

Development and Validation of IHES Measuring ICT Integration among Faculty Members in Indian Higher Education Sector

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Introduction

Students are the key to tomorrow's success and are the future. Technology has been instrumental in bringing about a much-needed change in the way students learn in classrooms, libraries or at home. It is imperative that the potential of technology in revolutionizing pedagogy be realized and exploited to the greatest extent possible. Nowadays, governments are aiming to achieve digital literacy and ICT proficiency. Digital literacy is "comprises a set of basic skills which include the use and production of digital media, information processing and retrieval, participation in social networks for creation and sharing of knowledge, and a wide range of professional computing skills" (UNESCO Institute for Information Technologies in Education, 2011). ICT proficiency is "the ability to use digital technology, communication tools, and/or networks appropriately to solve information problems in order to function in an information society. This includes the ability to use technology as a tool to research, organize, evaluate, and

communicate information and the possession of a fundamental understanding of the ethical/legal issues surrounding the access and use of information" (International ICT Literacy Panel, 2002). Organization for Economic Co-operation and Development (2017) developed a questionnaire measuring ICT in teaching. It involves questions regarding equipment, support and courses for teacher trainers, mentors and student teachers. The questionnaire comprises 25 questions grouped into four heads – background information, technology and pedagogical use of ICT and mentor's responsibilities regarding the use of ICT in teaching. ESSIE is an ongoing project of European Schoolnet and University of Liège. ESSIE designed the Survey of Schools: ICT in Education which was funded by the European Commission. There are 29 questions related to experience with ICT in teaching, ICT access for teaching, Support to teachers for ICT use, ICT based activities and material used for teaching, Obstacles to using ICT in teaching and learning, learning activities with the target

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class, teacher skills, teacher opinions and attitudes and personal background information. Agrupamento de Escolas de Atouguia da Baleia is a portuguese organization that developed a teacher questionnaire on the use of ICT. The questionnaire is about digital literacy and use of ICT by teachers in schools. There are 26 questions grouped into – personal background information, experience with ICT for teaching, ICT access for teaching, support to teachers for ICT use, ICT based activities and material used for teaching, Obstacles to the use of ICT in teaching and learning, teacher skills and ICT in school management. Education Research Centre (2013) designed ICT in Schools Census for teachers that comprised 33 questions regarding personal background information, teacher beliefs and practices, access to ICT, using ICT to support teaching and learning, professional development and digital content. The questionnaire has multiple choice questions and takes 20 to 30 minutes to complete. Commonwealth of Learning has adopted the UNESCO ICT Competence Framework for Teachers that aims to enhance technology literacy, knowledge deepening and knowledge creation. For this purpose, a questionnaire titled 'ICT in Education: Teacher Survey' has been designed that comprises 13 questions regarding use of computers in school, use of ICT and use of technology for teaching and learning. Survey Monkey designed an online questionnaire for teachers and teaching assistant regarding the use of ICT. It comprises questions relating to knowledge of word processor, spreadsheets, database management systems, applications of ICT in planning, teaching, assessment and evaluation etc. The present study aims to develop a model of ICT proficiency among faculty members that would result in enhancing ICT literacy and usage.

Sample: This study used the snowball sampling and subjective sampling method because of time limitation and thus the generalizability of the results of the study are limited. The respondents for this study comprised faculty members serving in two central universities, three state universities and five private universities in the states of Punjab and Haryana. The study was carried out in two stages. The sample size for first study was 120 and for second study was 200 respondents.

Procedure: Review of literature, expert view, group discussions were used to finalize 19 items for the measurement of ICT level among faculty members. The scale was named ICT in Higher Education Sector Scale abbreviated as IHES. The initial questionnaire comprised 19 items measuring level of ICT integration among the respondents. EFA was performed using data collected to further refine the initial questionnaire. The final questionnaire after EFA comprised 14 items categorized as Information and Support (5 items), Resources (3 items), Communication (3 items) and Teaching (3 items). All items were measured on a five-point likert scale ranging from 1 = 'strongly disagree' to 5 = 'strongly agree'.

Exploratory Factor Analysis Results: The n=120 sample size dataset was used for EFA. KMO measure of sampling adequacy was 0.759, above the recommended value of 0.6 and Bartlett's test of sphericity was significant ($\chi^2(171) = 0.001, p < 0.05$). Thus, the factor analysis was suitable with all 19 IHES items. 5 items were eliminated as they had factor loading below 0.5. A principal components analysis of the remaining 14 items was conducted using equamax rotation with three factors explaining 65% of the variance. The

factor labels proposed were 'Infrastructure and Support', 'Resources', 'Communication' and 'Teaching'.

Confirmatory Factor Analysis Results: The n=200 sample size dataset was used for CFA. All items were retained as they had a factor loading greater than 0.5. Figure 1 shows the measurement model for the main construct ICT. Model fit was achieved as the GFI (0.812), AGFI (0.681), NFI (0.828), TLI (0.785), CFI (0.853), RMR (0.042) and RMSEA (0.087) were in the acceptable range. Discriminant validity was achieved as the correlation between the sub-constructs was lesser than

the square root of the AVE. Table 1 shows the CFA results.

Discussion and Implications of the Study:

The IHES comprises 14 items categorized into four factors viz., infrastructure and support, communication, resources and teaching. The significant contribution of the present study is that it has developed a model and measurement tool for ICT integration in the higher education sector. Thus, administrators and practitioners can use this scale to measure ICT literacy, proficiency and integration among faculty members.

Figure 1: Second Order CFA Measurement Model for main construct and sub-constructs

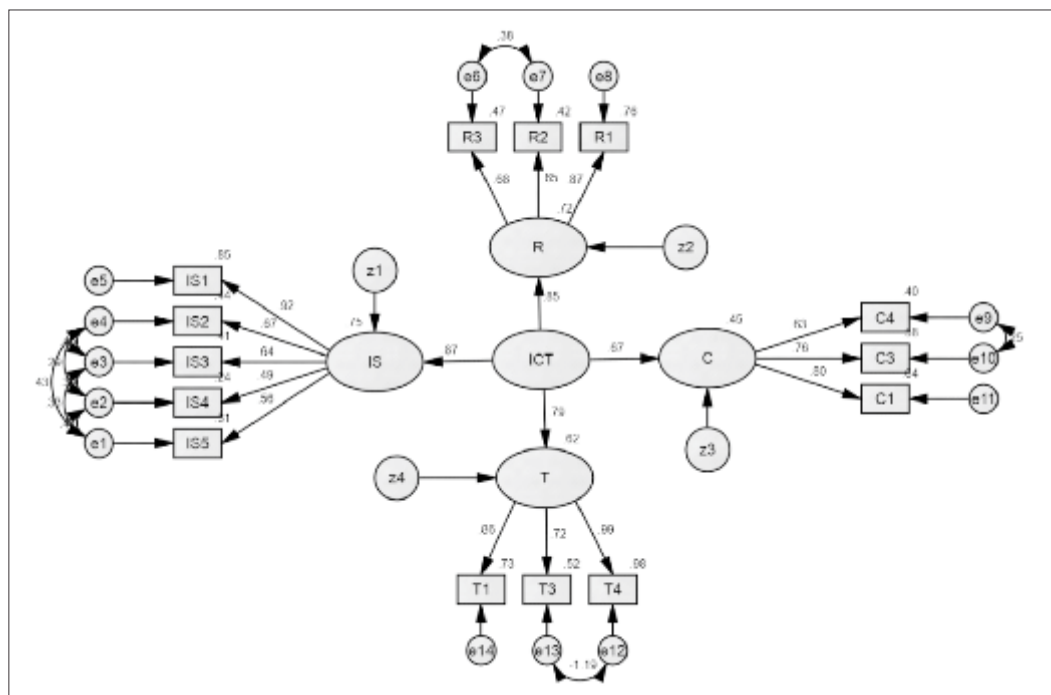


Table 1: CFA Results for the Measurement Model for Constructs

Construct	Item	Factor Loading	R ²	CR (>0.6)	AVE (>0.5)	MSV	MaxR(H)
	IS	0.867	0.75	0.949	0.636	-	-
	R	0.850	0.72				
	C	0.673	0.45				
	T	0.786	0.62				
Infrastructure & Support	IS1	0.914	0.85	0.867	0.568	0.432	0.919
	IS2	0.669	0.44				
	IS3	0.649	0.41				
	IS4	0.503	0.24				
	IS5	0.572	0.31				
Resources	R1	0.886	0.76	0.779	0.548	0.471	0.946
	R2	0.641	0.42				
	R3	0.67	0.47				
Communication	C1	0.84	0.64	0.802	0.575	0.379	0.809
	C3	0.728	0.58				
	C4	0.602	0.40				
Teaching	T1	0.868	0.73	0.859	0.683	0.471	0.975
	T3	0.726	0.52				
	T4	0.974	0.98				

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**Appendix: ICT in Higher Education Sector
Scale Items**

Infrastructure & Support

1. The institute communicates with me online
2. News, updates and information are available on the institute's official website
3. IT coordinator is available for help when required
4. Wi-fi connection provided by the institute is stable and reliable
5. Teaching aids such as projectors and interactive white boards provided in the classrooms are functional

Communication

6. I communicate with colleagues/supervisor online
7. I post exercises or tasks for students

online

8. I encourage students to make online submission of assignments

Resources

9. I use online resources for teaching purpose
10. I use online research databases to prepare teaching material
11. I assign students tasks that require the use of internet

Teaching

12. I use PowerPoint presentations to teach students
13. I encourage students to use online material for study purpose
14. I encourage students to give PowerPoint presentations in the class