Development of a conceptual model of ICT self-efficacy and the use of electronic information resources

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The purpose of the study was to identify the ICT self-efficacy (ICTSE) of users, factors affecting ICTSE, and the EIR usage of undergraduates based on the four sources in relation to the self-efficacy theory. The Survey research design was used in carrying out this research. A structured questionnaire was validated through experts and piloted among the final year undergraduates studying Humanities and Social Sciences of four state universities in Sri Lanka. The structural equation modelling was performed using partial least square. The model revealed that ICTSE has a direct, negative, and significant relationship with ICT anxiety and that ICT training also has a direct, negative, and significant relationship with EIR. The model explained that there is a 27% of variance in the EIR use variable. The management of the library may deem it a worthy investment to instil adequate self-efficacy in users and encourage them to engage in more self-reliant search practices and decrease their dependence on staff. The finalized scales provide a potential tool applicable to different domains and disciplines to yield more common managerial implications in relation to training, teaching, and learning along with can be used as a tool when policy-level decision are made about the behavioral changes among university users on EIR usage in the current ICT domains within the university library systems.

Keywords: ICT self-efficacy; EIR use; Efficacy factors; undergraduates; Sri Lanka.

Introduction

ICT self-efficacy (ICTSE) is an individual's belief regarding the ability to utilize ICT, and it plays a positive and significant role in deciding the adoption and usage of ICT[1,2]. The theory of self-efficacy is based on four principal sources of information: mastery experience, vicarious experience, social persuasion, and physiological and emotional states[3], which directly or indirectly help to improve the self-efficacy level of undergraduates. Even though, Sri Lankan universities have recently introduced ICT skill programs to enhance students' technical competency, a number of aspects require investigation. One important such aspect is whether undergraduates in Sri Lanka studying in the fields of Humanities and Social Sciences (HSS) are efficacious in using library ICT and EIR, the factors contributing to effective usage of ICT and EIR in the library and measures to improve the effective use of ICT and EIR. The results of such studies would elucidate the impact of the major source of efficacy on EIR usage, which in turn will provide valuable information for policy making in relation to designing training and teaching programmes along with designing course modules to cope up with the rapid advancement of the ICT.

According to Bandura[4], self-efficacy is the belief in one's capabilities to organise and execute the courses of action required to produce given attainments. The theory of self-efficacy suggests that individuals must feel confident in using new technologies in order to effectively employ them.

Information system research has shown the significant role played by self-efficacy in using ICT skills[1,5]. Techatassanasoontorn and Tanvisuth[6] state, "ICT skill increases self-efficacy which in turn influences ICT acceptance" (p.10). This suggests that incorporating self-efficacy in research will improve the decision to gain ICT skills development, which will subsequently lead to accepting ICT. Thus, Internet self-efficacy may be distinguished from Computer Self-efficacy (CSE) as Internet self-efficacy is the belief that one can successfully

perform a distinct set of behaviours required to establish, maintain and utilise the Internet effectively[7].

As self-efficacy assesses the perceived capability of a person, the goal of this research is to apply the self-efficacy theory in relation to the four sources of self-efficacy. This study involves measuring for ICT self-efficacy (ICTSE), EIR use (EIR), library support (LS), ICT training (TR), computer experience (CE) and ICT anxiety (ANX) relating to the four sources of the self-efficacy theory.

Development of a conceptual path model and hypotheses

The conceptual research model used in this study is concerned with ICTSE and associated factors. The study focuses on EIR use and the factors affecting it. The factors were used to draw the conceptual model and the path relationships of the model were formulated by 13 hypotheses based on the theory of self-efficacy (Figure 1).

Figure 1 indicates that, library support for ICT uses, ICT training, computer experience, and ICT anxiety directly influence ICTSE and EIR usage. Moreover, ICT anxiety and computer experience directly affect ICTSE and EIR use as well. Computer experience and ICT anxiety also indirectly influences EIR use through ICTSE. ICT training and library support are each held to influence ICTSE directly. Again, EIR use is directly impacted by these two factors. ICTSE influences EIR usage directly. Existing self-efficacy literature has not yet identified the relationship between ICTSE and the influence of EIR use in the libraries within the Universities in Sri Lanka. Therefore, empirical evidence from both literature pertaining to self-efficacy theory and EIR reinforces the arguments presented in the study.

Computer experience: The past computing experience (mastery experience) provides information for the development of one's self-efficacy[8]. Undergraduates with more computer experience tend to express more independent control towards the use of computers. Thus, the first four hypotheses are;

H1: The level of computer experience is associated with the level of ICT self-efficacy.
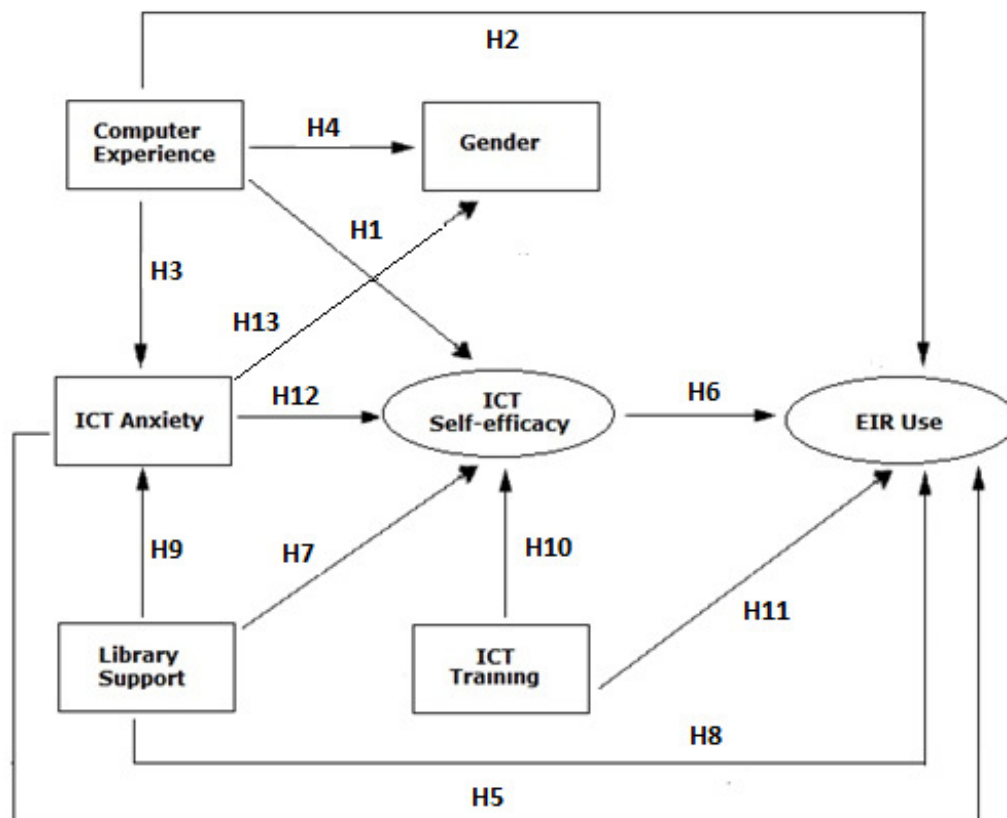

Fig. 1—Conceptual path model

H2: The level of computer experience is related with the use of EIR.

H3: The level of computer experience is associated with the level of ICT anxiety.

H4: The level of computer experience is associated with gender.

Use of EIR: EIR usage requires computer experience. Properly designed library instructions helps to motivate their skills[9]. Therefore, the hypothesis is;

H5: The higher the levels of EIR use, the lower the effects of ICT anxiety.

ICT self-efficacy: Techatassanasoontorn and Tanvisuth[6] states that, "more specifically, studies have shown that ICT skill training increases self-efficacy which in turn influences ICT acceptance". The next hypothesis was developed based on this observation;

H6: The higher the ICT self-efficacy, the higher the use of EIR.

Library support: Vicarious experience can be obtained through positive social interaction at the library. Peer support has been found to be closely related to individuals' self-efficacy[1]. Thus, the hypotheses are;

H7: The greater the extent of support given by library staffs to undergraduates, the higher the ICT self-efficacy of undergraduates.

H8: The greater the extent of support given by library staff, the higher the level of EIR use.

H9: The greater the extent of support given by library staffs to undergraduates, lesser the ICT anxiety.

ICT Training: Many researches[10-11] indicate that after attending training courses, sample populations have shown higher levels of self-efficacy, as well as an increase in the feelings of competency when it comes to using technology. Thus, following hypotheses were formulated.

H10: The greater the amount of ICT training provided by library staff to undergraduates, the higher the ICT self-efficacy of undergraduates.

H11: The greater the amount of ICT training provided by library staff to undergraduates, the higher the use of EIR.

ICT Anxiety: Anxiety caused by the prospect of a difficult task can cause people to believe that they are unable to complete the task[12]. The following two hypotheses were formulated to be tested;

H12: The level of ICT anxiety is associated with the level of ICT self-efficacy.

H13: The level of ICT anxiety is associated with gender.

Methodology

Exploratory and descriptive survey tools were applied in conducting this research. In the exploratory survey, the researcher conducted structured interviews with IT experts in the library to clarify the ICT & EIR services and to gain an understanding about the barriers in providing EIR services to their undergraduates. A semi-structured questionnaire was administered to the Unit Heads of ICT divisions to identify the extent of ICT and EIR awareness, ICT training, and library support that were provided to the students and barriers to their use.

In the second part, final-year undergraduates in the faculties of humanities and social sciences belonging to the four universities viz., University of Peradeniya (PDN), University of Sri Jayewardenepura (SJP), University of Ruhuna (RUH) and Rajarata University of Sri Lanka (RJT) were surveyed.

The ICTs and the EIR measures were prepared by paying special attention to the university library domain and the library user domain using ICTs and EIR[13].

Computer experience (CE): The use of ICT and the EIR depends on the experience gained by the undergraduates through a computer. Therefore, four items were used and two items were selected from factor loading.

Use of EIR (EIR): Use of OPAC, OPAC search, web OPAC, e-journals and Internet usage, use of search engines, ICT facilities and training needs were included to prepare the items. Factor loading was therefore done for 33 items.

ICT Self-efficacy (ICTSE): The General Computer Self-Efficacy (GCSE) of Murphy et al.,[14] and Internet self-efficacy (ISE) of Hsu and Chiu[15] were used to create the ICTSE for this study. To prepare the ICTSE scale, 15 items from the GCSE scale, 07 from ISE and 08 items were developed by researcher and were used. Out of 30 items, 23 items were selected.

Library support (LS): Fifteen items were developed based on the identification of critical factors from the undergraduates. Finally, 07 items were selected from the factor analysis.

ICT training (TR): ICT training was measured by using twelve items and the factor loading was limited to three items.

ICT Anxiety (ANX): Heinssen et al.'s[16] Computer Anxiety Rating Scale was selected to measure undergraduates' ICT anxiety with slight modifications to suit the needs of the present study. Out of 21 items, 10 were selected from factor loadings.

Gender (GEN): Gender variable was included as one item for the study.

Procedures

After preparing the pool of ICTSE items, other constructs were measured via a five point Likert scale. The pool of items were selected after being analysed by library experts ,who have Master's Degrees in LIS working in the university libraries[17-18] , to remove unclear and irrelevant items from the pool and to ensure face validation[17,19].

The questionnaire was piloted among randomly selected 100 students from the four universities in 2015. The content validity was established with the help of subject experts and their comments and suggestions were incorporated. The reliability analysis indicated that Chronbach's α is 0.94 which is satisfactory.

The required sample for the main survey was selected according to the Krejcie and Morgan[20] sampling method. A minimum of 840 responses were required after the selection was carried out through a stratified random sampling method covering all the departments of HSS faculties in the above mentioned universities in the academic year 2016.

Analysis

The data entered were subjected to the EXPLORE procedure in SPSS Ver. 20 to verify the integrity of data. The confirmatory factor analysis (CFA) and the Partial Least Squares (PLS Ver. 03) were used to analyse the structural models and Stone-Geisser criterion ($Q2$), the effect size (f^2) and VIF were used to evaluate the model.

Results of the study
Demographic data

The response rate was 72%. Of the usable sample of 604 respondents, 21.7% were male and 78.3% were female. The majority of respondents are studying in the Sinhala medium (86.6%); 11.6% of the respondents are from the English medium while 1.8% take courses in Tamil. Regarding searching patterns, 37.6% of respondents use both the card catalogue and OPAC; 37.3% use the card catalogue only; and 25.1% use only OPAC.

According to the survey, most of the respondents (86.3%) use the library frequently and moderately to fulfil their information needs.

Initial Measurement Model

An initial research path model was developed according to the conceptual framework constructed from the literature. Altogether 79 items were included for the CFA, according to the outer weights of the model. 16 items of the EIR scale, Gender (1 item), 1 item from ICTSE scale, and 3 items from LS scale were loaded < 0.5. Therefore, those 21 items were excluded from the final model.

Revised Structural Model

The initial path model was improved by removing < 0.5 constructs. The outer loadings of the final model are indicated in Table 1 and the latent variable and highlighting them indicates their respective manifest variables. There were no cross-loadings of the constructs. The majority of the constructs is well above 0.50 and was unique.

The removal of items with lower loading in the initial model led to a considerable increase in the alpha level of the constructs.

The path coefficients of the final model analysis were shown in Figure 2. R-Square (R^2) indicates the amount of variance explained by the model[21]. The path coefficient of the final Model represents the direct and indirect effects of each antecedent construct. Certain constructs showed direct negative relationships with the antecedent constructs. In the final Model, ICTSE has a direct, negative, and significant relationship with ICT anxiety (-0.256, p = 0.001); ICT training also has a direct, negative, and significant relationship with EIR (-0.089, p = 0.01). Figure 2 indicates the path coefficients of the final model.

Table 1—Outer loadings of the measurement model

|	ANX	CE	EIR	ICTSE	LS	TR
ANX10	0.796113	-0.03736	-0.23183	-0.25969	-0.0516	-0.03387
ANX11	0.809569	-0.03748	-0.17297	-0.2258	-0.01278	-0.04803
ANX12	0.728323	-0.04466	-0.17932	-0.23781	-0.03955	-0.01083
ANX2	0.638113	-0.01162	-0.11061	-0.15125	0.058549	0.073477
ANX3	0.805760	-0.09803	-0.216	-0.19472	-0.02071	0.048116
ANX4	0.768302	-0.0211	-0.21683	-0.17356	-0.01561	0.033156
ANX5	0.754772	-0.06542	-0.16505	-0.18509	0.00591	0.062277
ANX6	0.719801	-0.05654	-0.11648	-0.13874	-0.02861	0.0677
ANX8	0.658131	-0.02222	-0.05826	-0.1073	0.045258	0.048365
ANX9	0.795623	-0.03732	-0.23323	-0.20775	-0.04154	-0.00687
CE1	-0.06477	0.945130	0.145636	0.120895	0.083882	0.024416
CE2	-0.03669	0.848166	0.072802	0.094257	0.049815	-0.01584
EIR1	-0.1802	0.048081	0.625199	0.279217	0.085055	-0.04299
EIR10	-0.05134	0.067403	0.540894	0.23414	0.028747	-0.11364
EIR11	-0.05152	0.085458	0.513357	0.195611	0.047663	-0.1132
EIR12	-0.18327	0.081137	0.670985	0.467323	0.129045	0.067278
EIR13	-0.12012	0.062913	0.676884	0.330772	0.078764	-0.04259
EIR14	-0.15584	0.130365	0.701234	0.398144	0.120842	0.069248
EIR15	-0.12933	0.041278	0.530811	0.231934	0.028937	-0.07436
EIR17	-0.08767	0.076438	0.522287	0.207575	0.064914	-0.03763
EIR18	-0.14377	0.109509	0.594300	0.252502	0.046076	0.004254
EIR19	-0.12251	0.124319	0.644695	0.423312	0.127729	0.050864
EIR2	-0.11511	0.031469	0.601642	0.232151	0.051316	-0.00966
EIR20	-0.22014	0.034253	0.500746	0.286762	0.057807	0.028273
EIR21	-0.15396	0.032639	0.599088	0.286779	0.097461	0.037446
EIR22	-0.21595	0.080833	0.539705	0.20533	0.051047	-0.08865
EIR3	-0.17865	0.070985	0.639129	0.278716	0.044113	-0.04764
EIR6	-0.18788	0.105508	0.703050	0.322668	0.129676	-0.00619
EIR7	-0.16459	0.122841	0.683388	0.310267	0.15022	0.068284
ICTSE1	-0.19337	0.13194	0.414544	0.797503	0.184016	0.170816
ICTSE10	-0.17164	0.111553	0.41866	0.813224	0.163761	0.126374
ICTSE11	-0.18057	0.084471	0.314121	0.766714	0.151847	0.147463
ICTSE12	-0.15073	0.143411	0.406007	0.800547	0.189604	0.169888
ICTSE13	-0.18745	0.082625	0.409208	0.840081	0.155771	0.13158
ICTSE14	-0.1951	0.080372	0.389051	0.795477	0.17632	0.103599
ICTSE15	-0.25415	0.078905	0.366267	0.661644	0.188079	0.123464
ICTSE16	-0.22291	0.064337	0.322118	0.677200	0.162403	0.167566
ICTSE17	-0.22684	0.095466	0.369124	0.685836	0.152392	0.119538

Contd—

Table 1—Outer loadings of the measurement model

—*Contd*

ICTSE18	-0.24495	0.074105	0.313562	0.726260	0.153726	0.185654
ICTSE19	-0.19317	0.117473	0.408376	0.718365	0.099704	0.065816
ICTSE2	-0.17838	0.106634	0.334914	0.800505	0.155803	0.177782
ICTSE20	-0.24337	0.113118	0.421733	0.774262	0.104741	0.08391
ICTSE21	-0.22297	0.076609	0.46016	0.711076	0.094995	0.01452
ICTSE22	-0.24654	0.084985	0.429161	0.710306	0.124399	0.03425
ICTSE3	-0.15871	0.095304	0.324615	0.747797	0.176565	0.212306
ICTSE4	-0.16422	0.087664	0.360301	0.750928	0.171142	0.11349
ICTSE5	-0.16236	0.097183	0.364807	0.812436	0.171469	0.172442
ICTSE6	-0.17973	0.090803	0.343171	0.802774	0.200359	0.169098
ICTSE7	-0.23589	0.090642	0.411946	0.832738	0.137907	0.125662
ICTSE8	-0.21054	0.052864	0.429241	0.846549	0.122732	0.152843
ICTSE9	-0.19524	0.095111	0.378262	0.818457	0.186621	0.15693
LS1	-0.0203	0.07866	0.125033	0.197514	0.820535	0.087927
LS2	-0.00711	0.030333	0.109766	0.125718	0.736025	-0.01345
LS3	0.02357	0.085318	0.108283	0.136441	0.765940	0.003834
LS5	-0.07783	0.021092	0.049079	0.116411	0.593437	0.044968
TR2	0.034083	0.050334	0.011931	0.124142	0.03274	0.792910
TR4	0.030219	-0.00389	-0.04881	0.115873	0.097318	0.828168
TR9	-0.00494	-0.01412	0.008921	0.170135	0.00306	0.832137

Evaluating criteria for the validity of the constructs used in the model was calculated. In terms of the Tolerance and the Variable Inflation Factor (VIF), values for all exogenous variables ranged from 1.019 – 1.168 and were well below the threshold value of 5[22] which indicated that there was no multicollinearity issues within the model. The Stone-Geisser Criterion (Q^2) values indicate the predictive relevance of the constructs indicating the medium predictive power (p $= > 0.02$)[23]. The f-square values indicate the effect size (f^2), and indicate the magnitude of the effects of the predictor. Meanwhile, effect sizes of 0.02, 0.15 and 0.35 are considered to be of a small, medium and large impact[24]. According to that, ICTSE and EIR indicated that there is a Medium impact of the model. The ANX →ICTSE = medium, ICTSE →EIR = medium, LS → EIR = small, LS → ICTSE = small, TR → EIR = small and TR →ICTSE = small.

This research formulated thirteen hypotheses relating to the paths used in the Model. The structural testing results are explained as follows. The respondents' level of computer experience demonstrated a direct and statistically significant positive relationship with ICTSE (H1: β = 0.091, p < 0.001), and EIR usage (H2: β = 0.064, p. 0.01). However, the relationship between computer experience and ICT Anxiety is rejected (H3: β = -0.058, p > 0.05 and was not statistically significant.

The results support H5 (H5: β = -0.113, p < 0.001). With respect to H6 ICTSE exhibited a statistically significant positive relationship with the use of EIR (H6: β = 0.468, p < 0.001). Similarly, H7 support construct was significantly related to ICTSE, indicating (H7: β = 0.181, p < 0.001) but was not significant with reference to EIR use (H8: β = 0.041, p > 0.05); thus, H8 was rejected from the study. Library support is not significant with ICT anxiety (H9: β = 0.019, p > 0.05); thus, H9 was rejected. ICT training is also positively related to ICTSE, which indicated a direct significant relationship (H10: β = 0.168, p < 0.001); this supports H10 of the research model. H11 was negatively related (H11: β =-0. 089,
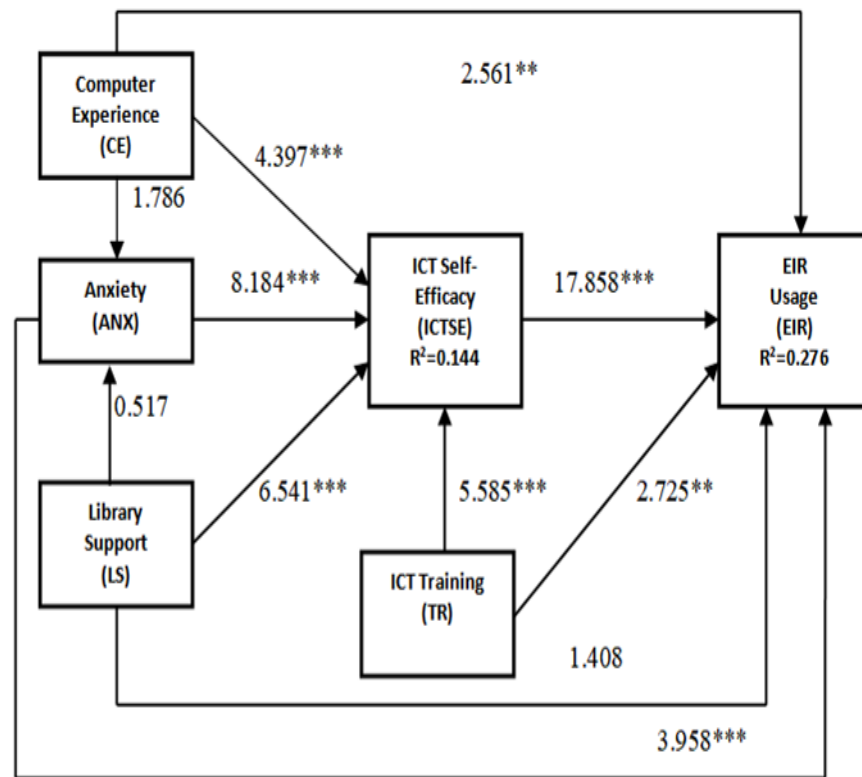
Note: * p < 0.05; **p < 0.01; ***p < 0.001 (based on t-two tailed test)

Fig. 2—The path coefficients of the research model

p < 0.01) and thus supported by the study's findings. ICT Anxiety has a direct, statistically significant and negative relationship with ICTSE (H12: β = -0.256, p < 0.001).

The results of the hypotheses, H1, H2, H5, H6, H7, H10, H11, and H12 are supported. However, H3, H8, and H9 were scarcely supported and H4 and H13 were not tested since the gender variable was removed from the final model due to the lack of a significant contribution.

Measurement model

The validity of the constructs depends on the convergent and discriminant validity of each measure in the path model. All composite reliabilities are greater than the expected level of ≥ 0.7. The Average Variance Extracted (AVE) value exceeds 0.60 and the measurement model explains more than half of the variance. The correlation between six constructs, represented the shared variance among constructs and did not exceed the square root of the AVE. All measures exceed 0.82 for internal consistency reliability in terms of discriminant validity. This suggests that the constructs in the study are distinct and unidimensional (Table 2).

Discussion

According to the theory of self-efficacy, there is a reciprocal relationship between an individual's performance and self-efficacy beliefs *via* performance, which is both the antecedent and the consequence of self-efficacy. The final model indicated that 27% of the variance is explained by the EIR use variable. Moreover, ICT anxiety has a direct and significant negative influence on EIR use; such evidence suggests that students have certain degree of ICT anxiety, which precludes the use of EIR effectively in the university libraries. ICTSE affects students' use of EIR use in university libraries comparatively. It is evident that ICTSE indicated that students who frequently use the library have more efficacies (83%) than students who moderately or rarely use the library (77% and 71%, respectively).

Table 2—Reliabilities and discriminant validity of the revised model

No.	Construct	CR	Inter-Construct Correlation and √ AVE					
			ANX	CE	EIR	ICTSE	LS	TR
1	ANX	0.927301	**0.748**					
2	CE	0.892413	-0.059	**0.894**				
3	EIR	0.908204	-0.242	0.129	**0.608**			
4	ICTSE	0.966991	-0.262	0.121	0.498	**0.768**		
5	LS	0.821576	-0.023	0.078	0.138	0.202	**0.728**	
6	TN	0.858346	0.020	0.009	-0.008	0.171	0.047	**0.812**

Note: CR: Composite Reliability calculated in PLS. Numbers in bold on the diagonal are the square root Average Variance Extracted (AVE). Off diagonal elements are correlations among constructs. For adequate discriminant validity of the constructs, diagonal elements should be greater than corresponding off-diagonal elements

However, the present research found that users with two or more years of computer experience moderately influence students' improved self-efficacy. All undergraduates have moderate anxiety levels relating to the use of EIR in the library. This supports prior studies[1,25-26].

Library support was believed to be an indicator of students' ICT or EIR use. Although Eastin and LaRose[7] and Compeau and Higgins[1] suggested a negative relationship between these two, the existing research proved that the library support is necessary to improve ICTSE but not for EIR use.

Training enables users to successfully perform specific tasks[27]. Similarly, participants agreed that ICT training would directly increase their ICTSE levels and they requested training in relation to using OPAC, printed guides, and training on how to conduct online searches.

Conclusion

This study was designed to investigate students' ICTSE on the basis of the self-efficacy theory and then to test the validity of formative measures of ICTSE, which has not been investigated in information science research thus far in Sri Lanka. The study's methodologically validated scales can be adopted by any research endeavour within this field. The PLS-SEM model's results were critical to the present study, contradicting self-efficacy theory's position that feedback improves performance. Considering the results of the study, pre- or post-training would also be helpful in determining undergraduates' use of e-resources. Studying a topic is the first step to gaining a more robust understanding of individual differences that may inform administrators' decisions, enhance training course effectiveness, and extend current understanding of the factors linked to ICT and EIR usage.

As the results of this study were derived from cross-sectional data, an assessment of a larger sample of students including all streams, additional variables and factors across a more homogeneous student population, newly developed technological areas in university libraries should be conducted for the generalization of the model.

Acknowledgement

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