Trends in the use of digital libraries by scientists in 2000-2005
A case study of FinELib

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Abstract

This study explores the trends in the use of electronic material and digital libraries by university faculty between the years 2000 and 2005. The data consist of nationwide web-based surveys of the end-users of FinELib, Finnish Electronic Library, at all Finnish universities. Although material provision has grown tremendously and consequently the use of electronic literature and of FinELib, the clients were polarizing into frequent and infrequent users. Perceived availability of the material provided was a major factor influencing this polarization. Availability was significantly stronger predictor of the use than users' discipline. It seems that availability underlies the disciplinary variation in the use of digital libraries.

Introduction

Researchers have rapidly adopted electronic literature as part of their daily work, although the degree of adoption varies by discipline and the availability of electronic material provided (Borgman 2000; Tenopir 2003). Our understanding of the changes in the use of digital libraries by university faculties is based mainly on studies, which are not aimed at exploring this change. Studies typically explore various factors associated with the use of digital libraries in a certain point of time. There are two major problems. First, in explaining digital library use both independent and dependent variables and their measurement vary. Second, the populations studied vary in many respects. The number of institutions, e.g. universities, and disciplines included may vary greatly (Tenopir 2003). It is not uncommon that many user surveys leave open the question about the generalizability of the findings due to the nature of the sample selected. Thus, variation in measurement and population limit to a great extent the comparison of the results between studies for revealing trends over time. Although comprehensive reviews like Tenopir (2003) give a careful account of changes of use, the conclusions they provide would benefit from longitudinal studies aimed at comparing changes.

The aim of this study is to compare the changes in use of electronic material and of digital libraries by university faculties between the years 2000 and 2005. We use representative samples of faculty members of all Finnish universities. The survey questionnaires included the same major independent and dependent variables in both years. The digital library studied is the Finnish Electronic Library - FinELib. It is a consortium of all Finnish universities for licensing and providing access to digital resources to its members. FinELib is the major supplier of electronic literature to university faculties in Finland (Annual Report of FinELib 2004) implying that it is their major channel for accessing electronic resources. This provides us with a unique opportunity to reliably analyze trends in the use of digital libraries and create a comprehensive picture of the patterns of use in one country. As far as we know, our study is first of its kind using comparable representative data from several points in time.

Finland is a small EU country with one of the most developed innovation infrastructure in the world. In many international comparisons Finland has continuously ranked as one of the leading countries in innovation, as measured in terms of growth, competitiveness and

technological sophistication and infrastructure. Finland is third in the world after Sweden and Israel in the share of R&D expenditure per GDP. In 2004 its share was 3.34 % of GDP. (Annual Innovation Policy Trends and Appraisal Report 2004-2005: Finland). By serving research and teaching FinELib is one means of enhancing the Finnish R&D system. The way it succeeds in this aim contributes to the volume and quality of national research output.

We study how the habits of university faculties of using digital libraries change and are influenced by discipline and availability of material over the years in a small research-intensive European country. Our results are likely to shed light on corresponding trends in small and medium-sized developed countries.

Related research

As far as we know, the only study which directly compares trends in the use of electronic material and of digital libraries is Tenopir & al. (2003). Other studies are cross-sectional revealing patterns of use in a certain point in time.

Tenepir & al. (2003) distinguish three evolutionary phases in the use of e-journals by scientists: early, evolving and advanced. They compare journal use at these phases. The years included for the early phase are 1990-1993, for the evolving phase 2000-2002 and for the advanced phase 2001-2002. The samples consist of 862 scientists and non-scientists from three universities and other organizations for the early phase, 235 scientists in two universities and one national laboratory for the evolving phase, and 508 members of the American Astronomic Society for the advanced phase. Astronomers, due to their research culture and developed journal system, represented the advanced phase, although the difference in time between the two last samples was small. The information given hints that the population of the samples varies a lot, which makes the comparison difficult. Especially the results concerning the advanced phase do not represent the whole variety of sciences, but only a small fraction of them. This all reduces somewhat the reliability of findings concerning trends.

The comparison shows that the amount of articles read by scientists per year has increased and especially scanning them has increased (Tenopir 2003, Tenopir & al. 2003). Also the number of papers read outside the researchers' own field has grown (Institute for the Future 2002). The use of library collections has increased, whereas personal subscription to journals has decreased as a result of digitalization. It seems that electronic format is rapidly compensating print format in the use of journal articles especially in the advanced phase. Of articles read by astronomers, 80 % were in electronic format. (Tenopir & al. 2003) However, this may not hold outside so called hard sciences.

Although both browsing and searching remain important information seeking strategies, e-journals (full-text databases in particular) are causing a decrease in browsing titles, while searching by topic has increased (Tenopir & al. 2003). Browsing of core journals by tables of contents remains important, but searching by topic for additional journals and articles is increasingly popular, particularly in large, mixed-journal databases (Tenopir 2003). Moreover, increased opportunities for chaining between electronic articles and journals are likely to increase the popularity of this method of accessing documents (Institute for the Future 2002).

In all, the digitalization of information resources has influenced scientists' ways of using and accessing electronic literature in digital libraries. However, there is lack of systematic information about these patterns of change especially among various disciplines.

Research design

Research questions

The aim of this paper is to analyze how the use of FinELib services has changed between the years 2000 and 2005. The major research questions are:

- To which extent the digitalization of the material used and the frequency of use of FinELib by university researchers and teachers has changed
- How the perceived availability of material in FinELib and users' discipline are associated with the use of FinELib

Data

The data were collected by FinELib in its annual user survey via www-questionnaires. They were posted on FinELib's homepage in November 2000 and in April 2005, and advertised in university libraries' main pages.

The questionnaires were addressed to the staff and students of all 22 Finnish universities. We are interested here in the trends of use among teachers and researchers including full time doctoral students. Students are excluded. Next we analyze how representative the data is by status and discipline.

To measure their academic status the respondents were asked to place themselves in one of the following categories: 1) full time doctoral student, 2) assistant/researcher, 3) lecturer/teacher/docent 4) professor.

The categories provided differed somewhat in 2000 and 2005. In 2000 full-time doctoral students were implicitly included in the category "assistants/researchers". There was no specific category for them in the classification. The structure of the categorization steered the doctoral students to select the "assistant/researcher" category. Assistants are mainly full-time doctoral students with some teaching and administrative duties. Therefore the context steered them to select this category.

The categorization is not totally mutually exclusive due to some vagueness in wording. The assistant/researcher category includes persons from full-time doctoral students with some teaching and administrative duties to researchers who may have a doctoral degree. Full-time doctoral students in the first category are focused mainly on research with no teaching or administrative obligations. Thus, the second category may include researchers with a longer research career. However, one has to emphasize that most of the assistants are doctoral students.

The lecturer/teacher/docent category consists of teachers with a longish academic career and typically with a doctoral degree. In Finland there is only one category of professor. Their competence for the position is assessed by external assessors. The academic status reflects the growing seniority and competence in academic tasks.

As table 1 indicates our sample is very representative according to status in 2005, but somewhat biased towards assistants in 2000. Younger scholars, i.e. assistants, are over-represented. These researchers are likely to be the most active users of digital material. Therefore the use figures may be somewhat higher than in the whole population. On the other hand, the samples are based on self-selection implying that the most active users of digital libraries are over-represented in the data. Therefore the figures are likely to overestimate the use of electronic material.

Table 1. The breakdown of sample and population by status (%)

	2000		2005	
Status	Sample (n=543)	Population (N=12361)*	Sample (n=532)	Population (N=14399)*
Assistants	73	66	64	65
Lecturers	13	17	20	19
Professors	14	17	15	16
Total	100	100	100	100

*Source: Kota Online University Statistics. http://www.csc.fi/kota/kota.html

The sample is in both years somewhat biased by discipline (table 2). In 2000 humanities and engineering are somewhat under-represented, whereas economics and natural sciences are over-represented. In 2005 natural sciences and engineering are slightly under-represented, while medicine and social sciences are over-represented. It seems that the bias in both years is neither in favor of active nor passive users of digital libraries. Over and under-represented groups include in both years disciplines which are typically either more active or more passive in terms of frequency of use.

Table 2. The breakdown of sample and population by discipline (%)

	2000		2005	
Discipline	Sample (n=543)	Population (N=12361)*	Sample (n=532)	Population (N=14399)*
Humanities	18	23	20	22
Natural sciences	28	22	17	22
Economics	11	6	8	7
Engineering	19	26	22	26
Medicine	14	14	19	14
Social sciences	9	8	14	9
Total	100	100	100	100

*Source: Kota Online University Statistics. http://www.csc.fi/kota/kota.html

Our data is relatively representative by status and somewhat biased by discipline. In addition to that, it is likely that active users of digital libraries are over-represented in the data.

Used variables

This study is comparative in two senses. On the one hand, it compares the patterns in the use of FinELib over the years, on the other hand it compares the use in relation to faculty members' discipline and perceived availability of material. Dependent variables are the frequency of use of FinELib and the degree of digitalization of the material used.

The frequency of use of FinELib was measured with a five-point scale ranging from less than a few times a month to daily. The second dependent variable, the degree of digitalization of the material used was measured by asking the respondents to select between the following options: In my work 1) I use solely or almost solely electronic material, 2) mainly electronic material, 3) both electronic and print material equally, 4) mainly print material, 5) I do not use electronic material.

The perceived availability of core literature in electronic format was measured by the question: "How does FinELib cover your own discipline's core resources?" A five-point scale ranging from not at all to very well was used.

In the questionnaire, respondents were asked to place themselves into a disciplinary grouping. The grouping of disciplines into six broad categories corresponds to the official categorization by the Ministry of Education (Table 3).

Table 3. Disciplinary categories

Category	**Disciplines**
Humanities	history, folklore, education, theology, psychology, linguistics, fine arts, music, theatre and dance
Natural sciences	mathematics, physics, chemistry, agriculture and forestry, dietetics, food industry and home economics
Economics	Economics
Engineering	engineering, computer science and architecture
Medicine	medicine, nursing science and physical education
Social sciences	social sciences, law and administration

These disciplinary categories are evidently not internally homogeneous regarding their research culture and literature orientation. Within the humanities group, psychology and education may share more features with social sciences than humanities. This kind of within group variance may decrease the between group variance of disciplinary categorization, reducing its explanatory power.

FinELib

FinELib was launched in 1997 to support higher education, learning and research in Finland as a part of the Information Society Program. In addition to that, a Program for Additional Research Funding was launched in 1997-1999. It raised the level of research funding in Finland to 3,1 % of GNP. The aim of this program was to enhance and internationalize research in Finland. Developing the National Electronic Library was seen as a means for achieving this aim. By providing access to high-quality resources it was pursued for increasing the quality and volume of research. (Varis & Saari 2003)

FinELib is a part of the services of the Finnish National Library (Hormia-Poutanen 2003). The main means of FinELib (Varis & Saari 2003) are

- To increase the amount of electronic information available to users on the net
- To improve information retrieval from the net

The main task of FinELib for increasing the availability of electronic material is to select it, to negotiate about the license rights with publishers, and to provide access to the material licensed.

FinELib is a consortium of universities, polytechnics, research institutes and public libraries. It was meant to serve universities, but its scope has expanded to cover also polytechnics and currently also public libraries to some extent. However, its main customers are universities, the share of which is 80 % of its annual budget (Annual Report of FinELib 2004).

FinELib is clearly the major supplier of electronic literature to universities in Finland. Most of the electronic literature used by university teachers and researchers is provided by FinELib (Vakkari & Talja 2005). In 2004 FinELib covered 84 % of acquisitions of digital materials at Finnish universities (Annual Report of FinELib 2004).

The provision of electronic material by FinELib, journals in particular, has grown remarkably (table 4). E-journals include both refereed and non-refereed journals. The emphasis is on the refereed journals.

When the number of e-journals licensed was 6000 in 2000, the figure was 19500 in 2004. These estimates are counted by summing up the number of tittles provided by licensed journal packages. The packages include to some extent same journals. Therefore, the number of unique journal tittles is somewhat smaller than these estimates. Despite of this, we may conclude that the number of electronic journals the university community had access to was threefold. The growth in the number of reference databases had been slower due to their good coverage from earlier times.

The use of the resources provided in terms of printed articles has also increased at the same pace as the supply of journals. The number of printed articles increased from one million in 2000 to 3,2 million in 2004. Also the number of searches in the databases has grown, although not at the same pace as the number of print-outs.

Table 4. Central indicators of material provision and usage

Indicators	**2000**	**2004**	**Growth %**
Electronic journals	6000	19500	232 %
Reference databases	90	115	28 %
Printed articles	1 million	3,2 million	220 %
Searches	8 million	18,5 million	131 %

Source: Annual Reports of FinELib 2000 and 2004 (Figures in 2005 not yet available)

The evaluation report in 2003 concluded that FinELib has improved the availability of electronic material for researchers. It was considered well advanced and functioning well especially within the hard sciences by providing databases for research and teaching in these fields. The situation in other fields like humanities, theology, social sciences and education was considered less well developed reflecting the state of e-content markets. (Varis & Saari 2003)

A more thorough analysis showed that smaller disciplines in humanities and social sciences were not so well served as other fields. This was in part due to the criteria for journal selection. The minimum criterion for licensing was the interest of at least six consortia members in purchasing a journal (Annual Report of FinELib 2003). The licensing policy was steered more towards humanities and social sciences and the criterion was somewhat loosened from 2003 onwards. In the strategy for 2004-2006 these and small fields of research and also Finnish material were selected as the areas of emphasis (Annual Report of FinELib 2004).

Results

First we explore the major trends in the use of FinELib and then elaborate on the results by analyzing the patterns of use associated with availability and discipline.

Main trends

The use of electronic material by university scholars increased considerably from the year 2000 to the year 2005 (table 5). In 2000 about one fifth and in 2005 already almost 60 % used mainly or only electronic literature in their work. The proportion of those using mainly print material has decreased from 31 % to 12 %. Those who only focused on print material comprised of only one percent or less of the respondents in both years. It is evident,

however, that their proportion in the whole population is greater because the active users of electronic material are likely to be over-represented in the data.

Table 5. The digitalization of literature used (%)

Use of literature	2000 (n=543)	2005 (n=532)
Electronic only	1	12
Mainly electronic	21	46
Equally both	47	30
Mainly print	31	12
Print only	1	0
Total	100	100

As one can expect, the proportion of frequent users of FinElib has also increased (table 6), although not as much as the degree of the use of electronic material. The proportion of those using FinELib at least several times per week has increased from 36 % to 53 %. On the other hand, those who used FinELib less than some times per month or not at all comprised 48 % in 2000 and 38 % in 2005. The proportion of infrequent users was not decreasing to the same extent than the proportion of frequent users is increasing. It seems that the clients of FinElib are polarizing into frequent and infrequent users.

Table 6. The frequency of the use of FinELib (%)

Frequency	2000 (n=543)	2005 (n=532)
Daily	9	20
Several times a week	27	33
Once a week	16	9
Less frequently	18	17
Do not use	30	21
Total	100	100

Studies indicate that the perceived availability of electronic material is perhaps the strongest predictor of its use (Törmä & Vakkari 2004). It is obvious that the increasing availability leads to the growing use of the material provided.

In 2005 69 % of users considered the availability of central material in their field provided by FinELib to be at least good, whereas in 2000 54 % were of the same opinion (table 7). Thus, the proportion of those who perceived the availability as at least good has increased by 15 %-units. The proportion of those who considered the availability as bad was small in both years. It seems that the actual availability of FinELib is rather good, because in 2005 over two thirds of the users considered it to be at least good and only a few percent of them considered it bad.

Table 7. Perceived availability of central material in FinELib (%)

Perceived availability	2000 (n=459)	2005 (n=466)
Very good	10	17
Good	44	52
Moderate	38	26
Bad or not at all	8	4
Total	100	100

For analyzing the association between availability and the frequency of use, we dichotomized availability by collapsing "very good" and "good availability" into one category and the remaining classes into another category. We measured frequency of use by counting the proportion of those who used FinELib at least several times a week.

In both years availability was significantly associated with the frequent use of FinELIb (2000: F=22,3; p=0,000 / 2005: F=74,0, p=0,000). The association has strengthened during the years (table 8). Of those who considered availability as at most moderate, about the same proportion - c. 30 % - used FinELib frequently in both years, whereas among those who perceived the availability as at least good, the proportion of frequent users have increased considerably from about half to over two thirds. A more detailed analysis revealed that the proportion of those using FinELib infrequently (some times a month or less) has increased from 46 % to 57 % among those who consider availability as at most moderate.

Table 8. The % of those using FinELib at least several times a week by perceived availability

Perceived availability	**2000 (n=459)**	**2005 (n=466)**
At least good	52	70
At most moderate	31	30
Total	43	56

In all, a growing proportion of users consider the availability of material provided by FinELib as good leading to an increasingly active use of its services. On the other hand, there is a diminishing proportion of users who perceive its availability as at most moderate and continuously use its services infrequently. It is evident that perceived availability is a central factor influencing on the polarization of clients into frequent and infrequent users.

Discipline and the use of FinELib

Researchers' disciplines are one of the strongest factors associated with the use of digital libraries (Borgman 2000; Tenopir 2003; Törmä & Vakkari 2004; Vakkari & Talja 2005).

An ANOVA showed that discipline was significantly associated with the proportion of those using mainly or solely electronic material in their work (2000: F=14,9; p=0,000 / 2005: F=34,3; p=0,000). This association was stronger in 2005. In both years among humanists and social scientists there were significantly fewer researchers using mainly electronic material compared to other disciplines (Dunnett C: p<0,05).

The difference between these two and other groups has increased remarkably (table 9). While the proportion of those using mainly electronic material has grown in humanities and in social sciences only 7 and 17 %-units, the growth in other disciplines varies between 38 and 53 %-units. When the difference between humanities and social sciences and other disciplines were in 2000 about 10-20 %-units, it was in 2005 already 45-60 %-units. A closer examination revealed that especially in the humanities the proportion of those who lean mainly on print material was greater than in other groups. The figure was 35% in humanities, whereas in social sciences 19 % and in other disciplines less than 6 %.

Table 9. The proportion of those using at least mainly electronic material by discipline (%)

Discipline (n)	**2000**	**2005**
Humanities (97/100)	10	17
Natural sciences (153/85)	22	75
Economics (69/41)	22	73
Engineering (103/108)	30	77
Medicine (76/92)	34	72
Social sciences (50/69)	12	29
Total	22	58

In the time period analyzed, humanists and social scientists have proceeded from using mainly print material to the equal use of print and electronic material. The majority in other groups already used both types of material in equal proportions five years earlier, and used

mostly electronic material in 2005. Thus, the use of electronic literature has been adopted in a very different pace in various disciplines.

Discipline was significantly associated with the proportion of those who used FinELib at least several times per week in both years. The association was stronger in 2005 (F=4,7; p=0,000) than in 2000 (F=2,3; p=0,041). The differences between the disciplines in the frequent use of FinELib have become somewhat greater during the last years (table 10).

In both years among humanists there were clearly proportionally less frequent users of FinELIb compared to other disciplines excluding social sciences. The difference was significant in 2005 (Dunnett C: p<0,05).

In humanities and economics the proportion of frequent users had increased slightly, about 5 %-units, whereas in other disciplines the proportion of frequent users had increased considerably (table 10). The intensity of the growth was related to the level of active use in 2000. The smaller the proportion of active users in 2000, the greater the rate of growth during the time period surveyed. In 2005 the users of FinELib could be classified in three categories depending on their frequency of use. Humanists were less frequent users, social scientists and economists formed a middle group and the representatives of all other disciplines were the most frequent users. There is a difference in the frequent use of FinELib in the soft-hard science dimension.

Table 10. The % of those using FinELib at least several times a week by discipline

Discipline (n)	**2000**	**2005**
Humanities (97/100)	28	33
Natural sciences (153/85)	35	64
Economics (69/41)	45	50
Engineering (103/108)	38	57
Medicine (76/92)	46	57
Social sciences (50/69)	24	43
Total	36	51

We showed earlier that the clients of FinElib are polarizing into frequent and infrequent users. In 2005 half of faculty members used services several times a week, whereas about 40 % used them at most some times per month. A detailed analysis revealed that in 2000 about 60 % of humanists and social scientists used FinELIb less than some times a month, whereas the figure was 36 % in medicine and 42-45 % in other disciplines. The proportion of infrequent users had remained about the same in humanities (61% - 55 %), economics (42 % - 41 %) and medicine (36 % - 35 %), whereas it had diminished in natural sciences (46% - 29 %), engineering (44 % - 33 %) and social sciences (58 % - 45%). This polarization is greatest in humanities followed by social sciences and economics.

The perceived availability of central material was also significantly associated with the discipline in both years (2000: F=9,7; p=0,000 / 2005: F=4,4; p=0,001) (table11). In 2000 a significantly bigger proportion of faculty members in natural sciences, economics, engineering and medicine considered availability as at least good compared to humanists (Dunnett C: p<0,05). Also among economists and engineers availability was considered as significantly better than among social scientists (Dunnett C: p<0,05). In 2000 availability was considered as best in economics, engineering and medicine, then in natural sciences followed by social sciences. In humanities the availability was experienced as weakest.

In 2005 there were not any more significant differences in perceived availability between social sciences and other disciplines (Dunnett C: p>0,05). The proportion of those

considering availability as at least good was significantly bigger in economics, engineering and medicine compared to humanities (Dunnett C: p<0,05).

Table.11. The proportion of those perceiving availability as at least good by discipline (%)

Discipline (n)	**2000**	**2005**
Humanities (97/71)	27	49
Natural sciences (153/50)	56	69
Economics (69/28)	74	76
Engineering (103/71)	66	76
Medicine (76/72)	66	77
Social sciences (50/54)	38	64
Total	55	69

We showed earlier that both discipline and perceived availability were significantly associated with the use of FinELib. In order to analyze in more detail how both factors are related to the use of FinELIb, an ANOVA was calculated. For the analysis availability was dichotomized as described earlier. Use was measured as the proportion of frequent users, i.e. those who used FinELIb at least several times a week.

In both years perceived availability was significantly associated with use (2000: F=13,5; p=0,000 / 2005: F=43,0; p=0,000), whereas discipline was not significantly associated with it (2000: F=0,9; p=0,48 / 2005: F=1,2; p=0,076). Although discipline was not significantly associated with the use, the proportion of frequent users varied somewhat by discipline in both groups of availability in 2005 in particular. The main conclusion is, however, that perceived availability is a significantly stronger predictor of the use of digital library services than users' discipline. Controlling of availability eliminates to a great extent the association between discipline and use. It seems that perceived availability varies with discipline and that produces the variation in the frequency of use. Thus, it is the varying perceived availability of electronic material between disciplines, which regulates the frequency of use.

Discussion and conclusions

Our study extends and deepens our knowledge about trends in the use of digital libraries by university faculties. As far as we know this is the first study that has used longitudinal, nationwide comparable data for exploring these trends. Our data is likely to be somewhat biased towards active users of electronic resources and therefore the actual use may not be as frequent as our results show.

We have measured the use of digital library by counting the frequency of use. Our instrument does not cover all the dimensions of use. However, we have explored elsewhere other features of use like the material types used (Vakkari & Talja 2005) the purpose of use (Vakkari & Talja 2006) and the search methods used (Vakkari & Talja 2006).

Our results show that the degree of digitalization of the literature used by faculty members has increased rapidly reflecting international trends (Borgman 2000; Tenopir 2003). Also the proportion of frequent users of FinELib has grown considerably, although not at the same pace as the use of digital resources. This perhaps reflects the supposed increasing use of electronic material available from channels other than digital libraries, for example from researchers' home pages (cf. Tenopir & al. 2003; Talja 2004).

It seems that the clients of FinELib are polarizing into frequent and non-frequent users. When the proportion of frequent users has increased considerably, the proportion of clearly infrequent users has decreased much less.

The perceived availability of central material provided has increased clearly over the years. This trend is a natural consequence of the tremendous growth in the supply of e-journals and reference databases by FinELib.

Among those who considered the availability as good a growing proportion used FinELib frequently, whereas among those who considered the availability at most moderate the share of frequent users were c. 30 % in both years. It seems that in the continuously diminishing group where the availability is worse than on average, the proportion of infrequent users is increasing. It is evident that perceived availability is a central factor influencing the polarization of clients into frequent and infrequent users.

Although scientists increasingly use electronic material in their work, electronic literature has been adopted in a very different pace in various disciplines as several studies have shown (Bonthron 2003; Borgman 2000; Tenopir 2003). This has led to a polarization of the frequent use of electronic material between humanities and social sciences and other disciplines. In the time period analyzed, humanists and social scientists have proceeded from using mainly print material to the equal use of print and electronic material. The majority in other groups already used both types of material in equal proportions five years earlier, and in 2005 used mostly electronic material.

In 2005 in engineering, natural sciences, medicine and economics about 75 % used mainly electronic material in their work. This figure resembles the finding in Tenopir & al. (2003), that in 2001-2002 c. 80 % of the articles read by astronomers were in electronic format.

The differences in the frequent use of FinELib between humanities and other sciences have increased. When most of the groups have intensified their use, the growth in humanities was slow. The disciplines can be clustered into three groups in hard vs. soft sciences dimension. Natural scientists, engineers and representatives of medicine are the most frequent users followed by economists and social scientists, humanists being less frequent.

We showed that perceived availability is a significantly stronger predictor of the use of digital library services than users' discipline. Controlling of availability eliminates to a great extent the association between discipline and use. It seems that availability varies with discipline and that produces the variation in the frequency of use. Thus, it is the varying perceived availability of electronic material between disciplines, which regulates the frequency of use, not discipline as such.

This result confirms the finding in Eason & al. (2000) and in Törmä & Vakkari (2004) that perceived availability is a stronger predictor of the use of digital libraries than users' discipline. It seems that availability underlies the disciplinary variation in the use of electronic material. However, in addition to perceived availability there may be other disciplinary factors, which cause variation in the use of electronic libraries and material. Fry and Talja (2004) have suggested some interesting hypotheses and Vakkari & Talja (2005) have shown that a specific disciplinary characteristic - the scatter of literature use - is associated with the number of various databases used. It seems necessary to study in more detail how specific disciplinary characteristics and the perceived availability are associated with the use of electronic material.

The enormous growth in the number of full-text journals provided by FinELib naturally explains the strong increase in the perceived availability and consequently in the increase of its use. It seems that the acquisition policy, which has favored humanities and social

sciences during the last couple of years, has been partly successful in the sense that social scientists have intensified their use at the same pace as other disciplines. On the other hand, the proportion of frequent users among humanists has not grown much.

Interestingly, the proportion of those who consider availability as good has grown most in humanities and social sciences, although they do not consider it as good as other disciplines. The discrepancy among humanists between the strong growth in perceived availability and scarce growth in use may mean that a great portion of humanists use literature in their work - books and journals - which is in paper form, not available electronically. Although there is interesting material available electronically, the nature of their research object leads them to use paper sources. It is likely that many representatives of so called national disciplines use Finnish periodicals, which are in paper form (Talja 2004). In humanities and social sciences, it is also common to use books, most of which are not available electronically.

The tremendous growth in the supply of electronic resources by FinELib has made a spectrum of old and new information resources, especially journals, available and easily accessible to researchers at Finnish universities. This has led to an intensified use of electronic resources via FinELib. It is likely that all this has contributed to the growth in the volume and quality of Finnish research according to the aims of FinELib. To which degree and through which mechanisms this has happened is a challenging research question.

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