

Acceptance of Open Learning Resources: Perspectives of Higher Education Students in India

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Abstract: The growing repository of learning resources on the internet provides a ubiquitous opportunity for learning. Worldwide, millions of learners leverage open learning resources (OLRs) to acquire knowledge and skills. Students in academic settings are ardent users of OLRs such as MOOCs and OERs. The purpose of this paper is to identify the factors influencing voluntary acceptance of OLRs by higher education students for complementing learning in the Indian context. The study also proposes a measurement scale for OLRs self-efficacy (OSE). This study extends and validates the innovation diffusion theory (IDT). The integrated research model reflects the effects of relative advantage, compatibility, OSE, subjective norm and facilitating conditions on acceptance of OLRs. Online survey data from 457 technical students in India were used for analysis using structural equation modeling. Results suggest that while relative advantage, compatibility, OSE and the subjective norm significantly impact intention to use OLRs, effect of facilitating conditions is not significant. Compatibility and OSE also significantly impact relative advantage. The proposed measure of OSE has valid psychometric properties. This study has advanced knowledge on the phenomenon of voluntary acceptance of OLRs from the perspective of students in traditional academic settings in a developing country context by extending and validating IDT. To the best of our knowledge, this is the first empirical study to understand the acceptance of OLRs by students in India. This study also provides a measure for OSE. The relative advantage mediating the effect of OSE on intention is confirmed by the results, which is scarcely tested before empirically. The study has practical implications for policy makers and teachers in a developing country to provide a more contextual learning environment to the students.

Keywords: Acceptance of Open Learning Resources, Self-efficacy, MOOCs and OERs in India, Technology acceptance, Informal online-learning, Open educational content and higher education

1. Introduction

Learning based on online resources gained prominence with the advancement in internet technologies, leading to the emergence of open content in 1998 and OpenCourseWare (OCW) in 2001 by Massachusetts Institute of Technology (MIT)(Mishra, 2014). Since then, there has been a growing momentum worldwide among higher education (HE) institutions to offer open online educational resources (Yuan, et al., 2013), thus providing learners access to a vast repository of educational resources in different forms such as, open educational resources (OERs), Massive Open Online Courses (MOOCs), eBooks and so on. The University of Oxford (2015) found MOOC to be a prevailing trend in HE with 142 universities providing free courses open to all participants through Coursera and edX alone. Currently there are 81 million MOOC learners (Edsurge, 2018) enrolled in various topics in humanities, science and technology, primarily at the undergraduate level (University of Oxford, 2015). Students account for 45% of visitors of OCW which they use to enhance personal knowledge, plan and complement a course of study (MITOCW, 2011). In a study on the usage of Coursera, Zhenghao, et al. (2015) find that almost half of the education seekers are students in traditional academic settings, mostly from developing countries. It is evident that the phenomenon of the use of open learning resources (OLRs) by students is widespread and continues to be reported in different media; however, research on this phenomenon is scarce.

The term OLRs in this study refers to the various comprehensive educational resources available in the public domain on the internet (or intranet) for learning, such as MOOCs, OERs and eBooks. Research indicates that OLRs are utilized by 'students in HE' (students) for learning (Yuan, et al., 2013; Hao and Jackson, 2014; Kim, et al., 2015; Zhou, 2016; Wu and Chen, 2017).

OER is defined by Altbach, et al. (2009) as "any type of educational material that is in the public domain or introduced with an open license (i.e., anyone can legally and freely copy, use, adapt and re-share)". The eBooks refer to textbooks in digital format which are increasingly being adopted in place of printed textbooks by students, faculty and libraries (Hao and Jackson, 2014). MOOC is a recently launched model of educational

delivery that has theoretically no limit to enrolment, allows anyone to participate, usually at no cost, and learning activities typically take place over the Web (Educause, 2013).

The offerings of OLRs are accelerating through government funding, institutional initiatives and collaborations with organizations, in developed and developing countries alike. However, students from developing countries have cultural, economic, social and language characteristics (Nti, 2015) which constrain the use of OLRs. Research on acceptance of OLRs in a developing country like India is rare as compared to developed countries. Moreover, there is little understanding about how OCW is used by learners (Sheu and Shih, 2017), especially OERs as replacement to textbooks (Lindshield and Adhikari, 2013) and the psychological factors influencing MOOC usage (Zhou, 2016).

India has recognized the importance of OLRs in bridging the learning divide in the country. It launched the National Programme on Technology Enhanced Learning (NPTEL) to create curriculum material in HE. NPTEL currently offers around 1480 live courses including online courses for credits which are being accessed globally by learners. India has also recently launched 'SWAYAM', an indigenous platform to offer MOOCs.

However, despite these developments, face-to-face teaching and mentoring still dominate Indian HE with limited ICT use in curriculum. On the other hand, Indian students are quite tech-savvy and they use OLRs mostly in the voluntary mode to complement their learning. These students ranked second in number in attending and completing MOOC courses (Rayyan, et al., 2013; Alcorn, et al, 2015) but research provided little focus on use of OLRs from students' perspective especially in a developing country context.

Hence, this study aims to ascertain factors influencing voluntary acceptance of OLRs by students to complement their learning in India a developing country. Besides enhancing knowledge on this phenomenon, we expect our findings to facilitate stakeholders to draw policies for providing appropriate learning environments to the new generation of tech-savvy students in developing countries.

The organisation of this paper is as follows: section two presents literature review and hypotheses where a research framework is developed. The next section discusses methodology, followed by data analysis and the result. Finally the discussion and conclusion section is presented with the implications, limitations and directions for future study.

2. Literature review and hypotheses

OLRs such as MOOCs represent an expansion in online-learning (Veletsianos, et al., 2015) in terms of open access to courses and scalability (Yuan, et al. 2013). Extant literature has used a variety of models and theories of technology acceptance to predict use of online-learning systems, which are information systems (IS). The basic premise of these theories is an individual's beliefs about the outcomes associated with the use of the target technology (Lewis, et al., 2003).

Lee, et al. (2011) investigated acceptance of eLearning based on innovation diffusion theory (IDT) and technology acceptance model (TAM), and the results indicated the attributes of innovation as significant factors. Hu and Hui (2012) examined the effects of computer self-efficacy (CSE), medium of learning and students' engagement on learning satisfaction. Merhi (2015) studied use of technology for learning by college students using TAM and IDT theories and the result indicated self-efficacy, relative advantage, image and usefulness among significant factors. Chu and Chen (2016) investigated acceptance of eLearning based on theory of planned behaviour (TPB) and found attitude, perceived behavioural control, subjective norm and group influences to be significant factors. MOOC usage intention was examined by Wu and Chen (2017) and Joo, So, and Kim (2018) by extending TAM.

Although the studies identify several factors for acceptance of eLearning, they are mostly based on formal courses offered by HE institutions. Research on the voluntary use of OLRs by students to complement learning is scarce. Formal eLearning courses are usually undertaken by learners for credits or degrees. In contrast, informal learning is expounded in literature as voluntary, open-ended, non-certificated, self-paced and learner-centred (Lin, et al., 2012). Hence, acceptance of formal online-courses might differ from voluntary acceptance of OLRs by students, depending on presence or absence of managerial interventions (admission,

cost, evaluation, grading, and support) in the course and voluntariness in the use of resources; which affect the beliefs and behaviours of learners (Agarwal, 2000; Lewis, et al., 2003).

The recent developments in OLRs (e.g., OERs and MOOCs) are considered innovations in education (Conole, 2016; Yuan, et al., 2013). Previous studies intensely utilized the IDT theory to explain and predict the adoption and use of various innovations. Rogers (2003) extensively studied diverse innovation adoption behaviours and posited five attributes of innovations: relative advantage, compatibility, complexity, observability and trialability that drive adoption of innovation. These attributes have been widely examined in extant literature as key independent variables predicting innovation adoption (Agarwal and Prasad, 1997; Chen, et al., 2009; Kim and Ammeter, 2014 and Wang, et al., 2018). However, Tornatzky and Klein (1982), in their meta-analysis on the characteristics of innovation, concluded that only three attributes: compatibility, relative advantage and complexity consistently influence innovation adoption decisions. Furthermore, longitudinal studies have found diminishing effect of ease of use (similar but opposite of complexity) on behavioural intention with time (Davis, et al., 1989; Venkatesh, et al., 2003).

Hence, to investigate the factors influencing voluntary acceptance of OLRs by students, this study considers IDT (Rogers, 2003) as the base model with compatibility and relative advantage, the two consistent factors of innovation adoption and use. Following an integrated approach, three other factors, self-efficacy (Bandura, 2004; Hu and Hui, 2012; Chen, 2014), subjective norm (Jackson, et al., 2013; Venkatesh and Morris, 2000) and facilitating conditions (Venkatesh, et al., 2003; Zhou, et al., 2010) are included in this study based on our beliefs that they affect acceptance of OLRs in India. The identified factors, linkages and proposed hypotheses are described in the following sub-sections.

2.1 Compatibility of OLRs

Rogers (2003) defines compatibility as “the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters.” Learning using open resources is consistent with the information behaviour (information need-seek-use cycle) of current students, called Net generation students (Lippincott, 2005), who are adept in online information search and use. Rogers (2003) posits that greater the degree of compatibility of innovation, the lesser would be the uncertainty in accepting new behaviour.

The importance of compatibility in predicting technology acceptance has also been empirically studied and supported in prior IS studies (Wu and Wang, 2005; Kim and Ammeter, 2014 and Wang, et al., 2018). Accordingly, it is hypothesised that:

H1: Compatibility will positively influence intention to use OLRs.

2.2 Relative advantage of OLRs

According to Rogers (2003), relative advantage means, “the degree to which an innovation is perceived as being better than the idea it supersedes.” It indicates benefits and costs resulting from adoption of an innovation.

This study compares use of OLRs with the traditional way of study using textbooks. OLRs may be considered advantageous by students, as they access video lectures delivered by teachers of world renowned institutions, with a few clicks of a mouse, anywhere, anytime, and at almost no or a minimal cost. Whereas in traditional settings, they have to invest money, effort and time for obtaining reference textbooks, either from a library or by making a purchase. Online multimedia resources are less cognitively taxing, convey information efficiently and effectively and enable the learners to acquire and memorize more (Dror, 2008). Time and effort thus saved using OLRs may increase the efficiency and productivity of learning tasks.

Prior studies in literature have recurrently found significant impact of relative advantage on users’ intentions to adopt new technology. Chen and Hung (2010) and Kim and Ammeter (2014) and Wang, et al. (2018) found relative advantage positively influencing behavioural intention. Hence, it is proposed:

H2: Relative advantage will positively influence intention to use OLRs.

2.3 OSE

Bandura (1977) defines perceived self-efficacy as “beliefs in one’s capabilities to organize and execute a course of actions to attain designated goals.” Efficacy beliefs influence one’s motivation, selection of activity for pursuance, perseverance, and endeavours to overcome obstacles for successful performance (Bandura, 1989). Persons of high efficacy expect to realize favourable outcomes (Bandura, 2004) by pursuing the chosen activities. Students with higher OSE are likely to be motivated to use more OLRs to attain their learning goal by leveraging the abundant quality OLRs provided by premier institutions.

Self-efficacy belief is behaviour-specific (Bandura, 1977). In this study, OSE is conceptualized as beliefs in ‘self-capability’ to search learning resources online, acquire and use relevant OLRs for study to attain learning goals. While we could not locate OSE in extant literature, we did find evidence of various other self-efficacies as factors of acceptance of diverse technology such as self-efficacy for online-learning (Bates and Khasawneh, 2007) and mobile-based learning (Lin, et al., 2016). CSE significantly impacts students’ web-based learning (Chen, 2014) whereas Internet self-efficacy (ISE) influences online behaviours (Hsu and Chiu, 2004; Torkzadeh, et al., 2006). Hence, in line with extant literature, it is proposed that:

H3: OSE will positively influence intention to use OLRs.

2.4 Subjective norm

Subjective norm refers to students’ beliefs about what other people who are important to them think regarding their use of OLRs. Research shows that views of faculty matter for students’ engagement and learning (Umbach and Wawrzynski, 2005), and normative pressure from supervisors and peers reduces uncertainty in the adoption of innovation (Karahanna, et al., 1999). Previous studies on subjective norm in the IS domain provide mixed results. Ajzen (1991) and Davis, et al. (1989) found an insignificant effect of subjective norm on intention. However Venkatesh, et al., (2003) and Staples and Seddon(2004) found positive results only in mandatory and initial use. Chu and Chen (2016) find a significant effect of subjective norm on intention. In the Indian academic settings, students (shishyagun) are likely to value and comply with suggestions and opinions of good friends and teachers (gurus) (Raina, 2002). As the impact of subjective norm on intention to use OLRs is yet to be examined and results reported by prior studies are inconsistent, we investigate this relation with the following hypothesis:

H4: Subjective norm positively influences intention to use OLRs.

2.5 Facilitating conditions

Facilitating conditions (FCs) refer to the environmental factors which make an act easy to do. In the context of this study, the FCs include availability of hardware, software, fast Internet connectivity in campus, support of technical staffs etc., which facilitate students to access and use the OLRs. Although, students tend to use their personal computing device (e.g. laptop) they are also dependent on the in-campus facilities (e.g. internet connections).

Access to fast internet at low cost is still an issue in India. Besides, poor students may find it difficult to arrange their personal computing systems to access OLRs anywhere anytime. Hence, the students are more likely to use OLRs when facilitated by proper environmental conditions, a fact that finds support in extant literature (Cheung, et al., 2000; Venkatesh, et al., 2003; Chen and Hung, 2010; Alalwan, et al., 2017). Hence, we propose that:

H5: Facilitating conditions will positively influence intention to use OLRs.

2.6 Compatibility and relative advantage of OLRs

There is inherent relative advantage in using online resources for searching, navigating to related information using hyperlinks, and using OLRs in multimedia formats, in comparison to using textbooks. However, this is not enough to form a perception about the real relative advantage of OLRs, unless they are found compatible with students’ way of learning and consistent with their past experience, information need and preferred type of content (e.g. video, eBook). The more compatible an OLR is, the more is the relative advantage perceived by a student. Hence, the degree of perceived compatibility of OLRs will influence students’ perceptions of its relative advantage.

Prior studies have found that compatibility influence perceived usefulness (Tung, et al., 2008; Chen, et al., 2009; Lee, et al., 2011) for acceptance of assorted IS behaviours including eLearning. Perceived usefulness is often considered similar to relative advantage by researchers (Venkatesh, et al., 2003). Hence, it is hypothesized that:

H6: Compatibility will positively influence the relative advantage.

2.7 OSE and relative advantage

Bandura (2004) posits that self-efficacy affects behaviour both directly and indirectly through its influence on outcome expectations, goals etc. He further posits that “self-efficacy beliefs shape the outcomes people expect their efforts to produce.” Hence, students with higher OSE will expect higher performance in learning using OLRs. Prior studies reported positive influence of self-efficacy on outcome expectations (Hsu, et al., 2007; Chen, 2014) and perceived usefulness (Shih and Huang, 2009; Merhi, 2015).

However, the impact of self-efficacy on a similar construct, relative advantage has been rarely tested empirically. Hence to empirically test the relationship, we propose:

H7: OSE will positively influence the relative advantage.

2.8 Intention to use OLRs

For this study, we consider intention to use OLRs as the dependent variable in line with prior studies (Agarwal and Prasad, 1997). Intention to use OLRs is defined as a measure of the strength of intention to use OLRs to complement learning by a student who has some prior experience in using OLRs.

The proposed research model is shown in Figure 1. Five independent variables, compatibility, relative advantage, self-efficacy, subjective norm and facilitating conditions are proposed to influence the dependent variable, intention to use OLRs. Relative advantage is also proposed to be influenced by self-efficacy and compatibility.

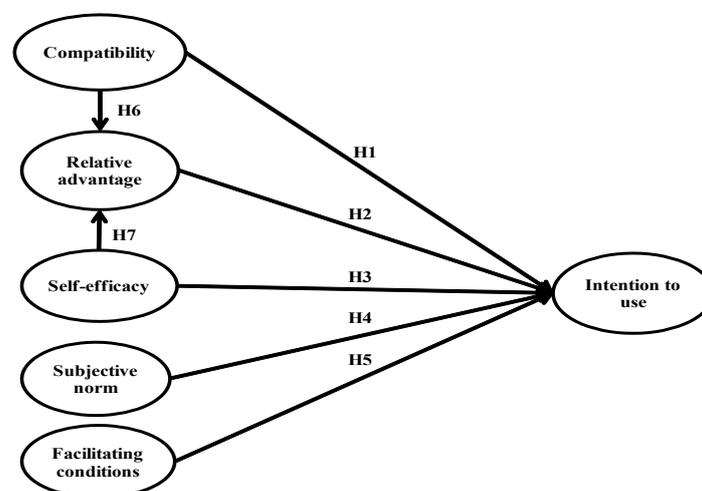


Figure 1: The proposed research model

3. Research methodology

For a research problem which identifies factors that influence an outcome or tests theories, the quantitative approach is best, however when a phenomenon is not explored much and researcher does not know variables to examine, the qualitative approach works better (Creswell, 2003). With an objective to find the factors of OLRs acceptance, this study employs the quantitative survey research method. There are several quantitative methods available such as survey research (cross-sectional or longitudinal), correlational research, and experimental research. As we intended to collect data at a given point in time, a cross-section survey was used which is supported by similar prior studies (Chen, et al., 2009; Kim and Ammeter, 2014 and Merhi, 2015). We

did not use longitudinal surveys as identifying change in a respondent’s behaviour across time was not desired. This study was also not limited to finding the correlation of two or more variables, as is the case in a correlational research, The experimental strategy presented an alternate choice for study which was not followed as it was not possible to control and track the voluntary use of various OLRs by the participants, since they use their personal devices to access a variety of OLRs.

The participants for this study were students registered in the engineering degree programmes with different departments (Electrical, Mechanical, Computer Sciences etc.) in technical institutes in India. We chose technical students as our research subjects as NPTEL has been targeting this population for over a decade.

3.1 Survey instrument

The survey questionnaire comprised of three sections. First, the cover page stated the purpose of the study, voluntariness in participation and assurance for anonymity and confidentiality of responses. It included questions to filter out non-users of OLRs and part-time students. The next section had statements to measure the independent and dependent variables followed by a section on demographics questions. To ensure content validity, the measures used for constructs’ operationalisations were adapted from relevant prior studies (Table 1). Since we could not find a suitable measure for OSE in extant literature we developed a new measure, adapting items mainly from General/Internet CSE by Marakas, et al. (2007), as discussed in Section 3.2.

The study adopted a reflective measure on a seven-point Likert scale (1-strongly disagree to 7-strongly agree) for all constructs, except OSE, a formative construct (in line with Marakas, et al., 2007) measured on a 10-point scale (1-not at all confident to 10-totally confident). The wordings, readability, navigation etc. of the survey instrument was pre-tested by two experts and three scholars and accordingly some minor modifications were made.

Table 1: Constructs measure source and reliability

Construct	Source	Outer loading	AVG	CR
Compatibility(C)	Wu and Wang (2005) and Cho(2006)	0.860	0.719	0.911
		0.883		
		0.863		
		0.782		
Relative advantage(RA)	Ahn,Ryu and Han (2007)	0.801	0.632	0.923
		0.821		
		0.815		
		0.630		
		0.804		
		0.841		
Subjective norm(SN)	Venkatesh and Morris(2000)	0.859	0.803	0.891
		0.932		
Facilitating conditions (FC)	Cheung, Chang and Lai (2000); one item added	0.808	0.643	0.9
		0.713		
		0.818		
		0.791		
		0.871		
Intention to use OLRs(I)	Barnes and Vidgen(2012)	0.894	0.833	0.937
		0.919		
		0.924		

3.2 OSE measure development

In this study, we conceptualize OSE as beliefs in ‘self-capability’ to search learning resources online, acquire and use relevant OLRs for study to attain learning goals. We reviewed several studies with self-efficacy (Table 2) for OSE operationalisations.

The majority of existing studies in Table 2, used the CSE instrument developed by Compeau and Higgins (1995) to measure self-efficacy for online-learning. This instrument assesses CSE as one’s ability to use a software package to accomplish a task (without assessment of necessary skills required to execute the task). The measurement items used in Compeau and Higgins (1995) scale such as:

“...if I had only the software manuals for reference, ...if I had seen someone else using it before trying it myself, ...if I could call someone for help if I got stuck... etc.”

did not align with the context of this study for acceptance of OLRs by the current ‘Net generation’ students. Similarly, measures of CSE and ISE by Torkzadeh, et al. (2006) and Hsu and Chiu (2004) did not find relevance in the context of this study.

Table 2: Select past studies on self-efficacy used in technology acceptance domain

Author	Self-efficacy(SE)
Marakas, Johnson and Clay (2007)	Internet computer SE, General computer SE
Torkzadeh, Chang and Demirhan (2006)	Internet SE, Computer SE
Hsu and Chiu (2004)	General Internet SE, Web-specific SE
Compeau and Higgins (1995)	Computer SE
Merhi (2015), Chen (2014), Bates and Khasawneh (2007) and Ong, Lai and Wang (2004).	SE for online learning adapted from Computer SE scale of Compeau and Higgins (1995)

Marakas, et al. (2007) posited that with rapid evolution in the domain of IT, “newer CSE measures developed to reflect these evolutionary changes will be better predictors of performance than older measures.” Bandura (2006) also posited that “there is no all-purpose measure of perceived self-efficacy and the ‘one measure fits all’ approach usually has limited explanatory and predictive value due to little or no relevance to the domain of functioning.”

Consistent with the suggestions of Bandura (2006) and Marakas, et al. (2007) for tailoring the scales of self-efficacy in tune with the target domain of functioning, a list of tasks for using OLRs was developed through discussions with four technical students and two research scholars from IS area. The tasks included searching topics on the Web, downloading files, onscreen study using multimedia resources comfortably and effectively; communicating on the internet groups/forums, submitting the completed assignments, and troubleshooting common computing problems.

Next, the existing measures applied in prior studies (Table 2) were reviewed with scholars. It was found that the tasks identified above were partially covered by the General/Internet CSE scales by Marakas, et al. (2007). We selected a total of eight items (three and five items respectively from General CSE and Internet CSE) and made slight modification in wordings to reflect the context of OLRs acceptance. Two items: SE1 and SE6 (Table 3) were added to measure the perceptions of capability to search and communicate online efficiently.

The items generation process revealed some essential skills related to learners’ perceived cognitive abilities for effective learning on-screen with digital contents. However, we were unable to identify suitable measuring items in relevant extant scales. We next reviewed the relevant theories/studies in education psychology area on cognitive aspects of learners in the eLearning environment and found that an individual having efficacy in using computing technology may not be comfortable with onscreen reading and could experience

metacognitive disorientation in unstructured hypermedia environment (Schwartz, et al., 2004). The interactive online environment may impose additional processing demands/load on learners’ cognitive resources hindering their learning (Kalyuga, 2007). Drawing upon these findings and the items generated for OSE measurement, we included two new items (SE5 and SE8) in the OSE measure to assess students’ perceived ability to read onscreen using digital contents and to learn effectively using OLRs.

Next, two experts and three scholars were asked to separately evaluate the content validity of the OSE scale (Table 3), and based on their recommendations, we made the necessary modifications. The construct validity (convergent validity, redundancy analysis, variance inflation factors (VIFs), items outer weight/loading) was ensured with a subsequent pilot study.

Table 3: Measure for OLRs Self-efficacy

	Scale Items	Source	Outer Weight	Outer Loading	VIF
SE1.	I believe I have the ability to search relevant open online courses on Internet for my study.	Scale items: SE1 adapted from Web specific self efficacy by Hsu and Chiu (2004).	0.164	0.786	3.797
SE2.	I believe I have the ability to download relevant information from Internet to my computer for further use.	SE2, SE3, SE4, SE7, SE9 and SE10 adapted from Internet computer self-efficacy and General computer self-efficacy scales by Marakas, Johnson and Clay (2007).	0.001	0.805	4.225
SE3.	I believe I have the ability to install software tools on my computer for displaying / playing the downloaded educational resources from Internet.	SE5, SE6 and SE8 added new.	-0.071	0.800	4.012
SE4.	I believe I have the ability to subscribe/ register to different websites/ institutions offering OLRs.		0.182	0.909	3.001
SE5.	I believe I have the ability to study comfortably from educational resources in digital/multimedia format.		0.276	0.735	4.303
SE6.	I believe I have the ability to clarify my doubts by communicating with online groups/ forum.		-0.050	0.820	2.699
SE7.	I believe I have the ability to post my comments, completed assignments and quizzes online.		0.162	0.917	3.203
SE8.	I believe I have the ability to learn effectively using OLRs.		0.338	0.826	3.783
SE9.	I believe I have the ability to operate my personal computing devices and configure these for Internet connection.		-0.033	0.840	3.533
SE10.	I believe I have the ability to identify and correct common operational problems with a computing device.		0.18	0.8471	2.945

Notes: Outer loadings of all items were found significant with p values equal to 0.000 (p<0.001) .
Outer weights of only four items: SE1, SE5, SE7 , SE8 and SE10 were found significant with p values 0.017, 0.030, 0.093, 0.000 and 0.053 respectively.

3.3 Data collection

Before data collection, a pilot test was conducted by collecting data from a convenience sample of graduated technical students/professionals (total 114) to check for the reliability and validity of the survey instrument. The psychometric properties of the measurement scales were found within the acceptable range.

A cross-sectional online survey was employed for data collection where participants were asked to respond to queries in a Google form. A total of 457 usable responses were received. The Harman’s single factor test extracted more than one factor with Eigen value greater than one indicating the absence of common method variance (Podsakoff, et al., 2003).

The demographic profile of respondents showed that about 70 percent were male and 30 percent were female. The majority of students were in the age group of 18-23 years (82.5%) and in undergraduate programmes (72%). Approximately 65% students reported using OLRs for less than 10 hours/week thus indicating complementary use of OLRs for their study. Students reported using more than one type (3-4 types) of OLRs resources.

4. Data analysis and results

The partial least squares (PLS)-structural equations modeling (SEM) method was employed in this study for statistical analysis of the data. This is widely adopted by IS researchers (Chin, 1998). Following 2-step analytical approach (Hair, et al., 2014), psychometric assessment of the measurement scales was first conducted and then the structural model was evaluated using SmartPLS version 3.0. The evaluation of the measurement model was performed by assessing the both the reflective and formative measurement models.

4.1 Assessment of reflective measurement

Compatibility, relative advantage, subjective norm, facilitating conditions and intention were the reflectively measured constructs. Composite reliability with values above 0.7 demonstrated high internal consistency of the constructs (Chin, 1998). The convergent validity was assessed by AVE values (all values were greater than 0.5) and outer loading values (Table 1).

Discriminant validity was found satisfactory for all constructs as an inspection of cross loadings showed that each item loaded the highest on its respective construct. The Fornell-Larcker criterion was also checked and found valid.

4.2 Assessment of formative measurement

All indicators of OSE (formative construct) were found to have a VIF value < 5 indicating the absence of collinearity issues. The assessment of 'significance and relevance' of each formative indicator was conducted through examination of its outer weight, outer loading and corresponding *p*-values (Table 3) as per the guidelines of Hair, et al. (2014) and all were found fit to be retained.

4.3 Assessment of structural model

The structural model represents the relationships among constructs in the research model. Collinearity issues between constructs were not present as the VIF values of all the constructs were less than 5. The coefficient of determination (*R*² value) depicts the structural model's predictive accuracy (Hair, et al., 2014) which is 0.707 (Figure 2) for the intention (dependent variable) i.e., the combined effect of the five independent variables can cause 70.7% variation in it.

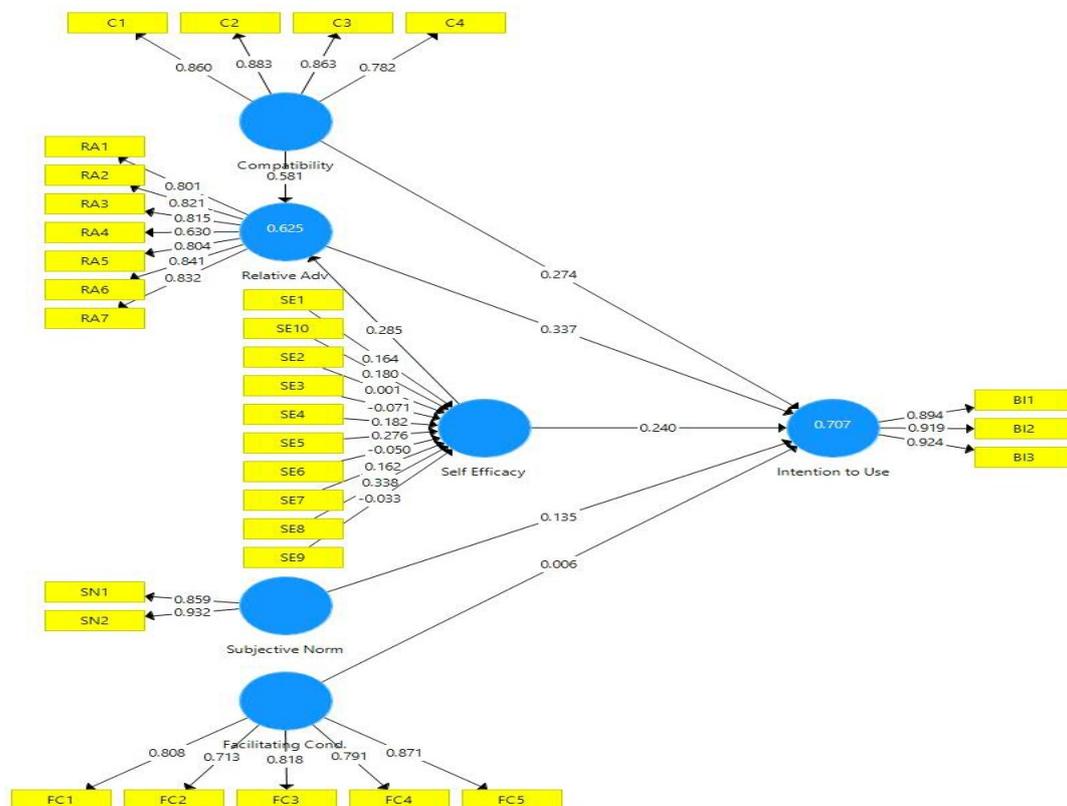


Figure 2: Research model with PLS-SEM results

The t-values of the paths indicated that all but one proposed structural model relationships are significant ($p < 0.001$) Path coefficient of the significant paths Relative advantage->Intention has the largest value (0.337), followed by Compatibility->Intention(0.274), Self-efficacy->Intention(0.240) and Subjective norm->Intention(0.135), in that order. The path Facilitating conditions->Intention is not significant. Relative advantage is impacted significantly by compatibility (0.581) and self-efficacy (0.285), as depicted in Table 4.

Table 4: Hypothesis testing results

Hypothesis	Path	Supported	Path-coefficient	T-statistics
H1	Compatibility->Intention	Yes	0.274	6.048
H2	Relative advantage->Intention	Yes	0.337	6.486
H3	Self-efficacy->Intention	Yes	0.24	6.522
H4	Subjective norm->Intention	Yes	0.135	4.15
H5	Facilitating-Conditions->Intention	No	0.006	0.206
H6	Compatibility->Relative advantage	Yes	0.581	11.381
H7	Self-efficacy->Relative advantage	Yes	0.285	6.129

4.4 Control variables

Demographic variables like gender, departments of engineering course, programmes were checked for correlation with the variables in the research model. As the results were not significant, these control variables were excluded from data analysis (Becker, 2005).

5. Discussion and conclusion

This study aims to investigate factors influencing students’ intention to use OLRs voluntarily, for complementing study in Indian context. The extended IDT research model consists of five salient factors, namely compatibility, relative advantage, OSE, subjective norm and FCs, drawn from the technology acceptance theories in IS literature. The data analysis results reveal high predictive accuracy of the model and six out of seven hypotheses are supported. The growing use of OLRs for complementing learning among Indian technical students is primarily attributed to the abundant availability of quality OLRs resources, India’s initiatives to promote OLRs in HE, and the factors examined in this study. The results confirm that IDT variables: relative advantage and compatibility are the two most influential factors for acceptance of OLRs, which is well corroborated by previous studies (Agarwal and Prasad, 1997; Kim and Ammeter, 2014) on innovation acceptance. The use of OLRs is considered compatible with prior learning experience and values by tech savvy students who also responded that OLRs made learning easier and improved the productivity and performance of their tasks. Compatibility significantly influences relative advantage which is consistent with the previous findings (Tung, et al., 2008; Lee, et al., 2011). The significant effect of self-efficacy on intention is well supported by prior research findings (Ong, et al., 2004; Chen, 2014) in the eLearning domain but the results revealing indirect effect of OSE through relative advantage on intention has rarely been empirically examined before; although the effects of self-efficacy are examined on outcome expectations (Chen, 2014) and on perceived usefulness (Shih and Huang, 2009). Subjective norm found significantly impacting intention (discussed in section 5.1).

The results revealing the insignificant impact of facilitating conditions is surprising in the context of this study, as in India, a developing country, access to fast internet and the availability of low cost computing environment anytime anywhere is still constraining for students. The availability of suitable facilitating conditions should have a positive impact on intention as found in past studies (Venkatesh, et al., 2003; Wang, et al., 2007) too. A few respondents were questioned on this issue, and based on their responses, the following plausible reasons are identified: i) the students arrange for internet facility personally through telecom service providers (e.g. by purchasing dongle) if the facility is not satisfactory in campus, ii) students often download the entire relevant course once and share with friends or on institutes’ LAN for reading offline. This may have affected their responses on facilitating conditions making its effect insignificant.

5.1 Implications for theory and research

As compared to many studies on formal online-learning in IS literature, research on voluntary/informal learning behaviour using OLRs is not fully examined from the perspective of students especially in developing

countries contexts. We extend online-learning research by conducting this empirical study on voluntary acceptance of OLRs for complementing study from the perspective of students in a developing country. This is also the first empirical research on acceptance of OLRs in India. In the following texts, we discuss some important implications of this study.

5.1.1 IDT validation

This study empirically validates IDT theory of Rogers (2003) in the context of OLRs acceptance by students in India. In confirmation with prior studies, relative advantage and compatibility are revealed as the top influencing factors for acceptance of the OLRs, the innovations in education delivery. The integrated IDT model shows a better conceptualisation of the phenomenon with higher predictive capability.

5.1.2 OSE measurement

Although, OLRs has seen extensive acceptance in teaching and learning in recent years, no effort has been undertaken to measure self-efficacy of contemporary learners and this gap could affect both online-learning theory and practice. Extant IS literature has mostly adapted CSE scale by Compeau and Higgins (1995), however the scale only measures the operational abilities to accomplish tasks which may not assess OSE correctly given that a tech-savvy learner may feel cognitive load and metacognitive disorientation in unstructured hypermedia environment (Schwartz, et al., 2004; Kalyuga, 2007). Our study substantiates this aspect during the item generation process for OSE measurement and accordingly, incorporates items for assessing on-screen learning capabilities. Thus, our study provides an improved measurement of OSE and contributes to theories and research on the subject.

5.1.3 Indirect effect of OSE on intention through relative advantage

Bandura (2004) posits that self-efficacy impacts behaviour directly as well as through impact of other independent variables (outcome expectations, benefits etc.). Although, theoretically relation between OSE and relative advantage seems obvious but it has seldom been examined empirically explicitly. This study contributes to research in technology acceptance by linking these two constructs and empirically testing the indirect effect of OSE on intention through relative advantage.

5.1.4 Impact of subjective norm on intention

The findings of significant impacts of subjective norm on the intention to use OLRs voluntarily by respondents, experienced in OLRs is inconsistent with many prior studies, which either reported insignificant impacts or significant results only for initial and mandatory mode of technology use (see 'Subjective norm' in section 2)). A possible explanation for this discrepancy may be the influence of culture (collectivism/individualism) on the subjective norm of the respondents. The relations between student-student and student-teacher in collectivistic culture are harmonious, least contradictory and students respect their teacher (Hofstede, 1986). This study confirms that cultural factors play an important role on the influence of subjective norm on intention in the Indian context.

5.2 Practical implication

This study has some practical implications for policy makers, institutions and teachers, especially in a developing country and also for OLRs course providers. The HE policy makers and institutions in developing country should note that the findings of this study for framing policy and providing compatible learning environment for tech-savvy students. To ensure maximum benefit and utility to learners, OLRs course providers/designers should incorporate a user-friendly interface with graphics and examples, keeping in mind that students in traditional academics like to use OLRs only when it is found relatively advantageous than other alternatives in hand (e.g. reading textbooks). Consistency of students' syllabus with OLRs can increase its use which offers implications for teachers of HE in a developing country. OSE being a major factor of OLRs acceptance, educators can use the instrument provided in this study to assess self-efficacy and to promote learners' acceptance of OLRs.

5.3 Limitations and future research

We employed a cross-sectional survey with self-report measure which implies that the study cannot substantiate for causal relations and the absence of common method variance from the result. The participants of this study were technical students in India; hence generalization of the result to the other types of learners and in dissimilar economies might need adaptations.

In this study, OLRs represent multiple open online-learning resources and the students responded using on average 3-4 types these resources. Although, understanding how various online resources are used by a student for learning is beyond the scope of this study, researchers call for study on incremental innovation adoption (Bhattacharjee, et al., 2012) with availability of multiple competitive technological products. Hence, future studies should focus on the supply-side effects of learning technology on learners. Similar studies can be repeated with the validated instrument of this study across comparable economies to verify the generalisability of the findings.

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