Correlations between Users' Characteristics and Preferred Features of Web-Based OPAC Evaluation

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This paper examines the correlations between user characteristics and their preferences for two selected features of Web-based OPAC systems. User characteristics identified in this study were age, gender, educational status, computer skills and OPAC experience. Usability features included interaction styles, character and image on screen, browsing and navigating style, screen layout, and ease of learning, whereas availability features attended to availability of information, quality of information and up-to-date information. Individual variables and features are described, and the correlation between the variables and the features are explored using Pearson's correlation coefficient (*r*). Although based on a small-scale sample survey, a considerably large number of statistically significant correlations were found between the users' characteristics and the selected evaluation features of interactive Web-based OPACs. From these observations, it seems to be suitable to recommend that system designers should make a more considered appraisal of the users' demographic characteristics in the design of the new generation of OPAC such as in user-tailored interactive Web-based OPAC systems.

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I. INTRODUCTION

The most important effect of online public access catalogues (OPACs) becoming Web-based OPACs is that it allows users to be able to access secondary and primary information from their desktop computer at work or at home. This will allow users to access the OPACs of their institution and other institutions through the Internet without physically visiting a library. A consequence of the benefits of Web-based OPAC is thus broadened access. In turn, this implies a need for better understanding of the differences between users, their searching behaviour, and the capacity of good OPAC systems to manipulate and filter the available information to find useful material effectively and efficiently.

In particular, the necessity arises for a more comprehensive understanding of users' preferences in regard to the interfaces and the sensitivity of these preferences to users' individual characteristics of interactive systems. Since the users' requirements for Web-based OPAC design are potentially diverse and vast, information about the strong and weak points of Web-based OPAC systems and the identification of users' different preferences in using such systems will not only allow librarians to better help these users, but also assist system designers to produce better systems.

From the system designer's point of view, the key factor in the improvement of interactive Web-OPACs knowledge concerns to how users' interact with such systems. One of the difficulties is that there are many different kinds of the users of Web-based OPACs according to a number of variables, such as age, gender, educational status, library and computer experience as well as tasks and goals. It is also the case that the general in-

formation retrieval task is itself difficult [1], [2], and it is not easy to relate performance in this task to users' different characteristics [3].

Dix *et al*. [4] classified users according to whether their characteristic was long term (such as gender, physical capabilities and intellectual capabilities), shorter term (such as stress or fatigue on the user) and change through time (such as age). More substantially, Mitev [5] classified users according to at least two broad groups of 'objective' variables: (1) such as age, sex, educational background, communicative and linguistic skills, and typing abilities; (2) including experience with computer catalogues, experience with computers and libraries in general, and frequency of library usage.

Notwithstanding this, we should remember that, although as humans we share processes in common, users, are not all the same: individuals differ in their general skills, aptitudes, and preference for processing information, constructing meaning from it, and applying it to new situations.

Hence, it seems appropriate and timely that we should investigate user-centered variables in order to improve the new generation of OPACs. In this study we adopt, based on the above earlier studies, a modified Mitev's [5] classification for our demographic variables, i.e., (1) age, (2) gender, (3) educational status, (4) computer skills, (5) familiarity with OPAC system.

II. RESEARCH DESIGN

1. Research Questions and Objectives

In this study, three rather broad research questions arise with regard to the use of Web-based OPACs: (1) how well do these systems serve users? (2) how do users' characteristics affect the system evaluation? and (3) which user characteristics strongly correlate with the preference for the system features, if any?

Although there have been many studies [6]–[10] of, and efforts to improve, OPAC systems, unfortunately, there is little information on the characteristics, skills, and preference patterns of specific user groups.

The objectives of the present study are: (1) to explore the extent to which demographic variables such as age, gender, computer skills, OPAC experience and educational status affect users' preferences for particular design features of Web-based OPAC systems, (2) to provide fundamental evaluation data on a Web-based OPAC system to aid future design improvements, and (3) to discover the correlation between demographic variables and users' attitudes towards the usability of Web-based OPAC systems.

2. Experimental Design

To accomplish these objectives, the experimental work in Stages 1–4 below was undertaken:

Stage 1

- The interaction styles supported by 264 university library Web-based OPAC sites were categorised into eight classes of HCI (Human Computer Interaction) using Newman and Lamming's [11] classification of HCI. The main purpose of this stage was to know how many different interaction styles were running on Web sites at the time of the study (November 1996) and the relative frequencies of each style.

Stage 2

- Semi-structured interviews were conducted as a preliminary survey. Considering volunteers' demographic information, three male and two female doctoral students from different academic backgrounds and varying duration of research took part. The purpose of this stage was to identify students' major concerns and obtain an initial understanding of their views of Web-based OPAC systems, adoption of their opinions into the questionnaire was also important to this stage.

Stage 3

- A Web-based online questionnaire, based on the results of these interviews and the review of literature, was developed using HTML (HyperText Markup Language) and CGI (Common Gateway Interface) script.
- The online survey was made available through the PC network of the University of Sheffield, U.K. Postgraduate student volunteers were sought, and instructions given by email to an undetermined number of students on the University postgraduate emailing list.
- According to the defined CGI function, questionnaire responses were automatically emailed to the researcher. This online survey was designed to produce easy data capture in a 'real' research environment rather than creating an artificial 'laboratory' environment setting.

Stage 4

- Valid data were converted into SPSS (Statistics Package for Social Sciences) for Windows the data were analysed.
- Code values were assigned for each of the five demographic variables, e.g., for gender, male = 1, female = 2. Where variable was not discrete, i.e., age code values represented a range of ages, thus age 21 to 25 = 1, age 26 to 30 = 2, etc.
- The differences in students' opinions on Sheffield University's Star[1)] Web-based OPAC system were evaluated and their preferences for interaction style were accessed. Addi-

[1)] Sheffield University's library catalogue is known as 'Star' and contains records of all items held by the library, including books, periodicals, conferences, theses, CD-ROMs, videos and microforms. Star is available in 1) all library branches on dedicated PCs, 2) any networked PC on campus by clicking on the Star icon in the Library Service Window, 3) links to the Library Web Page: http://www.shef.ac.uk/~lib/, or 4) alternatively, by use of a WWW browser by direct link to the URL http://library.shef.ac.uk/.

tionally, student's views on the evaluation criteria for OPAC systems were analysed to explore the sensitivity of such preferences as well as the views of individual differences.
- The results are presented in graphic and table form focusing on both students' variables and the OPAC system features.

3. Questionnaire

The questionnaire was designed according to systematic structures based on the results of the interviews and the literature review. The composition and criteria were adapted primarily from the previous work of Shneiderman [12], Murphy, Pollitt and White [13] and Tyldesley [14]; however, many parts were altered to suit the Sheffield University's Web-based OPAC features.

The questionnaire consist of two sections:

- Section A — Preference for Interaction Style and Evaluation criteria of Web-based OPAC (10 questions); and
- Section B — Personal demographic information (7 items).

Section A was designed to find out the students' preference for interaction style and evaluation criteria for the usability of Web-based OPAC system. In the case of interaction style respondents were asked for their preference amongst 'Command interaction,' 'Menu-based interaction,' 'Natural Language Dialogue,' 'Graphical Direct Manipulation,' 'Function-key Interaction,' and 'Question-and-Answer.' Students were also asked to choose their favourite interaction style from six example presented to them. An embedded image was used to make the question unambiguous

For the usability of Web-based OPAC two categories were focused on:

(i) Usability features — 'Character and Image on Screen', 'Browsing and Navigating Style', 'Screen Layout', and 'Ease of learning', and

(ii) Availability features — 'availability of information', 'quality of information', and 'up-to-date of information'.

Section B was designed to collect students' demographic variables: gender, age, education status, computer skill, OPAC experience, year of research, department, and faculty.

Two types of question structure were adopted: closed questions, where the respondent is asked to select an answer from a choice of alternative replies, and open questions, where the respondent is free to provide his/her own answer and mention any other issues that they consider important.

A five-point, Likert-type scale was used in this questionnaire where the strength of agreement is measured with a clear statement. (See Appendix for the Questionnaire.)

III. DATA ANALYSIS

A total of forty-six respondents returned completed questionnaire, forty-four (96%) were identified as valid data. Two students did not fully complete the questionnaire and were not included in the analysis. Subjects were analysed focusing on five variables, fundamental features of usability of Web-based OPACs were analysed and presented as a histogram for the overall basic analysis, i.e., frequency, percentage, mean and standard deviation.

Correlations between selected five variables and the OPAC systems' usability features were explored using Pearson's correlation coefficient (r)[2] and presented in tabular form. Each variable and each feature was analysed with concentration being made on those where a significant correlation was found. Two-tailed significance, with $P < 0.05$ was adopted to test the significance of relationships.

1. User Variables

- *Variable 1: Age groups*

Raw age data were categorised into five age groups: (1) 21 to 25 aged student; (2) 26 to 30 aged students; (3) 31 to 35 aged students; (4) 36 to 40 aged students; and (5) 41 to 45 aged students. The majority of subjects were students aged 21–25 (47.7 %), 29.5 % were aged 26–30 and 13.6 % were 31–35 years old.

- *Variable 2: Gender*

Students were classified (1) male and (2) female as the gender variable. Twenty-seven male students (61.4 %) and seventeen female students (38.6 %) participated in the survey.

- *Variable 3: Educational status*

The educational status of students were divided into (1) MA or MSc and (2) Ph.D. Thirty (68.2 %) Ph.D. students took part in the survey, whereas fourteen (31.8 %) were Master students.

- *Variable 4: Computer skills*

Student computer skills were classified as (1) Beginner, (2) Intermediate, and (3) Expert. This was measured by subject self determination from the response to the question "How would you rate your familiarity with computers generally?" A total of twenty-seven (61.4 %) students rated themselves as

[2] A measure of linear association between two variables. Values of the correlation coefficient range from –1 to 1. The absolute value of the correlation coefficient indicates the strength of the linear relationship between the variables, with larger absolute values indicating stronger relationships. The sign of the coefficient indicates the direction of the relationship.

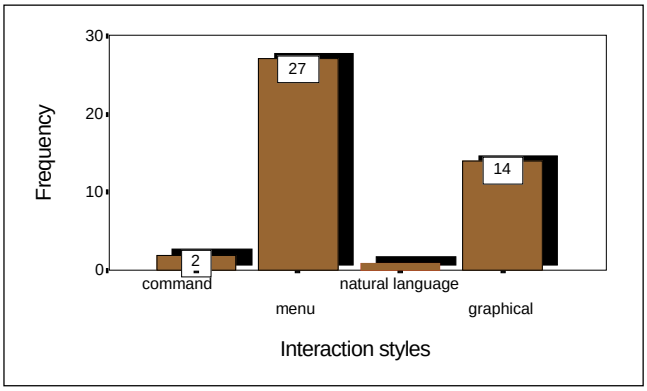

Fig. 1. Preference for the interaction styles.

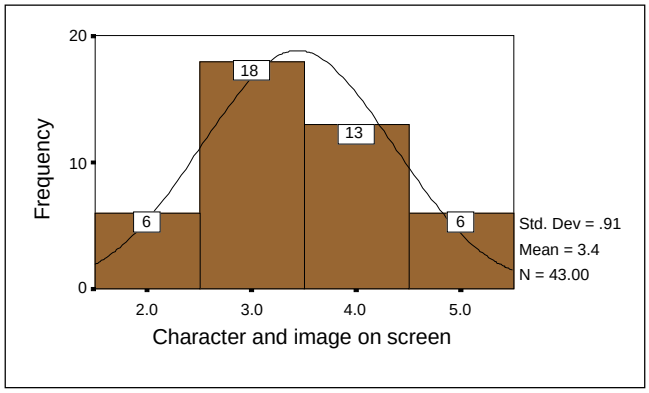

Fig. 2. Evaluation of the character and image on screen.[3]

Table 1. Correlation between the variables and the preference for the interaction styles.

AGE GROUP	GENDER	EDUCAT. STATUS	COM. SKILL	OPAC FAMI.
r=–.060 (N=44) P=.699	r=–.306 (N=44) P=.044	r=.278 (N=44) P=.068	r=.214 (N=44) P=.164	r=.170 (N=44) P=.269

(r=Coefficient, N=Cases, P=2-tailed Significance)

'Intermediate', fourteen (31.8%) students rated as 'Expert' and three (6.8%) students rated themselves in the 'Beginner' category.

- *Variable 5: Familiarity with Star OPAC*

Subjects' familiarity with OPAC system was divided into three categories: (1) Beginner, (2) Intermediate, and (3) Expert. These categories were self determined by subjects in response to the question "Please rate your familiarity with the Star Web-based OPAC system." Twenty-four (54.5%) students rated themselves as 'Intermediate'; eighteen (40.9%) students 'Expert' and two (4.5%) students rated themselves in the 'Beginner' category.

2. Usability and Availability Features in Web-based OPAC Evaluation

Two categories of features were considered in this section. First, students' preferences for the style of interaction: 'Menu-based interaction,' 'Graphical direct manipulation,' 'Command,' 'Function key,' 'Natural language dialogue' and 'Question-and-answer' were analysed.

Second, students' opinions of evaluation criteria toward usability and availability of Web-based OPAC features: (i) 'Character and Image on Screen,' 'Browsing and Navigating style,' 'Screen layout,' 'Ease of learning,' and (ii) 'Availability of Information,' 'Quality of Information,' 'Up-to-date Information' were examined.

Feature 1: Preference for interaction styles (F1)

[Question] Students were asked, "Which interaction style do you prefer in general when using a Web-based OPAC?"

[Basic Analysis] Twenty-seven students (61.4%) responded 'Menu'; fourteen students (31.8%) 'Graphical Direct Manipulation'; Two students (4.5%) 'Command'; one student (2.3%) 'Natural Language'. There were no responses for 'Function Key' and 'Question-and Answer'. Figures 1–8 presents the results of each style as a frequency histogram.

[Correlation] A negative correlation was found between gender and the preference for the interaction styles when $P < 0.05$ was adopted. This result indicates that female students tended to pick 'Menu' style, whereas male students showed a preference for graphical interaction style over other styles.

Feature 2: Character and image on screen (F2)

[Question] Students were asked "How would you rate 'Character and Image on Screen' in terms of your evaluation criteria for a good Web-based OPAC system?"

[Basic Analysis] Eighteen students (40. 9%) answered 'neutral', thirteen students (29.5%) replied 'important,' and six students (13.6%) responded 'very important,' six (13.6%) students also responded 'unimportant.' One missing value was identified. Overall, there were tendencies for students to consider that the 'Character and Image on Screen' were 'neutral.' The mean for this feature (3.44) indicating that it was a more than neutral feature in their evaluation criteria for a good Web-based OPAC system.

[Correlation] No significant relationship was found between the five variables and the evaluation criteria of the 'Character and Image on Screen', when $P < 0.05$ was adopted.

[3] From figure 2 to 8, X-axis values indicate: 1.0—'very unimportant', 2.0—'unimportant', 3.0—'neutral', 4.0—'important' and 5.0—'very important'.

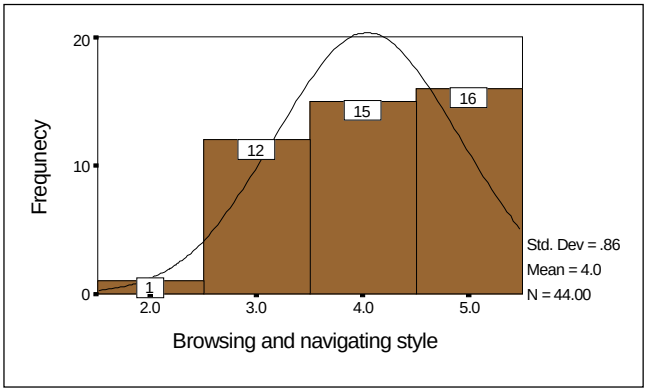

Fig. 3. Evaluation of the browsing and navigating style.

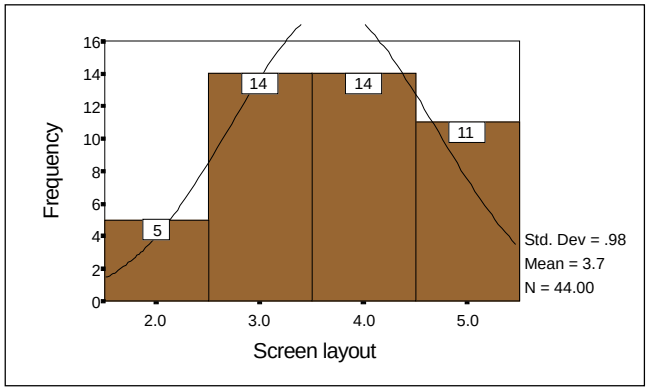

Fig. 4. Evaluation of the screen layout .

Table 2. Correlation between the variables and the character and image on screen.

AGE GROUP	GENDER	EDUCAT. STATUS	COM. SKILL	OPAC FAMI.
r=.223 (N= 43) P=.151	r=.211 (N=43) P=.175	r=–.184 (N=43) P=.238	r=.277 (N=43) P=.072	r=–.094 (N=43) P=.549

(r=Coefficient, N=Cases, P=2-tailed Significance)

Table 3. Correlation between the variables and the browsing and navigating style.

AGE GROUP	GENDER	EDUCAT. STATUS	COM. SKILL	OPAC FAMI.
r=.265 (N=44) P=.082	r=.232 (N=44) P=.130	r=–.250 (N=44) P=.102	r=.258 (N=44) P=.091	r= –.128 (N=44) P=.407

(r=Coefficient, N=Cases, P=2-tailed Significance)

Feature 3: Browsing and navigating style (F3)

[Question] Students were asked "How would you rate 'Browsing and Navigating Style' in terms of your evaluation criteria for a good Web-based OPAC system?"

[Basic Analysis] Sixteen students (36.4 %) answered 'very important', fifteen students (34.1 %) rated 'important', and twelve students (27.3 %) considered 'neutral' and one student (2.3 %) indicated 'unimportant.' There was a tendency for students to consider that the browsing and navigating style is 'important' in their evaluation criteria for a good Web-based OPAC system. This is demonstrated by a mean score of 4.05.

[Correlation] No significant relationships were found between the five variables and the evaluation criteria of browsing and navigating style, when $P < 0.05$ was adopted.

Table 4. Correlation between the variables and the screen layout.

AGE GROUP	GENDER	EDUCAT. STATUS	COM. SKILL	OPAC FAMI.
r=.323 (N=44) P=.033	r=.098 (N=44) P=.528	r=–.259 (N=44) P=.089	r=.052 (N=44) P=.739	r=–.011 (N=44) P=.942

(r = Coefficient, N = Cases, P = 2-tailed Significance)

Feature 4: Screen layout (F4)

[Question] Students were asked, "How would you rate 'Screen layout' in terms of your evaluation criteria for a good Web-based OPAC system?"

[Basic Analysis] Fourteen students (31.8 %) rated 'important', another fourteen students stated 'neutral.' Eleven students (25.0 %) regarded it as 'very important'; five students (11.4 %) considered it 'unimportant'. There was a tendency for students to consider that the screen layout is 'important' in their evaluation criteria for a good Web-based OPAC system. A value of 3.70 was obtained for this evaluation criterion.

[Correlation] A significant difference was found between age group and the evaluation criteria of screen layouts when $P < 0.05$ was adopted. Older students tended to consider the 'screen layout' as an important element of interaction style in their evaluation criteria than younger students.

Feature 5: Ease of learning (F5)

[Question] Students were asked "How would you rate 'Ease of learning' in terms of your evaluation criteria for a good Web-based OPAC system?"

[Basic Analysis] Twenty students (45.5 %) considered 'very important', seventeen students (38.6 %) rated 'important' and seven students (15.9 %) said 'neutral' to this question. Overall, students considered that the 'ease of learning' is more than

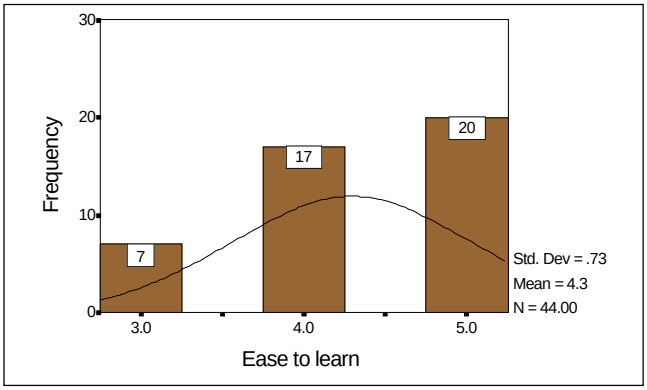

Fig. 5. Evaluation of the easy to learn.

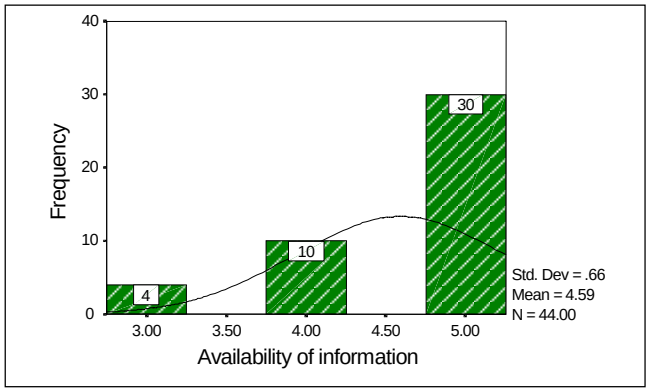

Fig. 6. Evaluation of the availability of information.

Table 5. Correlation between the variables and the easy to learn.

AGE GROUP	GENDER	EDUCAT. STATUS	COM. SKILL	OPAC FAMI.
r=.114 (N=44) P=0.461	r=.192 (N=44) P=.213	r=–.058 (N=44) P=.708	r=–.344 (N=44) P=.022	r=–.316 (N=44) P=.037

(r=Coefficient, N=Cases, P=2-tailed Significance)

Table 6. Correlation between the variables and the availability of information.

AGE GROUP	GENDER	EDUCAT. STATUS	COM. SKILL	OPAC FAMI.
r=–.285 (N=44) P=.061	r=.068 (N=44) P=.659	r=–.354 (N=44) P=.018	r=–.153 (N=44) P=.320	r=–.212 (N=44) P=.166

(r=Coefficient, N=Cases, P=2-tailed Significance)

'important' in their evaluation criteria of a good Web-based OPAC system. The mean score for this feature was 4.30.

[Correlation] Significant correlations were found between computer skills and the evaluation criteria 'ease to learn,' and between OPAC familiarity and the evaluation criteria of 'ease to learn' when $P < 0.05$ was adopted. The results indicate that student with poorer computer skills and students with little OPAC experience tended to consider that 'Ease of learning' is an important element of interaction style in their evaluation criteria of Web-based OPACs.

Feature 6: Availability of information (F6)

[Question] Students were asked "How would you rate 'Availability of Information' in terms of your evaluation criteria for a good Web-based OPAC system?"

[Basic Analysis] Thirty students (68.2%) considered 'very important,' ten students (22.7%) rated 'important'. Overall, there

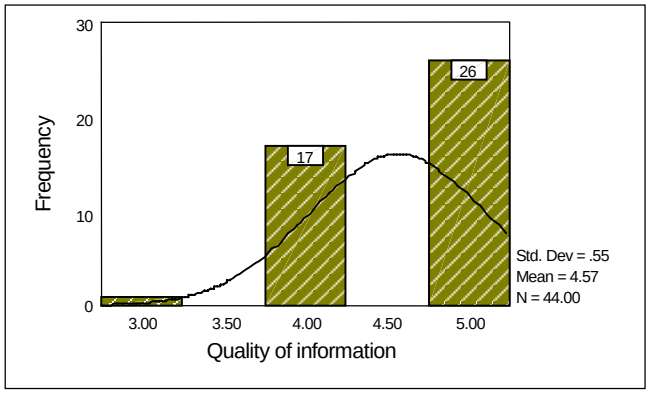

Fig. 7. Evaluation of the quality of information.

was a tendency for students to consider that the 'availability of information' is 'very important' (Mean 4.59).

[Correlation] Negative significant correlation was found between educational status and the evaluation criteria of availability of information when $P < 0.05$ was adopted. The results revealed that Master course students tended to consider that 'availability of information' is a very important feature.

Feature 7: Quality of information (F7)

[Question] Students were asked "How would you rate 'Quality of Information' in terms of your evaluation criteria for a good Web-based OPAC system?"

[Basic Analysis] Twenty-two students (59.1%) considered 'very important', seventeen students (38.6%) said 'important'. There was a tendency for students to consider that the 'quality of information' is 'very important' (Mean 4.57) in their evaluation criteria of a good Web-based OPAC system.

[Correlation] A negative significant correlation was found between age group and the evaluation criteria of quality of information. The result indicates that younger students consider 'quality of information' as a very important feature more than older students did.

Table 7. Correlation between the five variables and the quality of information.

AGE GROUP	GENDER	EDUCAT. STATUS	COM. SKILL	OPAC FAMI.
r=–.390 (N=44) P=.009	r=.203 (N=44) P=.187	r=–.004 (N=44) P=.979	r=–.130 (N=44) P=.402	r=.067 (N=44) P=.663

(r=Coefficient, N=Cases, P=2-tailed Significance)

Table 8. Correlation between the variables and the up-to-date of information.

AGE GROUP	GENDER	EDUCAT. STATUS	COM. SKILL	OPAC FAMI.
r=–.471 (N= 44) P=.001	r=.034 (N=44) P=.824	r=–.048 (N=44) P=.757	r=–.036 (N=44) P=.817	r=.079 (N=44) P=.612

(r=Coefficient, N=Cases, P=2-tailed Significance)

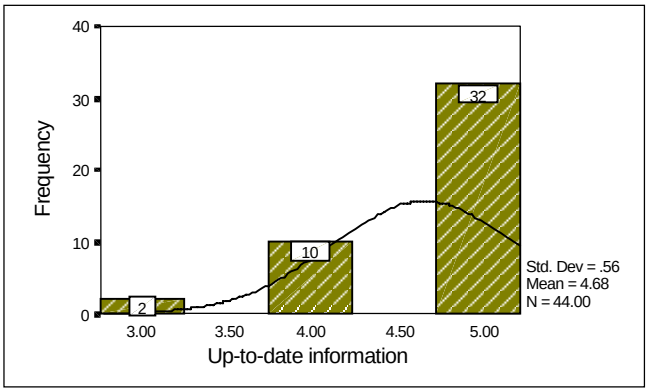

Fig. 8. Evaluation of the up-to-date of information.

Feature 8: Up-to-date information (F8)

[Question] Students were asked, "How would you rate 'Up-to-date Information' in terms of your evaluation criteria for a good Web-based OPAC system?"

[Basic Analysis] Thirty-two students (72.7%) considered 'very important', ten students (22.7%) said 'important'. Students judge that 'up-to-date of information' is 'very important' (Mean 4.68) in their evaluation criteria of a good Web-based OPAC system.

[Correlation] Strong negative correlation was found between age group and the evaluation criteria of 'up-to-date of information' when $P<0.05$ was adopted. Younger students tended to judge that 'up-to-date information' is a very important element.

IV. DISCUSSION

As Hildreth [15], [16] stresses, OPACs design must be directed to the needs and abilities of the intended users. Generally, evaluation and thoughtful analysis have identified the key research, design, and implementation issues of OPAC, and evaluation has also provided knowledge that can guide design efforts.

Based on the statistical data analysis the following aspects of a Web-based OPAC are discussed in this section and focus on: (1) usability—features of ease of use; (2) availability—features of the contents of information, and (3) significant correlations are discussed that show the significant correlations between demographic variables and postgraduate students' attitudes towards evaluating the Web-based OPAC system.

1. Usability Features

- *Preference for interaction styles (F1)*

Over 90% of students preferred either 'menu-based interaction' (61.4%) or 'graphical direct manipulation' (31.8%) for Web-based OPAC interaction style. In this study, only eight interaction styles were selected but certain style such as voice recognition was not chosen. In this case its omission was due to the technical difficulties integrating it into the overall Web-based OPAC system.

- *Evaluation criteria of usability features (F2, F3, F4, F5)*

Evaluation criteria of usability of a good Web-based OPAC system were ranked as follows: (1) ease of learning (Mean=4.30; SD=0.73), (2) browsing and navigating style (Mean=4.05; SD=0.86), (3) screen layout (Mean=3.70; SD=0.98), and (4) character and image on screen (Mean=3.44; SD=0.91).

2. Availability Features (F6, F7, F8)

Based on the students' judgements on the evaluation criteria of 'availability of information' a good Web-based OPAC system, 'Up-to-date information' (Mean=4.68; SD=0.56) was the most important feature, 'availability of information' (Mean=4.59; SD=0.66) was ranked second, and 'quality of information' (Mean=4.57; SD=0.55) was ranked third.

Even though it is not the main objective of this research, it is noteworthy that the availability of information features (overall Mean=4.61) achieved higher scores than the usability features (overall Mean=3.87) in terms of the overall mean of the students' judgements. The results demonstrate that although both usability and availability features are considerably important, it may be more instructive to consider the *contents of information* rather than the *ease of use* of the OPAC systems.

Table 9. Significance correlation found: focus on the variables.

Variables	Features	No. Found
AGE GROUP	Screen layout; Quality of Information; Up-to-date of Information	3
GENDER	Preference for Interaction Style	1
EDUCAT. STATUS	Availability of Information	1
COMPUTER SKILL	Ease of Learning	1
OPAC FAMILIARITY	Ease of Learning	1

Table 10. Significance correlation found: focus on the features.

Feature	Variables	Feature	Variables
Preference for Interaction Style	Gender	Ease of learning	Computer skill, OPAC familiarity
Character and Image on Screen	None	Availability of Information	Education status
Browsing and Navigating Style	None	Quality of Information	Age group
Screen layout	Age group	Up-to-date of Information	Age group

3. Significant Correlation

- *Significant correlation found: Focus on Variables*

Focusing on the five variables the following significant correlations ($P < 0.05$) were found between (i) Age group and Screen Layout, Quality of Information, and Up-to-date of information; (ii) Gender and Preference for Interaction Style; (iii) Educational status and Availability of Information; (iv) Computer skill and Ease of learning; and (v) OPAC familiarity and evaluation criterion of Ease of learning.

These results revealed that age group was the most significant contributory variable in evaluating Web-based OPACs amongst the variables where significant correlations were found. Table 9 summarises these results.

- *Significant correlations found: focus on features*

Table 10 summarises the analysis results with respect to the features. This is in contrast to Table 9, which focuses on the variables.

- *Summary of significant correlations found*

This research result revealed the following:

- When focusing on the preference for interaction styles (F1), gender was found to be an important variable. The significant difference found was that female students tended to prefer menu-based interaction style, whereas male students preferred graphical direct manipulation.
- 'Evaluation of the screen layout' (F4) showed that age group was an important variable. The major feature being that older students tended to consider the screen layout as an important element of interaction style in the evaluation criteria more than the younger students do.
- 'Ease of learning' (F5) established that both computer skills and familiarity with OPACs were found to be the important variables. The significant result established was that the students with poorer computer skills and lower OPACs familiarity tended to consider that ease of learning was an important element of interaction style, whereas students with good computer skills and higher OPACs familiarity did not tend to show this.
- Focusing on 'Availability of Information' (F6), it was revealed that the educational status was an important variable, that is, Master students tended to consider that 'availability of information' is important element more than Ph.D. students.
- 'Quality of Information' (F7) and 'Up-to-date Information' (F8) were significantly related to the age variable. Younger students were inclined to consider that both 'quality of information' and 'up-to-date of information' are very important features of Web-based OPAC systems more than the older student.

Although this discussion does not consider every evaluation feature of the usability and availability of OPAC systems, it is hoped that relevant major aspects of this study can be considered as useful guidance in the user centered design of improvements in the next generation of OPACs such as in user-tailored interactive Web-based OPAC systems.

V. CONCLUSIONS AND FURTHER RESEARCH

This empirical study outlined the evaluation of the Web-based OPAC system that requires future improvements in its design, and highlighted the correlations between five variables categorizing user characteristics and their attitudes towards Web-based OPAC system evaluation. Although based on a small-scale sample restricted to one academic environment, this study has furthered our understanding of user aspects by discovering significant correlation between demographic variables and the preferred characteristics of a Web-based OPAC interface. In this study age was revealed as the most significant variable, followed by gender and subjects' computer skills and OPAC experience. From these observations, it seems to be suitable to recommend that system designers should make a

more considered appraisal of the users' demographic characteristics in the design of the new generation of OPAC systems such as user-tailored interactive Web-based OPAC systems.

For the present, the research findings made here point to a number of avenues of enquiry that could be pursued in future studies.

Firstly, since this research has shown that students placed usability and availability of HCI at a very high level in their evaluation criteria, there is a need to investigate the HCI issue further.

Secondly, it may be fruitful to consider extending this research to include undergraduate students and university staff as subjects, because research and development issues in OPACs, especially in Web-based OPACs, are defined as one of information retrieval systems designed for heterogeneous populations of end-users [7].

Thirdly, follow-up studies are needed in light of the relatively small-scale sample in this survey. It would be valuable, therefore, to conduct similar studies of students at other universities, and to augment these case studies with in-depth interviews to learn more about how individuals use OPACs.

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APPENDIX. The Questionnaire

SECTION A: Web-based OPAC System

The questions asked in this section are about your preference of Web-based OPAC (On-line Public Access Catalogue) systems.

1. Which interaction style do you prefer in general when using a Web-based OPAC system? (Please choose only ONE)

   ❍ Command interaction (Click here for an example)
   ❍ Menu-based interaction (Click here for an example)
   ❍ Natural language dialogue (Click here for an example)
   ❍ Graphical Direct manipulation (Click here for an example)
   ❍ Function-key interaction (Click here for an example)
   ❍ Question-and-answer (Click here for an example)
   ❍ Other? Please specify: [ ]

2. Would you rate the following features in terms of your evaluation criteria for a GOOD Web-based OPAC system?

<about INTERACTION STYLE>

2-a. Character and Image on Screen?

❍1 ❍2 ❍3 ❍4 ❍5

1[Not at all important] 2[Not important] 3[Neutral] 4[Important] 5[Very important]

2-b. Browsing and Navigating style (Interaction style)?

❍1 ❍2 ❍3 ❍4 ❍5

1[Not at all important] 2[Not important] 3[Neutral] 4[Important] 5[Very important]

2-c. Screen layout?

❍1 ❍2 ❍3 ❍4 ❍5

1[Not at all important] 2[Not important] 3[Neutral] 4[Important] 5[Very important]

2-d. Ease to learn?

❍1 ❍2 ❍3 ❍4 ❍5

1[Not at all important] 2[Not important] 3[Neutral] 4[Important] 5[Very important]

2-e. Other? Please specify: [ ]

❍1 ❍2 ❍3 ❍4 ❍5

1[Not at all important] 2[Not important] 3[Neutral] 4[Important] 5[Very important]

<about CONTENT>

2-f. Availability of information?

❍1 ❍2 ❍3 ❍4 ❍5

1[Not at all important] 2[Not important] 3[Neutral] 4[Important] 5[Very important]

2-g. Quality of information?

❍1 ❍2 ❍3 ❍4 ❍5

1[Not at all important] 2[Not important] 3[Neutral] 4[Important] 5[Very important]

2-h. Up-to-date information?

❍1 ❍2 ❍3 ❍4 ❍5

1[Not at all important] 2[Not important] 3[Neutral] 4[Important] 5[Very important]

2-i. Other? Please specify: _____

❍1 ❍2 ❍3 ❍4 ❍5

1[Not at all important] 2[Not important] 3[Neutral] 4[Important] 5[Very important]

SECTION B: Personal Identification

The questions asked in this section are designed to identify the range of user categories. This information will remain strictly confidential and will be used only for purely this research.

Age	
Gender	
Educational Status	❍MA or MSc ❍PhD
Computer Skills	❍Beginner ❍Intermediate ❍Expert
OPAC experiences	❍Beginner ❍Intermediate ❍Expert
Year of Research/Study	
Department/Faculty	
Email—if you are further interested in this research.	

Feel free to add any comment:

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