An experiment was conducted to demonstrate the validity of a journal selection and ranking algorithm designed for any discipline. The characteristics of the journal generation procedure incorporate both cited and citing journals so that basic scientific research journals contributing to the research foundation of the discipline, as well as journals in the discipline, might be identified. A Discipline Influence Score was proposed as a journal weight which could reflect the relative citation influence of each journal to the discipline under consideration. Two evaluation studies showed that this method produced many journals which were perceived as frequently used journals by a group of American and Chinese professionals in veterinary medicine. Journals with high Discipline Influence Scores were also selected by experts in their compilations of basic recommended lists in this discipline. In particular, the easy implementation of this journal selection algorithm appears to be of practical use to resource-poor libraries.

INTRODUCTION

Assessing the importance of journals for acquisition remains a difficult problem. Several articles have reviewed journal selection techniques [1-3]. Most of them were designed for special libraries, whose users often share a common subject interest. Thus, the library collection is often unified by a group of related topics or disciplines. Superficially, it would appear that the task of journal selection would be simply to subscribe to all relevant journals relating to the subject or discipline under consideration. In reality, few libraries can afford the luxury of an exhaustive collection. The journal collection at the National Library of Medicine is a rare exception. In 1984, it reported having received 22,994 serial titles [4]. For most special libraries, it is impossible to duplicate such an extravagant acquisition program. Especially for small libraries facing tight budgets and a lack of practical guidelines, journal selection is indeed a challenge to the librarian.

JOURNAL SELECTION STRATEGIES

Operationally, most libraries today still rely on the best subjective judgement of the librarian. Aside from the cost factor, three considerations dominate the selection decision. They are *utility* to the intended users, *quality* of journals, and *relevance* to the disciplines and areas of interest. Relatively objective data could be obtained from usage statistics and users' surveys. Since the 1959 publication of Urquhart's landmark work [5], there have been many studies done. However, in a developing country such as the People's Republic of China, many journals published in Europe and America are inaccessible. As a result, lower use is hardly an indicator of less worth. A strict adherence to a strategy based on use alone would yield misleading data.

Although journal quality and relevance are difficult to define, most previously pro-

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posed selection methods attempt to incorporate at least one of the two aspects. Several major types of selection methods are described below.

The most practical guide in journal selection for specific disciplines is the list of recommended basic titles produced by professional societies or librarians. The Brandon list for medicine is a typical example [6]. It is compiled as a general guide for all health science libraries giving equal coverage to all fields of medicine. Lists for more specialized subareas are also available. The list of 183 journals for veterinary medicine appears in the *Journal of Veterinary Education* [7], and it has been supplanted recently by an updated version [8]. Nonetheless, if money is available for only a few titles, one is left in a quandary as to which of the suggested journals to choose. These lists of "preferred" titles are only of limited use to libraries with severely limited budgets. For them, lists of journals ranked according to quality and relevance would best meet the long range collection development needs, even if funds only slowly become available. Flexibility in terms of use, as well as economy, is the key consideration in an effective journal selection strategy for a specific discipline.

It has been pointed out in a recent article that every ranking study employs at least one of three general ranking criteria: actual use, subjective user judgment, or a bibliometric statistic usually based upon citations [9]. The familiar *Bradford distribution* of journals is based on journal yield in a given field or discipline [10]. It has often been referred to as having applications in journal selection. Yet its use is not without its critics [11]. Although it has been previously demonstrated that journals with a concentration of articles correlate with the quality of those journals, a recent experiment sheds doubts on the claim that quantity may be equated with quality [12]. Moreover, to produce a Bradford distribution of journals in a given subject, a near comprehensive bibliography must be compiled. For a small library, it is impractical to conduct such time-consuming compilation of comprehensive productivity data.

An early article by Gross and Gross and a subsequent publication by Brown have often been cited as the initial attempts in using citations to indicate a journal's worth [13,14]. With the publication of the *Science Citation Index*, a practical means of conducting citation analyses was provided. Much has been written to support the claim that there is a direct relationship between the frequency of citations and the "influence," if not "quality," of the cited work. That this attribute is objectively quantifiable makes citation counts one of the most studied measures in this field. Furthermore, several important studies have provided evidence that frequently cited items correlate positively with subjective selections made by professional individuals in a given field [15,16]. Pan found statistically significant correlation between the frequency of citations and use statistics [17]. An unexpected finding in her study was that the total number of publications in a given journal regardless of their subject content was just as accurate an indicator of potential usage as were citation counts. If her findings can be corroborated, article counts could provide a simple and effective journal selection method.

Despite the relative ease with which citation counts can be made, even Garfield admitted that straight citation counting is a crude weight for journals [18]. Subsequently, many different algorithms using bibliometric statistics have been developed which incorporate a factor allowing the weight to be independent of the size of the journal in terms of the number of articles it publishes or of the number of references it contains.

Thus the journal impact factor was proposed as a modified citation weight; it is the number of citations made to a citable item in the journal [18]. Yet in several studies, impact factor did not correlate highly with use statistics [16,19]. Therefore, the uncritical use of impact factor should be avoided. It does not reflect the utility of journals whose main function is to alert users of newsworthy events and results. Since the impact factor of a journal title is based on the number of citations made to that journal, its computation depends on the number of times the given title is cited by all other journals in the database of the Institute for Scientific Information. In other words, the universe of citing journals consists of a multiplicity of journals with varying emphases on research, applications, reviews, topics, etc. They range from journals of fundamental research to journals with applications in a specific type of disease. Furthermore, citing behaviors and the relative frequencies of citations are field-dependent [20–22]. Thus, the comparison of a science journal title such as the *Journal of Biological Chemistry*, which has a high impact factor, with a mathematics journal such as the *Annals of Mathematics*, which has a lower impact factor, is meaningless. Journals ranked according to their impact factors may offer a useful indication for journal selection within a general library [9,22,23]. Within the context of a special library, however, where emphasis is on a specific discipline, journal weights must relate to the specific subject emphasis of that discipline.

Hirst recognized the need for a ranking algorithm for a small core list for a specific discipline [24]. His *Discipline Impact Factor* is similar to impact factor. It differs though by using only the citations made by a number of known relevant journals in the given discipline in its computation. Thus, the impact to the discipline is reflected. Yet the author cautions that there is still bias towards long established journals.

In association with a study of the research interaction among 50 fields in biomedicine, Narin proposed the *Total Citation Influence Measure* as an indicator of the influence of individual biomedical journals [25]. The project represented a massive study of 900 journals, each of which was classified among 50 fields. The total citation influence measure of journal A was computed as follows:

$$\frac{\text{\# of times A is cited by all other journals}}{\text{\# of times A cites all other journals}} \times \frac{\text{\# ref.}}{\text{\# publ.}} \times \text{\# of publ.}$$

Although this measure is a composite value computed from the product of three separate components, influence weight, influence per publication, and total influence, respectively, it is based primarily on the number of citations received by the journal in question. Yet, two points were brought out which were of particular interest in terms of discipline-specific collections. First of all, each of the 900 journals was categorized into one of four research levels:

Level 1: Clinical Observation
Level 2: Clinical Mix (medical research + observation)
Level 3: Clinical Investigation
Level 4: Basic Research

That journals dealing with fundamental basic research, such as the *Journal of Biological Chemistry*, made minimal reference to journals in the other three research levels, shows the definite hierarchical nature of biomedical research literature. Journals in these three levels tended to rely on and to cite basic research journals. Secondly, journals at each research level tended to cite those at a higher level rather than those at a lower level. However, journals at every level cited journals at the same level most frequently. Narin's article shows how the journals in each of two fields are connected by the two most frequently cited journals. The self-contained field of otorhinolaryngology consists of a tightly-knit journal citation network. Yet in other fields, such as cell biology, the key journal directs its references primarily to journals in biochemistry and to multidisciplinary and cross-disciplinary journals. The *Journal of Cell Biology* does not reference other cell biology journals to any extent. Thus, selection methods such as the Discipline Impact Factor, which generate relevant journals by a selection process based solely on cited journals would most likely have missed many journals in cell biology. Garfield has reported similar situations [26,27]. He found that in some fields, such as agriculture and veterinary medicine, the journals cited by researchers differ from those in which they publish their works. In both these fields, scientists cite the same basic research journals as do other life scientists. It appears that for a discipline oriented collection such as one for the Harbin Institute of Veterinary Medicine in China, the journal collection must contain relevant basic science journals as well as journals dealing with the practice of veterinary medicine. In other words, an effective selection algorithm should take into account cited journals as well as the journals citing key journals in the discipline. Therefore, the algorithm proposed here attempts to incorporate key elements observed by previous researchers. A description of the proposed selection algorithm is provided.

DISCIPLINE-SPECIFIC JOURNAL SELECTION ALGORITHM

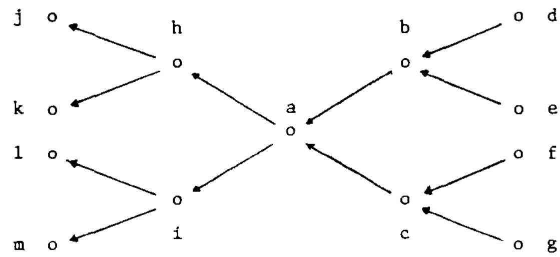
To present a ranked list of journals specific to a discipline, a two-step procedure is needed. First, a pool of candidate journals of potential contribution to that discipline must be identified. This set of journals will be known as the "Candidate Journal Set." Secondly, a weighting score must be computed for each journal in the Candidate Journal Set. Presumably, if the weighting scheme is accurate and valid, higher scores would be assigned to those journals that are more relevant to the given discipline, thus letting these journals be ranked high on the list. Ideally, regardless of the size of the Candidate Journal Set, the relative position of each journal would remain the same. As a practical consideration, there is no need for a truly universal journal set. Depending on the need of each library, the method used to generate a Candidate Journal Set should be flexible enough to identify larger or smaller sets depending on the available manpower and budget resources at the time of the study.

A. Generation of the "Candidate Journal Set"

The proposed method is based on citation data. Its objective is to identify two types of journals relevant to a given discipline: those that are contributors to the research foundation of the discipline; and those that are used for the professional practice of the discipline. By asking any knowledgeable individual, it is easy enough to start with one or more key journals known to be significant to research and/or practice in a given discipline. Any such journal is known as a "seed" journal. Clearly, journals whose subject content has been heavily "used" or cited in the key journal of the given discipline are of potential significance to that discipline. This is the same basis for all the other citation-based selection methods. If a relatively exhaustive set is desired, all journals cited by the key journal may be included. On the other hand, journals which have only been occasionally cited could be ignored. A reasonable strategy would be one which includes only those titles which have been cited by the "seed" journal for more than a certain percent of its total citations. In this manner, the Candidate Journal Set would contain only those which have contributed fairly substantially to the known key journal.

It has been suggested that by starting with a single journal in a topic, a complete network of journals can be created which reflects the intellectual structure of related subject knowledge [28,29]. Since the cited journals in a journal citation network represent the antecedent or "parent" generation of the "seed" journal, the antecedents of the antecedents can be identified by the same process. This iterative process is suggested to assure more complete coverage in the event that the suggested "seed" journal may not be the most cited journal in the discipline. Research has shown that as the process of identification of the cited journal continues, more and more basic research level journals have been linked until, eventually, no new journals are identified in the set [25,26]. In practice, one may wish to identify only one or two generations of the antecedent journals.

Narin found that journals at each research level cite substantial numbers of articles from journals at the same level and next higher level. Given the fact that only one or a few journals are used as the "seed(s)", these are probably the most prestigious journals in the field. Articles in these key publications would be expected to cite basic research materials as well as the most research oriented publications within the discipline. They are also likely to cite more fundamental works. As was shown in cell biology, the key journal minimally cites other cell biology journals. Limiting the identification of journals in the Candidate Journal Set to those cited journals would, in all likelihood, exclude most of those major application-oriented journals in the discipline. For a discipline such as agriculture or veterinary medicine, this procedure would exclude journals central to the practice of agriculture or to the diagnosis and treatment of animal diseases. Since journals also frequently cite other journals at the same level, these citation interactions could be utilized to capture relevant journals, by noting those which frequently cite the key journals in the discipline. These are, in a sense, the descendents from the "seed" journal. These descendent journals have "utilized" or relied heavily upon the key journals. Similarly, descendents of the descendents could be identified by the same process. As a result, the citation chain may be extended in both directions as shown in Fig. 1. Several generations of journals may be generated from



Notes:

a - the "seed" journal;

b, c - journals directly cited by a, first generation of antecedents from the "seed";

d, e, f, g - journals cited by b or by c, thus indirectly related to the "seed" journal, second generation of the antecedents of the "seed";

h, i - journals citing the "seed" journal, first generation of descendants of the "seed";

j, k, l, m - journals citing h or i, thus indirectly related to the "seed" journal, second generation of the descendants of the "seed".

Fig. 1. Antecedents and descendants of a "seed" journal.

the "seed" journals. Theoretically, all journals citing and cited in the few key journals may be collected. However, it would be practical to identify only those which contributed a substantial proportion of the total citations. For example, one could compile a list of journals, each of which has contributed one or two percent of the total number of citations to the key journals. Similarly, another group could consist of journals in which at least one or two percent of their references have been made to one of the key journals. Thus, journals which have contributed to, and others which have utilized the subject content of a few key journals in a discipline are identified as potentially useful journals in the discipline. This method of journal generation allows for the flexibility as previously dictated by the needs and available resources of the individual library.

B. Discipline Influence Score—A Discipline-Specific Journal Ranking Weight

The idea that a ranking score of a journal should be based on the citation influence of a selected Discipline Journal Set has been suggested by Hirst [24]. This journal set may be taken from a list of frequently used titles, most cited titles with high impact factors, or titles selected by professionals in the field. It is then possible to rank the journals in the Candidate Journal Set by the relative citation influence on the Discipline Journal Set. The Discipline Influence Score of each journal A in the Candidate Journal Set may be computed by:

$$\mathrm{DIS}_{\mathrm{A}} = \sum_{i=1}^{n} \frac{\text{number of times } J_i \text{ cited journal A}}{\text{total number of times } J_i \text{ cited all journals}} \tag{1}$$

where $\mathrm{DIS}_{\mathrm{A}}$ = the Discipline Influence Score of journal A in the Candidate Journal Set; J_i = a member of the Discipline Journal Set, and; n = the total number of journals in the Discipline Journal Set.

The Discipline Influence Score associated with journal A is the sum of the relative frequency of citations made to journal A by each of the journals in the Discipline Journal Set. In other words, one may interpret it as the total sum of probabilities that journal A would be cited by a group of journals considered relevant to the discipline. Journals in the

Candidate Journal Set may then be ordered according to their associated Discipline Influence Scores.

EXPERIMENT

An experiment was conducted to demonstrate this discipline-specific journal selection and ranking algorithm. Veterinary medicine was chosen as the discipline for testing. Its literature is believed to emanate from many countries since certain animal diseases are indigenous to restricted geographic locations. Yet the journals of interest to veterinary research consist largely of the medical research literature [27]. Although there are fewer veterinary medicine journals than journals in human medicine, many schools of veterinary medicine maintain departmental libraries. The discipline does encompass most of the facets of biomedicine. Furthermore, the importance of this discipline is recognized among the developing countries of the world. Fundamental research in biochemistry, cell biology, general medicine, and pharmacology are applicable to veterinary medicine to a large degree.

1. *Seed Journals*: Garfield identified five key journals in veterinary medicine [27]. They contained 25% of all publications in the subject as it appeared in the 1980 volume of the *Journal Citation Reports*, and accounted for 51% of all citations made to veterinary medicine in the Institute for Scientific Information database. The five key journals were:

   Journal of Animal Science
   American Journal of Veterinary Research
   Veterinary Record
   Journal of the American Veterinary Medical Association
   Research in Veterinary Science

2. *Candidate Journal Set*: Antecedent journals cited in the five "seed" journals were identified. In order to generate a fairly small set of journals, a cutoff of 1% was used. That is, to be selected as an antecedent journal, the number of times it is cited by any one of the "seed" journals must exceed 1% of the citations made in the "seed." Citation data were derived from the Citing Journal Package contained in the 1983 volume of *Journal Citation Reports*. A total of 21 unique journals were identified as antecedents of the five "seeds." A second iteration of the same procedure yielded 86 antecedents to the 21 antecedents from the first generation. Thus a total of 107 unique cited journals, derived from two parent generations, were included in the Candidate Journal Set.

   Using the Cited Journal Package in the *Journal Citation Reports* published in 1983, the descendent journals of the five "seed" journals were identified. Each journal selected met the requirement that at least 2% of the bibliographic references contained in its articles were made to one of the five "seed" journals. The assumption was that only those journals which substantially "drew" on one of the key journals in veterinary medicine were allowed membership in the Candidate Journal Set. Unlike the cited journals, whose descendents "contributed" rather than "used" the subject content of the five known relevant journals, a more rigorous cutoff of 2% was selected. Eighteen journals were direct descendents of the five "seeds", and 43 were derived from the first generation of 18 descendents. Thus a total of 61 unique titles from the two descendent generations were added to the Candidate Journal Set. Eliminating duplicate titles, the Candidate Journal Set contained a total of 146 unique journal titles linked by citations to and from five key journals in veterinary medicine.
3. *Discipline Journal Set*: Before computing the Discipline Influence Score for the journals in the Candidate Journal Set, membership of the Discipline Journal Set must be defined. For convenience, the list of journals with high impact factors categorized under the subject "veterinary medicine" in the 1983 volume of *Jour-*

nal Citation Reports was used as the Discipline Journal Set. A total of 74 journals were on the list.

4. *Discipline Influence Score*: The next step was to compute the Discipline Influence Score for the journals in the Candidate Journal Set using Eq. (1). Table 1 shows an example of the computation of the Discipline Influence Score for the *New England Journal of Medicine* which is a member of the Candidate Journal Set. Under the heading "Citing Journal", only 17 of the 74 titles in the Discipline Journal Set cited the *New England Journal of Medicine* in 1983. Thus, each of the remaining 57 citing journals contributed no value to the summation. The computed Discipline Influence Score was 0.1672. Finally, the 146 journals were ranked according to their Discipline Influence Scores.

COMPARISONS WITH FOUR OTHER RANKING TECHNIQUES

To assess the validity of this discipline-specific journal selection algorithm, the ranked list of 146 journals was compared with lists of the same journals ranked by four other methods. Each journal in the Candidate Journal Set was ranked according to: (1) the number of articles published in 1983, (2) the number of citations received during 1983, (3) the impact factor for 1983, and (4) the total citation influence measure computed for 1983. The choice of these four methods was guided by the practicality of these methods as well as by their implicit validity. For example, the ranking technique as performed by the Discipline Impact Factor was not included because, as was expected, from the exclusive use of cited journal data, the journal list generated by this method included primarily cross-disciplinary journals and journals in general medicine, such as *Lancet* and *Nature*. Journals central to the practice of veterinary medicine were conspicuously absent. Data used to order all four journal lists were extracted from the *Journal Citation Reports* of 1983. Spearman's rank-correlation coefficients were calculated for every other pair of the five rankings. The results are presented in Table 2.

The most obvious finding was that the list ranked according to the Discipline Influence Score did not correlate with any of the other four methods. The four other rankings

Table 1. Sample computation of a discipline influence score for the *New England Journal of Medicine*

Journal Code: 117

Journal Title: NEW ENGL J MED

Citing Journal	# of citations received from citing journal	Total # of ref. the citing journal gives to all journals	Discipline Influence Score
AM J VET RES	64	10040	0.0063745
J AM VET MED ASSOC	54	6195	0.0087167
J AM ANIM HOSP ASSOC	40	3041	0.0131535
VET IMMUNOL IMMUNOP	30	2285	0.0131291
CAN VET J	18	1446	0.0124481
LAB ANIM SCI	11	1167	0.0094258
VET PATHOL	11	1822	0.0060373
COMP IMMUNOL MICROB	10	667	0.0149925
J MED PRIMATOL	10	267	0.0374531
J SMALL ANIM PRACT	10	1206	0.0082918
ADV VET SCI COMP MED	8	2289	0.0034949
CAN J COMP MED	8	1790	0.0044692
VET MED SMALL ANIM	8	1843	0.0043407
VET MICROBIOL	7	1206	0.0058043
DEUT TIERARZTL WOCH	6	2340	0.0025641
KLEINTIER PRAX	6	741	0.0080971
VET HUM TOXICOL	6	713	0.0084151

Total Discipline Influence Score: 0.1672078

Table 2. Spearman rank-correlation coefficients for five rankings of the journals in the candidate journal set

	Article Counts	Citation Counts	Impact Factor	Total Citation Influence Measure
Citation Counts	0.888*			
Impact Factor	0.619*	0.790*		
Total Citation Influence Measure	0.877*	0.931*	0.804*	
Discipline Influence Score	-0.016	-0.037	-0.124	-0.021

* significant at 0.01 level.

showed statistically significant correlations among each other. Thus, one of two opposing conclusions could be drawn: either the Discipline Influence Score is accurate as a journal weighting technique or any of the four other ranking methods is accurate. Two evaluations were performed to arrive at the final conclusion.

EVALUATION

Two types of evaluations were performed. First, a survey of professionals in veterinary medicine was conducted to assess the utility of the top 20 journals in 3 ranked lists. Second, the journals with high ranks on each of the five lists were compared with two recommended basic journal lists.

1. A questionnaire survey was designed to probe the expressed preference of journal use by subject experts in veterinary medicine. The 146 journals in the Candidate Journal Set were ranked by the Discipline Influence Score, by article counts, by citation counts, by impact factors, and by total citation influence measures. Since the rankings by article counts and by citation counts correlated significantly with that by impact factors and by total citation influence measures, only the ranked lists by impact factors, total citation influence measures, and Discipline Influence Scores were examined closely. From each of these three ranked lists, the top 20 journals were pooled. Naturally, some journal titles appear on more than one list. As a result, a total of 46 unique journal titles were identified and alphabetically arranged.

This list of 46 journals was submitted to researchers and professionals in a veterinary research institute and three veterinary schools in the United States. They were the National Animal Disease Center of USDA, the School of Veterinary Medicine of Purdue University, the College of Veterinary Medicine of the University of Minnesota, and the College of Veterinary Medicine of the Washington State University. Each individual was asked to circle 5 to 10 journals in the list perceived by him to be used most frequently in relation to his teaching or research. A blank space was also provided for titles not present in the list.

Researchers at the Control Institute of Veterinary Biologicals of the Ministry of Agriculture and the Harbin Institute of Veterinary Medicine of the Chinese Academy of Agricultural Sciences were also surveyed. The former is the organization in China whose sole responsibility is the supervision of the production of vaccine, serum, antitoxin and other veterinary biologicals. The latter is one of the three national veterinary research institutes in China.

This sample from six institutions was selected to represent active professionals and researchers in developed and developing countries. In an effort to obtain a high return rate, an individual at each institution known to one of the authors was contacted. Through this individual, other professionals were solicited for their cooperation in filling out the questionnaire. The local contacts at each site were successful in persuading the return of a total of 141 questionnaires. From each institution, a return rate between 19% to 43% was achieved.

Totalling the returned questionnaires, each of the 46 journals was weighted by the number of selections made by the 141 experts. Thus a ranked list of 46 journals titles was compiled based on the number of selections made by the experts. Spearman's rank-correlation coefficients were computed for the associations between the rankings according to every other pair of the following: expert evaluation, Discipline Influence Score, impact factor, and total citation influence measure. The results are shown in Tables 3 and 4. It appeared that the rankings according to expert evaluation correlated only with the rankings associated with the Discipline Influence Scores. The coefficient obtained was at 0.741 which is significantly higher than the 0.5 obtained from most other studies [9,30].

2. At the time of the study, there was a recommended basic list of journals in veterinary medicine published in the *Journal of Veterinary Medical Education* [7]. A new list was submitted to the Medical Library Association for approval in 1981 [8]. These two lists

Table 3. Combined list of the top 20 journals ranked by discipline influence score, impact factor, total citation influence measure, and expert evaluation

Journal Title	Ranked by			
	Expert Evaluation	Discipline Influence Score	Impact Factor	Total Citation Influence Measure
AM J VET RES	1	3	*	*
J AM VET MED ASSOC	2	1	*	*
VET REC	3	2	*	*
CAN J COMP MED	4	18	*	*
SCIENCE	5	*	9	4
INFECT IMMUN	6	9	*	*
NEW ENGL J MED	7	*	1	13
BRIT VET J	8	17	*	*
RES VET SCI	9	6	*	*
AUST VET J	10	5	*	*
CORNELL VET	11	16	*	*
J IMMUNOL	12	14	13	6
LAB INVEST	13	*	17	*
AVIAN DIS	14	8	*	*
NATURE	15	11	6	3
J COMP PATHOL	16	13	*	*
IMMUNOL REV	17	*	3	*
J ANIM SCI	18	4	*	*
J SMALL ANIM PRACT	19	20	*	*
J DAIRY SCI	20	10	*	*
ENDOCRINOLOGY	21	*	18	20
P NATL ACAD SCI USA	22	*	8	2
J BIOL CHEM	23	*	15	1
J EXP MED	24	*	5	7
BIOCHEM J	25	*	*	11
CANCER RES	26	*	*	18
LANCET	27	*	4	*
THERIOGENOLOGY	28	12	*	*
AM J PHYSIOL	29	*	*	16
ANN INTERN MED	30	*	10	*
J CELL BIOL	31	*	7	17
J REPROD FERTIL	32	7	*	*
CANCER	33	*	*	19
CELL	34	*	2	14
EUR J IMMUNOL	35	*	16	*
J CLIN INVEST	36	*	11	10
BIOCHEMISTRY-US	37	*	19	8
BIOCHIM BIOPHYS ACTA	38	*	*	5
DEUT TIERARZTL WOCH	39	15	*	*
IMMUNOGENETICS	40	*	20	*
J MOL BIOL	41	*	12	*
ASTROPHYS J	42	*	*	12
BERL MUNCH TIERARZTL	43	19	*	*
BIOCHEM BIOPHY RES CO	44	*	*	15
BRAIN RES	45	*	*	9
NUCLEIC ACIDS RES	46	*	14	*

* - indicates rank greater than 20.

Table 4. Spearman's rank-correlation coefficients for the journals with high discipline influence scores, impact factor, total citation influence measure, and expert evaluation

	Impact Factor	Total Citation Influence Measure	Discipline Influence Score
Total Citation Influence Measure	0.868*		
Discipline Influence Score	-0.545*	-0.434*	
Expert Evaluation	-0.201	-0.224	0.741*

* significant at 0.01 level.

contained 183 and 182 journal titles respectively. Only 113 journal titles appearing on both lists were still published. Many titles from both lists were not covered by the *Journal Citation Reports.* Finally, although only 66 of the 113 titles were members of the Candidate Journal Set, this 58% of the recommended journals may also be identified through linkages by cited and citing journals.

From each of the five journals lists ranked by the five different criteria, the top 20 journal titles were considered the most important by each selection method. Each of the set of 20 titles was compared with the 66 journals included in the recommended basic list. Table 5 shows the results of the comparison. The top 20 journals identified by the Discipline Influence Scores were all recommended titles on the recommended basic list. A maximum of only 10 titles in each of the other four lists was found on the recommended basic list.

Similarly, when the top 40 journal titles were compared, the list ranked by the Discipline Influence Score showed 38 titles from the recommended list. A maximum of only 20 titles from each of the other four lists was found in the list of recommended titles (Table 5).

CONCLUSION

The objective of this study was to demonstrate that for a discipline-specific journal collection, an effective journal selection algorithm could identify two types of journals. The first consists of contributors to the subject content of the key journals in the discipline. These are often basic science journals and multidisciplinary medical journals with research emphasis. They are frequently cited titles. The second type publishes the literature of the discipline. Authors of papers in these journals are the professionals of the field. These journals frequently cite the publications in key journals of the discipline. The proposed algorithm incorporated both cited and citing journals, which in this instance was used to generate a balanced journal list for veterinary medicine. This list consisted of 5 basic science journals, 78 medical journals, 20 agricultural journals and 39 veterinary medical journals. This procedure was used with a journal scoring method, the Discipline Influence Score, to weight each journal in the list. The resulting ranked list of journals was shown to be a strong predictor of users' expressed preference of journal with relation to their professional work. On the other hand, articles counts, citation counts, impact factor, and total citation influence measure were unable to predict users' preference of veterinary medical journals. Additionally, journals with high Discipline Influence Scores on this list also were selected independently by experts on their recommended journal lists.

Furthermore, this algorithm seems to be able to accommodate any discipline and to produce larger or smaller sets of journals depending on needs. Experience has also shown

Table 5. Number of journals in the top 20 and the top 40 journals ranked by five ranking weights, selected by recommended basic journal lists

Journal Ranking Weights	# of Journal Titles also Selected by Recommended Lists			
	Top 20 Rankings		Top 40 Rankings	
Article Counts	9	45%	17	42.5%
Citation Counts	10	50%	19	47.5%
Impact Factor	10	50%	18	45.0%
Total Citation Influence Measure	10	50%	20	50.0%
Discipline Influence Score	20	100%	38	95.0%

that this two-part algorithm is simple and easy to implement. Evidence has been overwhelming that this technique appears to rank journals according to the perceived usefulness by professionals. The actual data collection took a few hours, making this a practical journal identification method. Further testings of this method are planned.

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REFERENCES

1. Singleton, A. Journal Ranking and Selection: A Review in Physics. *Journal of Documentation*, **32**(4):258–289; 1976.
2. Kraft, D. H. Journal Selection Models: Past and Present. *Collection Management*, **3**(2/3):163–185; 1979.
3. Dhawan, S. M.; Phull, S. K.; Jain, S. P. Selection of Scientific Journals: A Model. *Journal of Documentation*, **36**(1):24–41; 1980.
4. U.S. Department of Health and Human Services. Public Health Service. National Institute of Health. *National Library of Medicine: Programs and Services, Fiscal Year 1984*. Bethesda, Maryland: National Library of Medicine; 1985.
5. Urquhart, D. J. The Use of Scientific Periodicals. *Proceedings of International Conference on Scientific Information*, 277–290; 1958.
6. Brandon, A. N.; Hill, D. R. Selected List of Books and Journals for the Small Medical Library. *Bulletin of the Medical Library Association*, **67**(2):185–211; 1979.
7. Henley, A. L. Organization and Compilation of a Basic List of Veterinary Medical Serials. *Journal of Veterinary Medical Education*, **5**(3):136–138; 1978.
8. Boyd, T.; Hull, D.; MacNeil, K.; Malamud, J.; Anderson, D. C. Basic list of Veterinary Medical Serials. 2nd edition, 1981 with revision to April 1, 1986. *Serials Librarian*, **11**(2), 1986 (to appear).
9. Bennion, B. C.; Karschamroon, S. Multivariate Regression Models for Estimating Journal Usefulness in Physics. *Journal of Documentation*, **40**(3):217–227; 1984.
10. Bradford, S. C. *Documentation*. London: Crosby Lockwood; 1948.
11. Drott, M. C. Bradford's Law: Theory, Empiricism, and the Gaps Between. *Library Trends*, **30**(1):41–52; 1981.
12. Boyce, B. R.; Pollens, J. S. Citation-based Impact Measures and the Bradfordian Selection Criteria. *Collection Management*, **4**(3):29–36; 1982.
13. Gross, P. L. K.; Gross, E. M. College Libraries and Chemical Education. *Science*, **66**:385–389; 1927.
14. Brown, C. H. *Scientific Serials: Characteristics and List of Most Cited Publications in Mathematics, Physics, Chemistry, Geology, Physiology, Botany, Zoology, and Entomology*. ACRL Monograph No. 16. Chicago: Association of College and Research Libraries; 1956.
15. Virgo, J. A Statistical Procedure for Evaluating the Importance of Scientific Papers. *Library Quarterly*, **47**:415–430; 1977.
16. McAllister, P. R.; Anderson, R. C.; Narin, F. Comparison of Peer and Citation Assessment of the Influence of Scientific Journals. *Journal of the American Society for Information Science*, **31**(3):147–152; 1980.

17. Pan, E. Journal Citation As a Predictor of Journal Usage in Libraries. *Collection Management*, **2**(1):29-36; 1978.
18. Garfield, E. Citation Analysis As a Tool in Journal Evaluation. *Science*, **178**(4060):471-479; 1972.
19. Paranhos, W. *Application of An Entropy Measure for Journal Evaluation and Its Comparison to Other Quantitative Measures*. Cleveland, OH: Case Western Reserve University; 1981 (unpublished Ph.D. Dissertation).
20. Price, D. de S. *Little Science, Big Science*, New Haven: Yale University Press; 1963.
21. Folly, G.; Hajtman, B.; Nagy, J. I.; Ruff, I. Some Methodological Problems in Ranking Scientists by Citation Analysis. *Scientometrics*, **3**(2):135-147; 1981.
22. Garfield, E. *Citation Indexing—Its Theory and Application in Science, Technology, and Humanities*. New York: John Wiley & Sons; 1979.
23. Garfield, E. Why the Journal Citation Reports? *Current Contents*, **17**:9-12; 1983.
24. Hirst, G. Discipline Impact Factors: A Method for Determining Core Journal Lists. *Journal of the American Society for Information Science*, **29**(4):171-172; 1978.
25. Narin, F.; Pinski, G.; Gee, H. H. Structure of the Biomedical Literature. *Journal of the American Society for Information Science*. **27**(1):25-45; 1976.
26. Garfield, E. Journal Citation Studies. 20. Agriculture Journals and the Agricultural Literature. *Essays of an Information Scientist*. Philadelphia: ISI Press, **2**:272-278; 1977.
27. Garfield, E. Journal Citation Studies. 35. Veterinary Journals: What They Cite and Vice Versa. *Current Contents*, **13**:5-13; 1982.
28. Goffman, W. A Pragmatic Approach to Literature Selection. In: (Kenneth S. Warren ed.) *Selectivity in Information Systems: Survival of the Fittest*. New York: Praeger Press; 1985, pp. 117-143.
29. Goffman, W.; Pao, M. L. Retrieval of Biomedical Information for Emerging Interdisciplinary Problems. *Proceedings of the 4th International Congress on Medical Librarianship*. Belgrade, Yugoslavia, 39-50; 1980.
30. Chudamani, K. S. Journal Acquisition—Cost Effectiveness of Models. *Information Processing and Management*, **19**(5):307-311; 1983.