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ELECTRONIC SUPPORT AND RESEARCH PRODUCTIVITY: THE CASE OF ACADEMIC ENGINEERS AND SCIENTISTS

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ABSTRACTS:

Compares the frequency of eleven types of computer use with the publication productivity of 83 academic engineers and 239 academic scientists from University of Malaya and National University of Malaysia. The data was collected from two sources. A self-administered questionnaire was used to obtain demographic data, their opinion on the adequacy of the computer facilities made available for them and the types of use they made of the computers for research purposes. Data on the total number and type of publications authored was obtained from the questionnaire, and the annual reports of academic staff publications for the years 1990 to1995. The results revealed that the majority of both academic engineers and scientists made frequent use of computers for research. However, the scientists indicated a more varied use than the engineers. Both groups reported frequent use of computers for word processing (83% to 90%), sending or receiving e-mails (66% to 71%) and searching for information in the Internet (41% to 51%). Computers are least used for keeping personal bibliographical indexes (8% to 11%). For the academic scientists, the total publication productivity is correlated (£0.01) to using computers for creating databases, word processing, slide presentations, sending or receiving emails, obtaining information from the Internet and maintaining personal bibliographical indexes. For the academic engineers the total publication output is not correlated with frequent use of computers for research, although the mean score for each type of computer use is high. The frequency of computer use is also related to such factors as respondent's department, age, work experience and academic rank.

Keywords: Publication productivity; Academic scientists; Academic engineers, University of Malaya, National University of Malaysia; Computer use; Electronic support in research.

INTRODUCTION

The electronic support refers here to the computing facilities available for academic use. It refers to both stand-alone and networked computers, which are usually made available either in staff laboratories or on their desks. The use of computers (both stand-alone and networked) has grown explosively in academic institutions of the more developed countries, and such computers are also now becoming increasingly available in less developed nations, such as Malaysia. Liebscher, Abels and Denman (1997), reporting on the statistics provided by the

Internet Society, indicated a doubling in the number of Internet hosts from 3.8 million to 6.6 million for the period November 1994 to July 1995, with an estimated increment to more than 10 million by the end of 1996.

Even though the electronic support is widely available, it is believed that only a small percentage of academic faculties utilise the facilities fully. Ashley (1995) surveyed the use of the Internet by 888 faculty members at the University of Arizona and reported that only between 20% and 39% fully utilise the network facilities provided. This finding echoes the opinion of Brown (1994), who estimated that only 10% of faculty at institutions which have access to the Internet actually use it.

The use of computers and the Internet has been mainly for e-mail, subscription to discussion groups, access to electronic journals, running programs and transferring of files for teaching and research as has been indicated by a number of recent studies. Abels, Liebscher & Denham (1996) surveyed users and non-users of electronic networks in science and engineering faculties from small universities and colleges between 1993 and 1994. One of the factors looked at was the type of use made of the services discussed under the heading "tasks". Their respondents indicated using the e-mail mainly for teaching, research and administrative work. They joined discussion groups for research news, to keep up-to-date and for teaching needs; and they accessed databases, run programs and file transfer for research and teaching. In a later study, Lazinger, Barllan and Peritz (1997) examined and compared the use of Internet by 462 faculty members from the Hebrew University of Jerusalem, and found that over 80% use the Internet, with a higher percentage of users from the science and technology faculties. The highest use was for email and the use of the Internet for research was also evident. More than half of the respondents indicated that they conducted research with distant colleagues via the Internet. Over 80% indicated that the Internet has influenced them by increasing their cooperation with colleagues in research teams, improved their access to databases, and allowed them to obtain faster research updates.

To date, very few studies connect computer use to productivity. One of the earliest studies on the issue was by Hesse, Sproull, Kiesler and Walsh (1993). It used the questionnaire method to study the use of computer networks by oceanographers and the effect of this use on their publication productivity. The study found a significant correlation between network use, measured by self-reported usage, publication productivity, and professional recognition. Cohen (1996) reported a statistically significant relationship between faculty use of computer-mediated communications and their publication levels. The most recent study was by Kaminer and Braunstein (1998). They studied the level of Internet use and its possible effect on scholarly output. Data was obtained from three sources; publication counts derived from the bio-bibliographies maintained by the academic personnel office at the University of California at Berkeley and from the College of Natural Resources; the

actual use of the Internet was obtained from computer logs maintained on the University's UNIX system; personal, academic and institutional environment information was compiled from a questionnaire designed for the study and from the 1995/96 edition of *American men and women of science.* The variables to be compared with Internet use and publication productivity were age, age at obtaining Ph.D., time taken to obtain Ph.D., research load, and the Carnegie classification of higher educational institutional status. Age and age at Ph.D were found to be significantly related to publication productivity ($p \leq 0.05$).

Most universities in Malaysia have already established a campus network of computer systems with connections to JARING, the national gateway to the Internet. Most Malaysian university academics now have access to networked computer facilities not only in their laboratories but also on their desks. The availability of such computing facilities is expected to improve academic access to information as well as expedite communication of research. The aim of the present study is to find out the degree of use selected academic engineers and scientists in Malaysia make of computers and the type of usage. The ratings obtained will be compared and tested for correlation with research publication productivity.

BACKGROUND

The sample for this study comprises 83 academic engineers and 239 academic scientists from University of Malaya (UM) and National University of Malaysia (Universiti Kebangsaan Malaysia, UKM). The former figures represent 66%, and the latter 76%, of the total academic engineers and scientists in both the universities. The engineers came from four departments (civil, chemical, electrical, and mechanical) and the scientists from seven departments (botany, chemistry, genetics, geology, mathematics, physics and zoology).

The data for this study came from two sources. A self-administered questionnaire was used to solicit information on the demographic background of the selected respondents, as well as their opinions on the adequacy of the computer facilities made available to them, together with the frequency and the types of uses they made of the computers for research purposes. Information on the total number and types of publications authored is obtained from two sources: firstly, from a section in the questionnaire which requests the respondents to indicate the number of books, book chapters, journal articles, conference papers, research reports they published, books they have edited/translated, and standards or patents they have obtained; and secondly from the annual report of academic staff publications for the years 1990 to 1995 published by both the universities. The former is used when the information given is complete (some respondents attached a complete list of their publications) and the later is used when the information in the questionnaire is incomplete and for cross -checking.

METHODOLOGY

As this study forms a part of a larger study on academic productivity, only the

relevant sections of the questionnaire are mentioned here. Demographic data obtained from the questionnaire include variables such as respondent's age, institutional affiliation, department, gender, race, work experience, qualifications, academic rank, years passed since the highest qualification was obtained, the country from which the qualification was obtained and the percent of time allocated to research. The annual reports provide information such as the total number and types of publications authored and also whether the works were written singly or jointly. Respondents were asked to indicate whether they uses computers, the type of computers used (stand-alone or networked), the location of the computers used, the frequency of use and the quality of computing facilities for research purposes. The frequencies of the types of computer used for research were studied by employing eleven variables, and a five-point Likert scale. The variables can be categorised into three types of usage; processing information (creation of databases, statistical analysis, file transfer, programming); seeking and presenting information (graphical representation of data, word processing, preparing slide shows) and seeking and communicating information (searching databases, sending/receiving email, accessing information via the internet). The results were analysed statistically using SPSS version 7.5.

RESULTS

Computer Use

All academic engineers and scientists reported using computers. None reported rare or zero use. The majority of scientists (97.5%) used both stand-alone and networked computers for research while slightly more than a third (43.4%) of academic engineers indicated such usage (Table 1).

Location of the Computers

More than 90% of both academic engineers and scientists used computers which were available on their desks. This indicates that access to computers for research did not pose a problem. About a third (38%) of academic scientists compared to less than 10% of academic engineers used computers available for academic staff within their departments. A small percentage used computers available at the computer centres and libraries of each university (Table 2), besides the computers on their desks. In both cases most respondents indicate using computers in more than one location.

Frequency of Computer Use for Research

Both the academic engineers and scientists are frequent computer users. Almost all the engineers indicated that they are frequent users, while 94.6% (n=226) of scientists indicated so.

Table 1: Type of Computers Used

	Scientists (n=239)		Engineers (n=83)	
Type of computers used	**N**	**Row % of total**	**N**	**Row % of total**
Stand-alone microcomputers	5	2.1%	34	41.0%
Networked computers	1	0.4%	13	15.7%
Both	233	97.5%	36	43.3%

Table 2: Location of Computers Used

	Engineers		Scientists	
Location of computers	**N**	**Row % of total**	**N**	**Row % of total**
On own desk	78	94.0%	237	99.2%
In the department	32	38.6%	22	9.2%
At the Computer Centre	9	10.8%	4	1.7%
In the library	2	2.4%	6	2.5%

Assessment of the Quality of Computing Facilities

About 70% of both academic engineers and scientists noted that the computing facilities available to them in their respective departments are either good or excellent, and 15% to 22% indicated their computing facilities as fair.

Types of Computer Use and Research Productivity: Academic Scientists

Respondent's involvement in 11 types of computer use in research is indicated in Tables 3 and 4. For each type of computer use, respondents were asked to indicate the frequency of use on a five-point Likert scale (from 1=never use to 5=very

Table 3: Frequency of the Types of Computer Use Among Scientists (n=239)

	Frequent/very frequent			Sometimes		Seldom/never used			
Types of computer use	**Freq.**	**%**	**Rank most used**	**Freq.**	**%**	**Freq.**	**%**	**Rank least useful**	**Mean**
Word processing	216	90.4	1	18	7.5	5	2.1	11	4.54
Send/receive e-mails	171	71.6	2	35	14.6	33	13.8	10	4.03
Information via internet	122	51.0	3	71	29.7	46	19.3	8	3.44
Graphics	114	47.8	4	84	35.1	41	17.1	9	3.35
Create database	98	41.0	5	75	31.4	66	27.6	7	3.21
File transfer	91	38.1	6	73	30.5	75	31.4	4	3.06
Slide presentations	85	35.6	7	87	36.4	67	28.0	6	3.06
Statistical analysis	78	32.6	8	93	39.0	68	28.4	5	3.04
Search CD-ROM data bases	43	18.0	9	80	33.5	116	48.5	3	2.58
Programming	67	28.0	10	36	15.1	136	56.9	2	2.44
Personal bibliographical index	26	10.9	11	69	28.9	144	60.2	1	2.25

frequent use). From these ratings the mean value was computed, listed and ranked. To ease tabulating the results, the five-point scales are collapsed into three (Seldom/never use; Sometimes and Frequent/very frequent use).

The highest usage of computers amongst the academic scientists (with mean scores of 4 or above) are for word processing (90.4%) and sending/receiving email (71.6%). Also high on the list are using of computers to obtain information via the Internet (51.0%), preparing graphics (47.8%), and creating databases (41%). Academic scientists seldom use the computer for programming (m=2.44) or creating personal bibliographical indexes (m=2.25).

The types of computer use to support research needs are compared to respondents' total publication scores, publications written alone, jointly and types of publications such as books, book chapters, conference papers, journal articles, research reports, and standard specifications written, books translated/edited and patents obtained. The results are tested for correlation using the Spearman rho test (*p*) and the results are displayed in Table 4.

Total number of publications and types of computer use. The results indicate that the total publication scores is correlated to 7 of the 11 types of computer use and, for 6 of these, the results are significant at the 0.01 level. Those who are high

Table 4: Types of Computer Use and Publication Productivity: Academic Scientists

Publications	Create data-base	Statis-tical analysis	Gra-phics	Word proces-sing	Slide show	Search CD-ROM	Send/ receive email	File transfer	Infor via internet	Perso-nal bib index	Progra-mming
Total pub.	**.286****	**.139***	.122	**.210****	**.194****	-.021	**.176****	.068	**.176****	**.244****	-.095
Sig (2 tailed)	**.000**	**.032**	.059	**.001**	**.003**	.751	**.006**	.294	**.006**	**.000**	.141
Solo works	**.192****	.072	-.007	.079	.12385	.066	.044	-.024	**.142***	**.138***	.027
Sig (2 tailed)	**.005**	.298	.915	.250	.068	.340	.527	.729	**.038**	**.045**	.695
Joint works	**.215****	.091	.050	**.239****	**.194****	-.020	**.174****	.123	**.146***	**.181****	**-.129***
Sig (2 tailed)	**.001**	.167	.445	**.000**	**.003**	.756	**.008**	.061	**.026**	**.006**	**.049**
Books	**.272***	.223	**.203***	109	**.195***	.036	.137	.150	.154	**.290****	-.006
Sig (2 tailed)	**.020**	.058	**.035**	.358	**.043**	.714	.157	.206	.111	**.002**	.948
Book chapters	**.205***	.125	**.244***	.078	.131	.193	.087	.096	.079	**.280***	.144
Sig (2 tailed)	**.034**	.198	**.037**	.424	.268	.102	.464	.324	.507	**.016**	.223
Conf. Papers	**.284****	.065	.033	**.164***	**.225****	.072	**.156***	.021	.109	**.155***	-.013
Sig (2 tailed)	**.000**	.328	.619	**.13**	**.001**	.276	**.017**	.753	.097	**.018**	.843
Books edited	.140	.105	.185	**.288***	.079	-.064	-.074	-.045	-.064	-.097	-.235
Sig (2 tailed)	.331	.469	.199	**.042**	.585	.659	.608	.758	.660	.503	.101
Jour. Articles	.101	**.148***	.058	.104	.016	-.072	.092	.037	.089	.121	-.061
Sig (2 tailed)	.129	**.027**	.387	.121	.811	.280	.169	.583	.185	.070	.359

* Sig at the 0.05 level of significance** Sig at the 0.01 level of significance

publishers are more likely to use computers to create databases (p=.286, sig.≤0.01), maintain personal bibliographical indexes (p=.244, sig.≤0.01), use them for word processing (p=.210, sig.≤0.01), create slides for presentations (p=.194, sig.≤0.01), send/ receive e-mail (p=.176, sig.≤0.01), obtain information needed for research from the Internet (p=.176, sig. ≤0.01), and analyse statistics (p=.139, sig. ≤0.05)

Solo works and types of computer use. Those who are high publishers of solo works tended to make frequent use of the computers to create databases (p=.192, sig. ≤0.01), obtain information needed for research from the Internet (p=.142, sig. ≤0.05) and maintain personal bibliographical indexes (p=.138, sig. ≤0.05).

Joint works and types of computer use. Joint works are correlated to five types of computer use. These are for creating databases (p=.215, sig. ≤0.01), word processing (p=.239, p≤0.01), sending and receiving email (p=.174, sig. ≤0.01), obtaining information from the Internet (p=.146, sig. ≤0.05) and keeping personal bibliographic indexes (p=.181, sig. ≤0.01). The results show definite correlation in four of the five cases.

Conference papers published and type of computer use. A high rate of publication of conference papers are definitely correlated with frequent use of computers for creating databases (p=.284, sig. ≤0.01) and slide shows (p=.225, sig. ≤0.01). A slight correlation was also indicated between conference paper productivity and word processing (p=.164, sig. ≤0.05), sending and receiving email (p=.156, sig. ≤0.05) and keeping personal bibliographical indexes (p=.155, sig. ≤0.05).

Books and book chapters written and types of computer use. Those who wrote more books also made frequent use of the computers to create databases (p=.272, sig. ≤0.05), graphics (p=.203, sig. ≤0.05), slide shows (p=.195, sig. ≤0.05) and especially to keep their personal bibliographic indexes (p=.290, sig. ≤0.01). Those who wrote a higher number of book chapters, used computers frequently to create databases (p=.205, sig. ≤0.05), graphics (p=.244, sig. ≤0.05) and maintain their personal bibliographic indexes. (p=.280, sig. ≤0.05).

Other types of publication and the use of computers. The type of publication such as research reports, standards/ patents and translated works are not correlated to any type of computer use.

The results indicate that, in general, those academic scientists who attained high publication productivity tend to be also those who are frequent users of computers for processing data (create databases, statistical analysis), searching for information required for research (searching CD-ROM, the Internet) and presenting and communicating information (word processing, slide shows, bibliographical indexes, and e-mails). The mean values for each type of computer use for scientists are higher than that obtained for the engineering sample.

Types of Computer Use and Research Productivity : Academic Engineers

Academic engineers' ratings of the 11 types of computer use are shown in Table 5. For each type of computer use, the total mean scores were computed, listed and ranked in the order of highest mean use.

Table 5: Types of Computer Use by Academic Engineers

Types of computer use	Useful, V.useful		Sometimes useful		Both		Seldom, never useful			Mean
	Freq	%	Freq	%	Total	Rank most used	Freq	%	Rank least used	
Word processing	83	100.0	-	-	83 (100.0%)	1	-	-	11	4.69
Graphics	60	72.3	21	25.3	81 (97.5%)	2	2	2.4	10	3.93
Send/receive e-mails	55	66.3	24	28.9	79 (95.1%)	3	4	4.8	9	3.93
Information via internet	34	41.0	40	48.2	74 (89.2%)	6	9	10.8	8	3.37
Statistical analysis	38	45.8	34	41.0	72 (86.7%)	5	11	13.2	7	3.37
Programming	56	67.5	13	15.7	69 (83.1%)	4	14	16.8	4	3.63
Slide presentations	28	33.7	41	49.4	69 (83.1%)	9	14	16.8	5	3.27
File trasfer	43	51.8	24	28.9	67 (80.7%)	7	16	19.3	6	3.34
Create database	38	45.8	27	32.5	65 (78.3%)	8	18	21.7	3	3.27
Search CD-ROM database	7	8.4	16	19.3	23 (27.7%)	10	60	72.3	2	2.22
Personal bibliographic Index	7	8.4	14	16.9	21 (25.3%)	11	62	74.7	1	2.02

Academic engineers used their computers very frequently to word-process research material. This type of use tops the list with the highest mean score. Computer use for graphics and sending/receiving e-mails share the second place. Computers are also frequently used for programming. Moderate use were made for statistical analysis, getting information via the Internet; file transfer; creating databases and preparing slide presentations. Academic engineers seldom use the computer for searching CD-ROM databases or creating personal bibliographical indexes.

The types of computer use by academic engineers to support research are compared to their total number and type of publication scores. The crosstabulation was tested for correlation and only the correlated results are displayed in Table 6.

Table 6: Types of Computer Use and Publication Productivity: Academic Engineers

Publications	Slide show	Send/receive email	Infor. via internet	Programming
Solo works	**.255***	.095	.184	.012
Sig (2 tailed)	**.020**	.393	.096	.913
Books edited	.327	**.870***	.722	-.197
Sig (2 tailed)	.474	**.011**	.067	.673
Stand./patents	.000	-.588	.063	**-.789***
Sig (2 tailed)	1.000	.165	.894	**.035**
Trans. works	.030	-.028	**-.619***	.222
Sig (2 tailed)	.930	.94	**.042**	.511

Sig. at the 0.05 level of significance

Total number publications and types of computer use. The results indicate that ratings on all types of computer use are not correlated to total publication productivity among the academic engineers.

Solo and joint works and types of computer use. Those who are high publishers of solo works tended to make frequent use of the computers for preparing slide shows (p=.255, sig.≤0.05)., presentation. Solo works are not correlated to any of the ratings of the other 10 types of computer use.

Books edited and types of computer use. For types of publication, correlation is found in three cases. These relates to "edited books" and "sending/receiving e-mail" (p=.870, sig. ≤0.05); "standards /patents achieved" and "programming" (p=-.789, sig. ≤0.05) and between "translated works" and searching for "information via Internet" (p=-.619, sig. ≤0.05).

The results indicate that, in general, the total number and types of publication productivity of academic engineers are not correlated with the frequent use of computers for research. Although the mean scores for each type of computer use are high, this high use was not related to respondents' publication scores.

Types of Computer Use and Selected Demographic Variables

The ratings of the types of computer use among academic scientists are also cross-tabulated with selected personal and departmental variables to find out whether the variables are related.

Affiliation. Academic scientists' affiliation status is related to three types of computer use. These are: sending/receiving email (r^2 =10.354, df=4, p≤0.035), locating information from the Internet (r^2 =10.190, df=4, p≤0.037) and programming (r^2 =11.497, df=4, p≤0.022) (Table 7a). In all three instances, the academic scientists from UM are likely to rate more positively in terms of the three types of computer use. Affiliation is not related to the ratings for any type of computer use in the case of the academic engineers.

Departments. The variable "department" is clearly a significant factor in determining the use made of computers by academic scientists. There are significant differences in the ratings between the

departments for ten of the eleven types of computer use for research at the ≤0.01 level. For academic engineers, however, the relationship between departments and 6 types of computer use is found to be significant at ≤0.05 level (Table 7b).

Table 7a: Types of Computer Use and Personal / Departmental Variables

Affiliation	**x^2**	**df**	**Crit. x^2**	**Sig**
Affil. & create database	4.560	4	9.488	.335
Affil. & statistical analysis	1.805	4	9.488	.772
Affil. & creating graphical rep. of data	4.745	4	9.488	.314
Affil. & word processing	7.712	3	7.815	.052
Affil. & preparing slide shows	7.606	4	9.488	.107
Affil. & search databases on CD-ROMs	7.374	4	9.488	.117
Affil. & send/receive e-mail	**10.354***	4	9.488	**.035**
Affil. & file transfer	4.677	4	9.488	.322
Affil. & access information via the internet	**10.190***	4	9.488	**.037**
Affil. & personal bibliographical index	3.401	4	9.488	.493
Affil. & programming	**11.497***	4	9.488	**.022**

* Sig at the 0.05 level of significance

Table 7b: Types of Computer Use and Respondents' Department

Department : Scientists	**x^2**	**df**	**Crit. x^2**	**Sig (0.05)**
Dept. & create database	**60.268****	24	36.415	**.000**
Dept. & statistical analysis	**41.762****	24	36.415	**.014**
Dept. & creating graphical rep. of data	35.226	24	36.415	.065
Dept. & word processing	**39.926****	24	36.415	**.002**
Dept. & preparing slide shows	**73.753****	24	36.415	**.000**
Dept. & search databases on CD-ROMs	**64.834****	24	36.415	**.000**
Dept. & send/receive e-mail	**55.617****	24	36.415	**.000**
Dept. & file transfer	**73.467****	24	36.415	**000**
Dept. & access information via the internet	**57.444****	24	36.415	**.000**
Dept. & personal bibliographical index	**61.557****	24	36.415	**.000**
Dept. & programming	**136.093****	24	36.415	**.000**
Department: Engineers	***x^2***	**df**	**Crit. *x^2***	**Sig**
Dept. & create database	**24.858****	12	21.026	**.016**
Dept. & statistical analysis	**23.536***	12	21.026	**.024**
Dept. & creating graphical rep. of data	**20.788****	9	16.919	**.014**
Dept. & word processing	6.502	3	7.815	.087
Dept. & preparing slide shows	**35.786****	12	21.026	**.000**
Dept. & search databases on CD-ROMs	16.375	12	21.026	.175
Dept. & send/receive e-mail	7.234	12	21.026	.842
Dept. & file transfer	18.987	12	21.026	.089
Dept. & access information via the internet	**21.882***	12	21.026	**.039**
Dept. & personal bibliographical index	7.145	9	16.919	.622
Dept. & programming	**34.444****	12	21.026	**.001**

* Sig at the 0.05 level of significance ** Sig at the 0.01 level of significance

Gender and race. The other personal variables such as respondent's gender and race, are independent of the ratings for types of computer use.

For the variables, age, work experience, qualification, years since the highest qualification was obtained, academic rank and percentage of time spent on research were tested for correlation using the Spearman rho test. Only the types of computer use which are correlated to one or more of the demographic variables are displayed in Tables 8a and 8b.

Table 8a: Types of Computer Use and Demographic Variables: Academic Scientists

Publications	Age	Work experience	Highest qualifi-cation.	Year since highest qualification	Academic rank	Percentage of time allocated for research
Create database	.114	.097	.078	**.237***	**.143***	.017
Sig (2 tailed)	.078	.136	.228	**.031**	**.027**	.793
Graphics	.039	**.134***	-.002	-.069	.052	-.018
Sig (2 tailed)	.550	**.038**	.972	.538	.422	.785
Word processing	**.132***	**.164***	.074	.068	.099	.069
Sig (2 tailed)	**.042**	**.011**	.253	.542	.129	.285
Slide shows	**.130***	**.204****	.071	.201	**.167****	.103
Sig (2 tailed)	**.045**	**.001**	.275	.069	**.010**	.111
Send/receive email	.006	.001	.106	-.073	.111	**.134***
Sig (2 tailed)	.922	.985	.103	.518	.087	**.038**
Information via Internet	-.056	-.008	.042	.077	**.147***	.051
Sig (2 tailed)	.392	.908	.517	.492	**.023**	.431
Programming	-.062	-.099	-.067	-.061	.015	**.163***
Sig. (2 tailed)	.337	.127	.300	.584	.812	**.012**

* Sig at the 0.05 level of significance ** Sig at the 0.01 level of significance

Table 8b: Computer Use and Demographic Variables Among Academic Engineers

Publications	Age	Work experience	Highest qualifica tion	Year since highest qualification	Academic rank	Percentage of time allocated for research
Create database	**.267***	**.254***	.121	.118	**.240***	.047
Sig (2 tailed)	**.015**	**.020**	.274	.070	**.029**	.675
Slide shows	.097	**.241***	.104	.082	.117	.068
Sig (2 tailed)	.385	**.028**	.350	.208	.293	.539
Search CD-ROM databases	.082	.059	.165	-.062	.077	**.282****
Sig (2 tailed)	.462	.593	.136	.341	.489	**.008**
Send/receive email	**-.270****	-.097	-.075	.082	-.124	.114
Sig (2 tailed)	**.014**	.381	.498	.205	.264	.305
File transfer	-.145	-.190	**-.340****	-.018	-.207	-.080
Sig (2 tailed)	.192	.086	**.002**	.786	.060	.473

* Sig at the 0.05 level of significance ** Sig at the 0.01 level of significance

Age. For the academic scientists, age is correlated to two types of computer use: word processing (p=.132, sig. ≤0.05) and preparing slide presentations for dissemination of research results (p=.130, sig. ≤0.05) (Table 8a). A higher percentage of those in the age group of 51 and above, indicate frequent or very frequent use of computers for these activities. For the academic engineers, age is related to the use of computers for creating databases (p=267, sig. ≤.05) and sending and receiving mail (p=-.270, sig ≤.05). A higher percentage of the older academic engineers recorded frequent use of computers for creating databases. The younger academic engineers reported frequent use of e-mails for research.

Work experience. The academic scientists with greater working experience are more likely to make greater use of the computer for word processing (p=.164, sig. ≤0.05), preparing graphics for data presentation (p=.134, sig. ≤0.05) and slide shows (p=.204, sig. ≤0.01). The more experienced academic scientists seem to use computers to a greater extent for the presentation of research information. This is in contrast to the more experienced academic engineers who made more frequent use of computers for creating databases (p=.254, sig. ≤0.05) and creating slide shows (p=.241, sig. ≤0.05).

Academic rank. Academic scientists who have attained higher rank are more likely to use computers frequently for creating databases (p=.143, sig. ≤0.05), preparing slide shows (p=.167, sig. ≤0.05) and looking for information in the Internet (p=.147 sig.≤0.05). Amongst academic engineers, those with Ph.D. are more likely to use computers frequently for creating databases (p=.240, sig. ≤0.05).

Academic qualifications. Qualification is not significantly correlated with any of the 11 types of computer use for academic scientists. The majority of academic engineers with Masters qualification indicate more frequent use of computers for transferring files compared to those with Ph.D. (p=-.340, sig.≤0.01) (Table 8c).

Table 8c: Use of Computers for File Transfer and Academic Engineer's Qualifications

	Highest qualification			
	Masters		Ph.D	
	File transfer		File transfer	
	Count	%	Count	%
Never			2	3.7%
Seldom	3	10.3%	11	20.4%
Sometimes	4	13.8%	20	37.0%
Frequent	20	69.0%	20	37.0%
V.frequent	2	6.9%	1	1.9%
Total	29	100.0%	54	100.0%

p=-.340, sig.<0.01

Table 8d: E-mails Usage and Percentage of Time allocated for Research: Scientists

	Percent time on research							
	10-20		21-30		31-40		= >41	
	Send/receive email		Send/receive email		Send/receive email		Send/receive email	
	Count	%	Count	%	Count	%	Count	%
Never/seldom	7	18.9%	23	17.0%	3	5.5%		
Sometimes	10	27.0%	15	11.1%	10	18.2%		
Frequent/V.freque	20	54.1%	97	71.9%	42	76.4%	12	100.0%
Total	37	100.0%	135	100.0%	55	100.0%	12	100.0%

p=.134 sig.<0.05

Table 8e: Use of Computers for Programming and Percentage of Time Allocated for Research: Scientists

	Percent time on research							
	10-20		21-30		31-40		= >41	
	Programming		Programming		Programming		Programming	
	Count	%	Count	%	Count	%	Count	%
Never/seldom	24	64.9%	83	61.5%	25	45.5%	4	33.3%
Sometimes	6	16.2%	21	15.6%	8	14.5%	1	8.3%
Frequent/V.freque	7	18.9%	31	23.0%	22	40.0%	7	58.3%
Total	37	100.0%	135	100.0%	55	100.0%	12	100.0%

p=.163 sig.<0.05

Years passed since highest qualification was obtained. The years passed since the highest qualification was obtained is not strongly correlated to types of computer use. None of the ratings by the academic engineers indicates a correlation. However, for the academic scientist, one type of use is correlated to this variable, and that is creating databases (p= .237, sig.<0.05).

Time allocated to research and types of computer use. Academic scientists, who spent more time on research are more likely to use computers for communicating and processing data, especially sending/receiving emails (p=.134 sig.<0.05) and programming (p=.163 sig.<0.05).

All those who indicated spending over 40 percent of their time on research reported frequent use of computers for sending or receiving e-mail. A smaller number of the academic scientists who allocate less time for research report frequently use of e-mail (Table 8d) or programming (Table 8e).

Types of computer use and time allocated for research in the case of academic engineers were not correlated.

CONCLUSION

In this study, the majority of academic engineers and scientists indicate frequent use of the computers for research purposes. The present study reveals that 94.6% of academic scientists and 98.8% of academic engineers reported frequent use of computers The computers are mainly available either on their desks or in spe-

cial rooms allocated for faculty use within their departments. This finding is similar to those of Abels, Liebscher and Denham (1996), who reported 65% of users of electronic networks among the respondents

Despite this, an important result of this study is that the scientists are more varied in their use of computers than the engineers.

The results of this study can be summarized as follows:
(1). A high percentage of respondents from both groups reported frequent use of computers for word processing (83% to 90%), sending/receiving e-mails (66% to 71%), and searching for information in the Internet (41% to 51%). Computers are least used for keeping a personal bibliographical index (8% to 11%) and searching CD-ROM databases. This may explain, in part, the difficulty most respondents face in supplying a complete list of works they have published.

(2). Among the academic scientists, those who publish most are likely to be frequent users of computers. They particularly use computers to create databases, maintain personal bibliographic indexes, word process, prepare slide presentations, send/receive e-mails, analyze statistical data and locate information needed for research from the Internet. Since the prolific publishers are also prolific publishers of joint works, the pattern of computer use among the authors of joint works is closely comparable. This finding is similar to that of Hesse, Sproull, Kiesler & Walsh (1993), who found a significant correlation between network use and self-reported publication productivity. The pattern of publication productivity is not the same for academic engineers, since their use of computers is not significantly related to their publication productivity.

(3) The respondent's institutional affiliation, gender and race bear no relation to type of computer use. There were variations in computer use among respondents with respect to age, work experience, academic qualifications, and the percentage of time spent on research. As the study of Kaminer & Braunstein (1998) indicates, age is significantly related to certain types of computer use, such as word processing, preparing slides, creating databases and sending/receiving e-mails. In terms of using e-mails, the results obtained are similar to those of Chu (1994) who found a negative correlation between age and e-mail use (younger respondents tend to use it more frequently).

The present study found that the frequency of computer use is correlated with the publication productivity of academic scientists, but not of academic engineers, and that the frequency of computer use is related to factors such as respondent's department, age, work experience and academic rank.

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