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Conference Paper · March 2015
DOI: 10.13140/RG.2.1.5167.3122

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Development and validation of the Electronic Information Resources usage scale

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Abstract

The purpose of the study was to develop and validate the EIR use scale. The research took place in several empirical phases. Fist, a list of 97 items was developed by the researcher and was sent to the panel of experts for validation. Then a research instrument was formulated and pre-tested with 100 sample in four university undergraduates. After checking the face validity, the instrument was piloted with 540 sample and then evaluated through comments and suggestions. Finally, the main survey was conducted with 604 undergraduate sample and through the factor analysis the main and sub-factors were identified. Then the Cronbach's alpha reliability and other validation such as descriminant and convergent validity were established.

Keywords: EIR Scale, Training, Descriminant Validity, Internal Consistency, Convergent Validity.

1. Introduction

Electronic information resources (EIR), can be explained as resources whose content is not limited to printed resources, and they can provide access to information that might otherwise be restricted to users due to their geographical location or financial situation. The information explosion has brought about a rapid increase in the use of networked information and other EIR in libraries. EIRs are defined in various ways. "EIR are information that is stored in a computer-readable format and that can only be retrieved through computer systems and other related technologies". (Aderibidge and Ajiboye, 2013, p.248)

Using EIR is a key issue in the information age, and the real challenge of the users is to use EIR effectively, and therefore, the library user must be competent in computers. Even though these resources have been in place for a while, many aspects of using EIR are still under exploration (Koehn and Hawamdeh, 2010). To negotiate complex e-information formats, one must be capable in other literacies, such as visual media and computer networks. The purchase of e-resources has been heavily dependent on the provision of computers. Due to this reason, information from electronic resources cannot be accessed in the same manner that printed sources were consulted previously (Majid, 1999). Therefore, these technological advancements have both created new opportunities and posed new challenges to individuals, forcing them to acquire the necessary skills to benefit from these advancements.

Categories of e-resources most commonly include e-journals, e-books, online databases, CD-ROMs, OPAC, and Web OPACs. Armstrong and Lonsdale (2007) mentioned that libraries face a range of challenges relating to providing access to e-resources and to ensuring their uptake. Amongst the most significant are those associated with definition of e-resources and lack of knowledge and understanding on the part of students and academic staff of certain e-formats.

To access EIR, library users must be efficacious or exercise self-judgment of their abilities (Ren, 2000). Further, self-efficacy is a personal judgment or a self-evaluation of a person's capabilities or competence to successfully organise and execute a course of action required to attain designated types of performances (Bandura, 1982). It is a multi-dimensional construct that varies according to the domain of demands (Zimmerman, 2000).

Even though many studies on EIR usage in the field of Library and Information Sciences (LIS) have been conducted in Sri Lanka, few studies (Hewagamage, 2009; Punchihewa, 2008; and Seneviratne, 2004) have measured the accessibility of users with regard to the use of ICT and EIR in university libraries. Hence, to date no validated and reliable measurement has been developed to measure the EIR use in the university libraries in Sri Lanka.

2. Literature Review

Due to the dearth of literature on EIR efficacy measurement in the context of university libraries, the researcher found no scales that measure the EIR efficacy of users of Sri Lankan university libraries. Therefore, related past studies were examined and reviewed critically with a focus on empirical aspect of EIR utilisation in university libraries and were considered to prepare the EIR scale.

The e-resources can be distributed through university libraries via various media such as the Internet, databases (Online Public Access Catalogue-OPAC & Web OPAC), CD-ROM, and e-journals, which are the most commonly available types of e-resources on computers and online. This section reviews EIR usage patterns observed in the university libraries and further explains the types of EIR used in libraries.

The Internet is important to libraries for information searches of products and services, e-mail exchanges, web searches, as well as the performance and improvement of library tasks and services, such as downloading materials, delivering documents, and accessing entertainment.

Several studies have extensively explored the use of Internet in libraries in different countries. In the Sri Lankan university library context, Seneviratne (2004), revealed that although most respondents used the Internet regularly, for various reasons, they were not using the Internet at the University library. These libraries used more than one service such as e-mail and the WWW. Internet-based e-information services, web-based digital resources, the networked environment, and multimedia facilities are becoming very essential (Ankumbura, 2013). The Internet, at the global level, and several library networks, at the national and local level, has combined to create databases for information-sharing purposes (Siddike, 2008).

OPAC is a library catalogue accessed via a computer terminal for the benefit of library users. The OPAC system has changed the traditional concept of access, and it allows multi-dimensional searches through author, title, subject, keyword, call number, accession number, International Standard Book Number (ISBN), etc. (Ansari and Amita, 2008). According to Sridhar (2004), although the satisfaction level of OPAC users was high, many users were not aware of the expert search features provided by OPAC. However, Malliari and Kyriaki-Manessi (2007), Ansari and Amita (2008), and Morupisi and Mooko (2006) found that users often utilised the title and author search mechanism, but avoided "subject-item" searches due to their weakness in expressing the subject with the proper keywords and

their lack of knowledge of the system's capabilities. Morupisi and Mooko (2006) further stated that, students' encountered difficulties with subject search use of advanced searching options, downloading and printing search results, and accessing full-text journal articles through OPAC. Therefore, it was evident that users do not know the system's capabilities or they are hesitant to use it.

CD-ROM is one of the most effective and efficient means of managing and storing information. This is considered among one of the technologies that had a great impact on information organisation and delivery in libraries (Sulemani and Badu, 2003). The importance of CD-ROM for libraries includes the provision of information to isolated rural areas and to people who have no access to print, online, or Internet facilities and the decentralisation of library services to multiple populations through networking. This is a solution to the poor availability of academic and research information resources.

E-journals and e-databases are another information resource that provides access through ICT. A journal can be called as long as its contents are produced and stored in electronic form or if its contents can be scanned in a database and retrieved online (Nisha and Ali, 2013). The respondents need help with search formulation and search terms, and they recommended that these systems provide "suggested keywords" and "suggested search strategy" features (Othman and Halim, 2004). Libraries should teach their users about various search strategies and organise orientation sessions regularly (Nisha and Ali, 2013). Punchihewa (2009) mentioned that, many undergraduates have never used online journals and computer literacy was an important factor in searching online databases in Sri Lanka.

2.1 Users' Training Needs

Many studies have been carried out on ICT training in the field of LIS. Library orientation programs are often conducted by librarians, although sometimes, systems librarians or information technologists undertake this task (Nyamboga, 2004). In Sri Lanka, a number of studies (Jayatissa, 2009; Mashroofa, 2009; Ratnayake, 2004; and Seneviratne, 2009) have been conducted in various university libraries to evaluate the information literacy levels of students and their competency in using ICTs in the library. Ratnayake (2004) revealed that such programmes included an introductory lecture with a library tour, printed library guides, and brochures and handbooks. Barriers to training were identified by Tahir, Mahmood, and Shafique (2010), including lack of time to conduct searches, lack of training to use EIR products, lack of computer hardware and software, lack of support, and language barrier. However, Omekwu (2010) suggested that libraries offer undergraduate researchers information retrieval, IT competence, and Internet skills in the form of user education to enable them to make use of the library resources effectively. Alakpodia (2010) also reported that users should gain critical-thinking and technological skills that will allow them to find the appropriate information using a computer. Without effective and holistic user education, there will be barriers to accessing electronic information, especially in an academic environment.

According to the literature, all the researchers have studied the usage patterns of EIR other than using specific scale. Therefore this study was aimed to consider the components that researchers have used to prepare the scale of EIR use in university libraries.

3. InstrumEntation and Data Collection

The research to develop the EIR scale took place in several empirical phases (Figure 1)

- Develop the key components of EIR
- Discuss the components with experts for validation
- Edit and develop a list of items according to the list of key components
- Send to the panel of experts again for validation
- Edit the statements and prepare the questionnaire for pre-test and distribute among undergraduates
- To examining the responses the pre-test was send to the panel of experts for content validity
- After editing the questionnaire accordingly, the pilot instrument was developed
- Pilot suevey
- Corrected with experts view
- Main survey

With the help of the literature survey key components of EIR was identified and was discussed with panel of expertise in the library and information field who are knowledgeable about the university libraries' ICT and EIR services (Erfanmanesh and Karim, 2012; Jayasundara, 2009). These were reviewed by four senior library and information science professionals who manage the ICT/IT divisions of the four university libraries. These four professionals have more than 13 years of experience as librarians in university libraries, and they all hold master's degrees in LIS including network management. The purpose of this review process was to remove unclear and irrelevant components and repetitions from the pool. The researcher has personally visited the expertise and discussed the revision. After editing the components, they were send to the panel of reviewers for validity. Based upon the expert's comments, eleven (11) components were selected with editing. After editing nine components (09) were selected to prepare the items.

In the next stage of the study, a list of statements (97) was prepared based on the 09 components. All components were addressed in a minimum of one statement and care was taken to ensure that each statement was short, simple and clear. All these were again sent to the same panel of experts for validation. Based on the experts view, the question about computer experience was added. Then the statements for the questionnaire was prepared with 5 point Likert-type scale (1= strongly disagree to 5= strongly agree) and were distributed among the Humanities and Social Sciences undergraduates of final year in the four universities Peradeniya (PDN), Sri Jayewardenepura (SJP), Ruhuna (RUH), and Rajarata (RJT) University of Sri Lanka, to get the content and face validity from the pre-test; to achieve the following objectives; to identify the clarity of the language and the meaning of each statement; to confirm the relevancy of questions; and to improve the questionnaire structure (Compeau and Higgins, 1995). Pre-test was consisted with 50 convenient sample of 50 final year students. According to Compeau and Higgins, 1995 they used 40 sample for the pre-test. From the responses, some technical words and the structure of the questionnaire was changed.

Following the revisions to the list of questionnaire, a pilot instrument was developed in order to determine its potential validity. The pilot instrument consisted 97 items. The statements were both positive and negative forms and had at least one statement addressing each key component. Also demographic

questions were developed to collect the essential information for the study. With the ensuring of clarity, phrasing, terminology and readability of the items, the questionnaire was ready for the pilot survey.

Pilot study was conducted among 900 sample from four universities in February-March, 2012 and the response rate is 540 (60%). The instrument was distributed personally by the researcher to obtain comments and suggestions for the questionnaire. The objectives of the pilot survey were to gain additional feedback on the survey instrument of the questionnaire, and to assist in determining the response rate of the questionnaire for the main study (Compeau and Higgins, 1995). The comments and suggestions made by students in response to the pilot survey were also considered. The majority of the respondents gave the following comments:

- The questionnaire was relatively clear and helped them to measure their ICT knowledge independently;
- The questionnaire gave the students insight into their relative ICT skill level; and
- The questionnaire format made it readable and easy to complete.

In respect to the second objective, to determining the response rate, it was estimated and compared with the data requirements of the main study; this comparison was calculated based on the number of variables and the percentage of the total sample of the study. Time limits were not imposed for any of the instruments; however, no subject took longer than 25 minutes to complete the whole questionnaire. The ICT experts, senior librarians, and the researcher met to prepare the study's main survey questionnaire from this pool of items.

According to pilot survey more female students (67%) than male students (33%) participated in the study. The majority of students are female. Although, 13 disciplines in total were represented at these four universities, students from certain disciplines participated in the study: eight disciplines from PDN, two from RJT, four from RUH, and five from SJP. The discipline samples were selected from each department using a lottery method. The language of instruction used by each participant was identified too. Obviously, most students learn in the Sinhala medium (82% of the total sample). Only 7% of students are enrolled in courses taught in English while 11% of respondents take courses taught in Tamil for their degree programme.

The pilot survey explored the students' use of library search tools; 51% of students use the card catalogue, 26% use both the card catalogue and OPAC, and 23% use only OPAC. Moreover, OPAC was heavily used by PDN and SJP students. Finally, the pilot survey asked students how frequently they use the library. Most students reported using the library moderately (65%), followed by frequently (22%); 13% of respondents use their university libraries rarely.

Upon completion of the pilot study, the returned questionnaires were input into Statistical Package for Social Sciences for statistical analysis. As the researcher self-distributed the questionnaire and was explained in native language none of them were incomplete and all were taken for the analysis. In an attempt to assess construct validity of the instrument, an exploratory factor analysis was performed. Results of running and factor analysis using principal component and varimax rotation method yielded sixteen (16) factors which collectively explained 83.73% of total variance. The first factor accounted 26.51% of the variance (eigenvalue=20.14), the sec-

ond explained 11.44% of the variance (eigenvalue=8.69), the third factor represented 6.47% of the variance (eigenvalue=4.9), fourth factor accounted for 6.20% of variance (eigenvalue=4.71), and fifth factor accounted for 5.59% (eigenvalue=4.25). Factor six accounted 4.14% of the variance (eigenvalue=3.15), Factors 7-9 accounted variance 3.8-2.8 (eigenvalue=2.8-2.1), and factor 10-16 accounted 2.43-1.4% (eigenvalue=1.84-1.09). Items with factor loading less than 0.4 were reviewed and re-paraphrasing again. The researcher decided to keep all ninety-seven (97) statements for the second study.

The second stage of the study was conducted during June-September 2013 at the same universities. Before the researcher's arrival, the students were made aware of the survey, and then the researcher met with lecturers and students in classrooms to distribute the questionnaire and to explain its purpose in the students' native language. When collecting data, the researcher personally gathered representative data from each department of the HSS faculties, irrespective of their study language. The researcher explained the objectives of the survey before distributing the tool, and additional questionnaires were also distributed to each subject stream to gain maximum participation from the departments. Sample size included 840 undergraduates. Based on the department's percentage size, the researcher distributed the survey instrument to a surplus number of participants. Response rate is highly satisfactory at 72%. Of the usable sample of 604 respondents, 21.7% were male students, while 78.3% were female students. In terms of disciplines, undergraduates studying Geography, Sinhala, and Sociology comprised 12.4% of the total sample. The second-largest representative discipline was History (11.8%), followed by Economics (10.4%). Only 0.2% of respondents are studying Islam and Arabic.

4. Validation of the Electronic Information Resource Scale

From the responses, 604 questionnaires were usable for analysis, and 164 were unusable because the questionnaires were incomplete. According to calculations, the gross response rate for the questionnaire was 91%, including unusable questionnaires; this response rate dropped to 72% after the unusable questionnaires were eliminated.

All questions relating to EIR usage were used to identify the communality and the principal component factor loadings, with the overall aim of determining strong and reliable items for each construct. First, a test for data redundancy was carried out with EIR questions featured in the questionnaire. Communality and factor loading below = 0.500 were eliminated from the dataset when selecting strong reliable items for each construct of EIR usage in the study. Sampling adequacy and principal component factor analysis were carried out; then, reliability, convergent and discriminant validity were tested via the scale purification methods (Compeau, Higgins, and Huff, 1999; Shu, Tu, and Wang, 2011). Through these methods, the researcher was able to identify reliable items for the EIR construct and its sub-constructs.

Ninety-seven items (97) were used for factor analysis to finalise the items for the EIR construct and related sub-constructs. Before conducting the factor analysis of the EIR and training questions, a chi-square value of 35795.651 and a significance level of <0.001 were obtained using Bartlett's Sphericity test; these results suggest that the inter-correlation matrix contains sufficient common variance to make

the factor analysis worthwhile, by indicating KMO statistics 0.851 of sampling adequacy and Scree plot.

To produce meaningfully distinct factors, the principal axis method was used. Statements with factor loading less than 0.5 were dropped leaving 43 items. Initially 11 factors were loaded but using examinations of eigenvalues and scree plot it was decided to retain only 5 factors. These five factors were as follows: (1) items related to EIR use; (2) ICT facilities and use of e-journals; (3) obstacles to use of EIR; (4) training needs; and (5) computer experience. To improve the convergent and discriminant validity (Wang, 2007) of the EIR construct through principal component factor analysis, four commonly employed decision rules (Straub, 1989) were applied 1. Using a minimum eigenvalue of 1 as a cut-off value for extraction; 2. Deleting items with factor loadings less than 0.5 on all factors or greater than 0.5 on two or more factors; 3. A simple factor structure; and 4. The exclusion of single-item factors for the sake of concision. Although, many factors were extracted, 3,4,7,8, and six factors were not taken by considering the second rule of Straub, 1989. Therefore, following 5 factors were considered and were categorised as follows.

Table 1: Description of Factors

No.	Item of Facilities and use of E-journals	Factor Loading
1	Unsatisfactory results of the e-journals in the search	0.552
2	Low speed of the Internet to search e-journals	0.537
3	Use facility of Microfilm reader/ Printer	0.526
4	Use facility of computerized Audio Visual system	0.526
5	Time wasting to access e-journals	0.525
6	Complicated interface to access e-journals	0.524
7	Use of Cassettes	0.524
8	Prefer other type of resources than use of e-journals	0.515

According to Table 1 there were 43 items extracted from 5 factors of the study. The significant loading of all the items on the single factor indicates convergent validity; the fact that no cross-loading items were found supports for the discriminant validity of the scales. Each factor loadings were indicated in the following tables sorted by size of the loadings.

Table 2: Factor Loadings for "EIR use"

No.	Item of EIR use	Factor Loading
1	Can e-mail the search results	0.631
2	Ability to save the search findings of OPAC	0.594
3	Finding e-journals through Internet	0.593
4	Getting electronic information	0.590

5	Use of E-Journals	0.577
6	Use Internet for Career development	0.574
7	Use Internet for Research purposes	0.573
8	Use of E-mail	0.568
9	Facilities to use of Library website	0.567
10	Easy to retrieve the items in the Web OPAC without any guidelines	0.564
11	The library web page provides link to access Web OPAC	0.560
12	Use Internet to checking e-mails	0.556
13	Use Internet to reading E-news papers	0.554
14	Use Internet to update knowledge	0.549
15	Easy to search articles through OPAC	0.545
16	Facilities to use Internet services	0.543
17	Download the OPAC search results to diskette/ Pen drive/CD	0.535
18	The OPAC is user friendly	0.532
19	Web Browsing	0.531
20	Use the OPAC	0.525
21	Very easy to get the information from the OPAC	0.520
22	Ability to sort (A-Z) the search results of the OPAC	0.514
23	Combination search (and /or/and not) of the library software	0.514

Table 2 indicated the EIR use items which consist 23 items and according to the component matrix factor loadings ranging from 631 to 514.

Table 3 indicated the facilities and use of e-journals which indicate 08 items and according to the component matrix factor loadings ranging from 552 to 515.

Table 3: Factor Loadings for "Facilities and use of E-journals"

No.	Item of Facilities and use of E-journals	Factor Loading
1	Unsatisfactory results of the e-journals in the search	0.552
2	Low speed of the Internet to search e-journals	0.537
3	Use facility of Microfilm reader/ Printer	0.526
4	Use facility of computerized Audio Visual system	0.526

5	Time wasting to access e-journals	0.525
6	Complicated interface to access e-journals	0.524
7	Use of Cassettes	0.524
8	Prefer other type of resources than use of e-journals	0.515

Following Table 4 indicated the Obstacles to use EIR in the library which indicate 06 items and according to the component matrix factor loadings ranging from 574 to 522.

Table 4: Factor Loadings for "Obstacles to use EIR"

No.	Item of Obstacles to use EIR	Factor Loading
1	Low speed to access EIR	0.574
2	Poor guidance from the staff	0.562
3	Shortage of time allowed to access information	0.554
4	Lack of guidance from the lecturers / library staff	0.545
5	Connectivity problems	0.531
6	Information records are not accurate and up to date	0.522

Table 5 depicted the items loaded for Training needs scale. Only 04 items were loaded and component matrix factor loadings ranging from 575 to 545.

Table 5: Factor Loadings for "Training needs"

No.	Item of Training needs	Factor Loading
1	Internet browsing	0.575
2	Microsoft Office package	0.563
3	How to handle a computer	0.554
4	Library electronic catalogue (OPAC)	0.545

The last factor loading was indicated as computer experiences and only 02 items were loaded into required level. Table 6 indicated the component matrix factor loading ranged from 615 to 577.

Table 6: Factor Loadings for "Computer experience"

No.	Item of Computer experience	Factor Loading
1	Internet café	0.615
2	Other place	0.577

The next step was to determine the internal consistency of the total scale as well as each sub-scale. Cronchba's internal reliability coefficient alpha is the most commonly accepted measure for internal consistency. Table 7 contains the internal reliability coefficient alpha for EIR use scale. This factor scored alpha coefficient value of 0.910 which indicate the high degree of internal consistency.

Table 7: Internal Reliability Analysis for EIR use scale

Item No	Alpha if item deleted
EIR1	0.905
EIR2	0.906
EIR3	0.906
EIR4	0.905
EIR5	0.908
EIR6	0.906
EIR7	0.906
EIR8	0.907
EIR9	0.908
EIR10	0.908
EIR11	0.908
EIR12	0.906
EIR13	0.906
EIR14	0.906
EIR15	0.907
EIR16	0.908
EIR17	0.907
EIR18	0.907
EIR19	0.907
EIR20	0.908
EIR21	0.907
EIR22	0.908
EIR23	0.909

The internal reliability coefficient alpha of the second factor was analysed and Table 8 indicated the analysis. According to that all the items in the facilities and e-journal usage are as follows.

Table 8: Internal Reliability Analysis for Facilities and e-journal usage

Item No	Alpha if item deleted
FEJ1	0.630
FEJ2	0.674
FEJ3	0.747
FEJ4	0.745
FEJ5	0.659
FEJ6	0.654
FEJ7	0.749
FEJ8	0.658

Cronbach's coefficient alpha was also calculated for the second factor. This factor scored alpha coefficient value of 0.725 which is the acceptable value for the scale.

The third factor was the obstacles to use EIR. Internal consistency coefficient of this factor was 0.772 which is an acceptable value. The examination of the internal consistency reliability analysis of six items is indicated in Table 9.

Table 9: Internal Reliability Analysis for Obstacles to use EIR

Item No	Alpha if item deleted
OU1	0.740
OU2	0.746
OU3	0.723
OU4	0.749
OU5	0.730
OU6	0.740

To determine the internal consistency of the fourth factor, Cronbach's alpha was calculated and it was yielded a high reliability estimate 0.879. The follow-

ing Table 10 depicted the internal reliability level of each item in the scale and is in acceptable level.

Table 10: Internal Reliability Analysis for Training needs

Item No	Alpha if item deleted
TN1	0.840
TN2	0.880
TN3	0.845
TN4	0.812

The alpha coefficient of the fifth factor was 0.772 which indicated a high degree of internal consistency. The values indicated in Table 11 are as follows.

Table 11: Internal Reliability Analysis for Compute experience

Item No	Alpha if item deleted
CE1	0.640
CE2	0.629

Finally, to assessing the validity of the five EIR-related scales was the evaluation of the items' internal consistence reliability using Cronbach's alpha coefficients. Table 12 indicate the recommended alpha level for all five scales and for the total scale.

Table 12: Internal Reliability of Overall Scale and Sub-scales

No.	Name of the Scale	Code of the Scale	Number of items	Cronbach's Alpha-Reliability
1	EIR Scale	EIR	23	0.910
2	Facilities and use of e-journals	FEJ	08	0.725
3	Obstacles to use ICT	OU	06	0.772
4	Training needs	TN	04	0.879
5	Computer experience	CE	02	0.772
Total	EIR use Scale		43	0.875

5. Conclusion

The research question was tested using 97 EIR-related items created for the descriptive survey of the study. Before identifying the factor structure of the EIR, a chi-square value of 35795.651 and significance level of <0.001 were obtained using Bartlett's sphericity test. The set of EIR and training questions were used for KMO and Bartlett's sampling adequacy test, which reported 0.851 sampling adequacy. Then, the 97 items were selected for factor loadings; from that analysis, five factors, limited to the level of = 0.500 loadings, were extracted (Shu, Tu, and Wang, 2011). Out of the 97 items, 43 items were extracted as EIR-related items from the factor analysis. The 23 items for 'EIR use' and the remaining 20 items were extracted as follows: eight items for use of facilities and e-journals; six for obstacles to EIR use; four for training needs; and two for computer experience. All five factors achieved acceptable reliabilities between 0.725 - 0.910. Cronbach's alpha reliabilities of 0.7 or greater are considered acceptable for basic research (Compeau and Higgins, 1999; Shu, Tu, and Wang, 2011; Wang, 2007).

6. Implications

The principal-component factor analysis revealed five clear factors with factor loadings above 0.50, indicating high convergent and discriminant validity. As the 97 EIR and training needs items were compiled in the Sri Lankan university context, only 43 were selected for the five scales. That produced acceptable statistical validity properties, including reliability and discriminant validity. These scales can be utilised to assess an individual's EIR usage. As some of the specific items were dropped from the analysis and some of the different items were loaded as one factor of the study (facilities and e-journal usage), further study would be effective to enrich the scale.

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