Experiencing e-assessment during COVID-19: an analysis of Indian students' perception

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Abstract

Purpose – Presently the whole world has been experiencing a pandemic threat of coronavirus disease 2019 (COVID-19) and at the same time facing unprecedented changes in everything including education. E-learning has evolved as the only alternative of knowledge transmission even in third world nations, and e-assessment has been playing an increasingly important role in this digital transformation of education. But how far and of what depth it has made its place among students' minds need to be studied to leverage its full potential to transform students' learning needs. This study reports an investigation made in this direction.

Design/methodology/approach – An online survey consisting of 40 questions in Google Forms was conducted to collect primary data on students' perception of e-assessment among 200 Indian students pursuing higher education from several geographical locations. The quantitative methodological approach was followed. The data were analyzed descriptively and inferentially.

Findings – The results were analyzed based on the model of acceptance and usage of e-assessment (MAUE), and findings revealed that students' overall perception toward e-assessment was of moderate level and this perception varies depending on their gender, academic level, nature of the stream of study and their economic condition. Of the eight domains investigated, students showed better perception in the perceived usefulness, perceived ease of use, compatibility, subjective norms and self-efficacy domains, while they cut a sorry figure in domains like awareness, resource facilitation and information technology (IT) support. It became evident from their responses that COVID was instrumental in enhancing their interest in e-assessment.

Social implications – The implication of this study lies in strengthening e-assessment by attending to the factors as noted in the MAUE in India and alike developing nations having huge space left for e-learning to reach a boom.

Originality/value – This is an empirical investigation conducted in India on the state of students' perception of the e-assessment in the backdrop of the COVID-19 outbreak. To do this work, the authors conducted online surveys, and the write-up of the findings focus on the survey data only.

Keywords E-assessment, Paper-pen assessment, Higher education, ICT, India

Paper type Research paper

Introduction

John Dewey (1997) once said mankind likes to think in terms of extreme opposites during formulating his/her beliefs. Kucey and Parsons (2012) said the pendulum of educational

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Conflict of interest: The authors hereby declare that there have no conflicts of interest.

The authors hereby declare that every ethical measure was paid due respect and maintained with utmost dignity during making this study. Authors cordially acknowledge the voluntary contribution of all those 200 students who accepted the call and came out to reveal their perceptions on e-assessment. Moreover, the authors avouch hereby that no monetary funding from any source was availed in course of this research project.

philosophy has been vacillating backward and forward between traditional and progressive, between novel and ancient, and between radical and conservative. New theories arrive replacing the old ones, and then they get replaced by another new one. This is a universal cyclical process. E-assessment is one such progressive entry into the hegemony of paper-pencil mode of conservative assessments. Technological developments and their simultaneous penetration in the educational process in the 21st century have made this a novel way of evaluating student learning and providing feedback (Kundu, 2018a; Kundu *et al.*, 2020). “E-Assessment” is the use of digital technologies to create, dispense, evaluate and deliver feedback for formative, summative, diagnostic or self-assessment (Kocdar *et al.* (2018). This can deliver a greater variety of assessments seizing a wider range of skills and attributes that are not straightforwardly assessed in traditional methods (De Villiers *et al.*, 2016). E-assessment, alternatively known as electronic assessment, computer-based assessment, digital assessment or online assessment, is the use of information and communication technology (ICT) in the assessment (Electronic Assessment, 2020, 3rd July). Osuji (2012) said e-assessment could be hypothesized as the use of ICTs to facilitate the entire assessment process, from the designing and delivering of assignments to marking, reporting, storing the results and/or making statistical analysis. Crisp (2011) used the term e-assessment to refer to all the assessment tasks conducted through a computer, a digital tool and/or the web. Advancement of technology and e-learning systems has put e-assessment on high demand (Brink and Lautenbach, 2011). Kuh *et al.* (2014) said few higher-level cognitive or affective skills are very difficult to assess using traditional selected-response formats, which necessitates the use of e-assessments as an alternative. Whitelock (2009) said e-assessment is a new assessment paradigm and methodology that has been playing a progressively important role in the transformation of higher education. UNESCO (2020) also recommended the use of ICT in delivering traditional assessment formats more effectively and efficiently to measure the latest and soft nuances of modern competencies.

The organizational use of technology changes the roles and relationships for teachers and students (Kundu, 2018b). Still, planning efficient e-assessment techniques at the university level has become a matter of concern where students are a major stakeholder (Davidson and McKenzie, 2009). In this context, their perception, attitude and alertness are major determiners behind an effective culture of e-assessment to flourish (Sorensen, 2013). Jordan (2011) has specifically highlighted the importance of considering and evaluating students’ perceptions of e-assessment in several domains like awareness, ability, security, validity, teaching-learning, etc. Besides, Dermo (2009) found that while there is a profusion of research on teachers’ awareness and attitudes toward e-assessments, there is very little on students’ views toward them. Hardly, there is a study amidst this coronavirus disease 2019 (COVID-19), an instance of human helplessness fronting an enormous natural disaster bringing online education and e-assessment into limelight immense popularity (Kundu and Bej, 2021). The practice is altogether new and a honeymoon period for the majority of Indian students. The current investigation targeted this research gap to delve deep into the students’ perception of acceptance and awareness of e-assessment. The specific research questions set for this study were:

- (1) How was the Indian higher education students’ perception of e-assessment?
- (2) How far students were apprised of the e-assessment mechanism?
- (3) How far COVID has influenced students’ perception level of e-assessment?
- (4) Did the perception of e-assessment vary depending on students’ gender, academic grades, stream of study and economic condition?

E-assessment

Long ago Rowntree (1987) said an institution is known by its assessment policies and practices that influence havoc on students’ activities and achievements. Boud (1995) said

students can face poor teaching, but they cannot face the aftereffects of poor assessment. Thus, assessment is unavoidable in the learning process through which students demonstrate and apprise their abilities and prepare fields for necessary support for further progress (Amelung *et al.*, 2011; Gikandi *et al.*, 2011). Brink and Lautenbach (2011) have defined assessment as a vital process of collecting and interpreting information from students by teachers with the final goal of assigning a grade to them. Its potential is unquestionable in the fields of both assessing students' progress and certifying their progress (Lafuente *et al.*, 2014; Clements and Cord, 2013).

With the introduction of World Wide Web in the 1990s, a drastic change took place across the globe in several sectors, and the education sector was no exception (Kundu, 2020b). Alruwais *et al.* (2018) said ICT has been a blessing, a vital backing for education in a long time since the time of Sidney Leavitt Pressey when he designed a mechanical machine for automatic testing. Following this line of research, the latest addition is the e-assessment which means using the ICT to manage and deliver assessment in every form – diagnostic, summative or formative (Howarth, 2015). Crisp (2011) has defined e-assessment as a unique process of recording students' responses and providing feedback. Cook and Jenkins (2010) reported e-assessment as “end-to-end electronic assessment processes” where “ICTs are used for the presentation of assessment activity and the recording of responses” (p. 34). This means that ICTs are absolute necessities for e-assessment making it a part of the e-learning process opposed to the traditional ways of assessing students' progress (Howarth, 2015). Several studies have conducted wide research on the principles pertaining to e-assessment. Brink and Lautenbach (2011) said it needs to be authentic, consistent, transparent, having accurate and practical supporting system. Baartman *et al.* (2007) claimed it to be challenging, reflecting real world situations and depicting the skills needed in real life. Tinoca (2012) stressed on the practicability or feasibility of it since e-assessment requires numerous resources like time, cost, training, equipment, expertise, apposite attitude, etc.

Advantages of e-assessment

ICTs have brought the globe in a room and made functioning easy and faster (Kundu, 2020a). Similarly, e-assessment has made assessment developed, accurate and faster compared to traditional time-taking paper-based measures (Hillier, 2014; Stodberg, 2012; De Villiers *et al.*, 2016). Several studies reported many advantages of e-assessment, such as providing more accessible, flexible, efficient and convenient assessment experiences for learners, teachers and institutions (Attia, 2014; Sorensen, 2013; Pedersen *et al.*, 2012; De Villiers *et al.*, 2016; Crisp *et al.*, 2016); being fast and easy to use (Eljinini and Alsamarai, 2012); providing students more control, friendly interfaces and recreational experiences (Ridgway *et al.*, 2004; Way, 2010; Williams and Wong, 2009); providing immediate feedback compared with paper-based test that improves the learning level (Gilbert *et al.*, 2011; Way, 2010); increasing the students' motivation to enhance their performance (study in University of Winchester) (Gilbert *et al.*, 2011); saving teachers' time (Gilbert *et al.*, 2011; Ridgway *et al.*, 2004; Eljinini and Alsamarai, 2012; Sorensen, 2013; Gikandi *et al.*, 2011); adding more value to students' learning (Sorensen, 2013); saving valuable time for the institutions (Gilbert *et al.*, 2011; Ridgway *et al.*, 2004; Way, 2010; Donovan *et al.*, 2007; Sorensen, 2013; Gikandi *et al.*, 2011); easing tracking students' performance (Ellaway and Masters, 2008); making assessment fast and accurate (Ridgway *et al.*, 2004; Way, 2010); reducing the teachers' burden to assess large number of students (Nicol, 2007); helping teachers to improve the quality of feedback for the students (Ridgway *et al.*, 2004; Way, 2010); adding a higher level of security to assessment procedures (Sorensen, 2013); and finally supporting high-order thinking skills such as critiquing, reflection on cognitive processes and facilitating group work projects (Ridgway *et al.*, 2004).

Disadvantages of e-assessment

However, despite having many advantages, e-assessment is not completely free from disadvantages that curb its wide application and acceptance (Bacigalupo *et al.*, 2010). Several past studies pointed out disadvantages. Isaías and Issa (2013) talked about the lack of institutional commitment that most institutions have; Whitelock and Brasher (2006) pointed out the lack of confidence among students and teachers mainly due to their lack of computer efficacy; Bacigalupo *et al.* (2010) found the lack of students' motivation as a disadvantage, and Redecker *et al.* (2012) found teachers' doubt on its effectivity and unbiasedness as a disadvantage. Mason (2014) made a very significant point when he said computer distraction is a disadvantage for e-assessment affecting the students' achievement as whole. Whitelock (2009) found the lack of feedback as a potential disadvantage. Kocdar *et al.* (2018) found certain challenges pertaining to students' verification, authorship and authentication participating in e-assessment, and Xu and Mahenthiran (2016) found cheating and plagiarism as a grave concern associated with e-assessment compared to traditional paper-based assessment. Several other studies also advocated that cheating and plagiarism are easier and more frequent in e-assessment (Pedersen *et al.*, 2012; Kocdar *et al.*, 2018; Bartley, 2005; Rowe, 2004; Gathuri *et al.*, 2014; Mellar *et al.*, 2018; Hillier, 2014; Kocdar *et al.*, 2018). Apampa *et al.* (2011), Bartley (2005) and Mellar *et al.* (2018) categorize cheating and plagiarism in e-assessment like impersonation, taking materials into exams, looking at others' answers and ghostwriting. Kocdar *et al.* (2018) and Dermo (2009) unequivocally said such forms of malpractices undoubtedly affect the validity and reliability of the e-assessments.

Context analysis

India has been watching the success of the West in adopting e-learning which allows students and teachers to learn on their terms and is trying hard to accommodate it to achieve the target of making education accessible to every corner of the country (Kundu and Dey, 2018). The country is all set to transform India into a digitally empowered knowledge society, and in this direction, several initiatives have been taken to integrate ICT from the school curriculum to the higher education curriculum (Kundu, 2018b). Currently, India's higher education system is the largest in the world enrolling 37.4 million students, and in the last few years, the gross enrollment ratio (GER) has increased from 25.8 in 2017–18 to 26.3 in 2018–19 (Nanda, 2019). Taking 2017–18 as a reference year, the GER in higher education of the US is the highest at 88.2%, followed by Germany (70.3%), France (65.6%), UK (60.6%), Brazil (51.3%), China (49.1%), Indonesia (36.4%) and India (25.8% in 2017–18, 26.3% in 2018–19), and the country is ambitious to raise the GER 50% by 2035 through its much-anticipated National Education Policy 2020 (Sharma, 2020, 15th June). The new competence-based curriculum introduced in the National Education Policy (NPE, 2020) has included competencies such as collaboration, problem-solving, critical thinking, creativity and communication, as well as subject knowledge and skills (Kundu *et al.*, 2020). Renewed interest has been put on online education that has been getting traction across the country mandatorily will follow e-assessment (KPMG, 2017). In the meantime, the COVID pandemic outbreak and eventual country-wide lockdown since 16th March 2020 have pushed millions of students out of institutional education (Sanyal, 2020) and despite having a deep digital divide (NSS, 2018) have brought online learning and assessment to vast popularity. COVID, a threat to the conventional idea of classroom education, is an awaking call to all concerned that online learning is the only option left during pandemic devastation and it has inspired corporates, governments and policymakers to resort to having alternative backup emergency management plans by reducing the digital divide to deliver education online during periods of school closures (Kundu and Bej, 2021). Most of the schools, colleges and universities are in touch with their students over WhatsApp or email, are conducting classes

on platforms such as Google Meet, Microsoft Teams, Zoom, etc. and are planning to begin incorporating online exams as well (Time, 2020). All nation-wide “Mega Exams” are also being held online owing to lockdown and social distancing (Choudhary, 2020). The situation has made online education and e-assessment a mandatory requirement pushing all hesitations and taboos against e-revolution behind. A positive attitude of students and teachers enable e-learning and e-assessment more successful in improving the student performance (Attia, 2014; Sorensen, 2013). Several past studies assessed students’ opinions about e-assessment but most of them belong to Western countries. For example, Donovan *et al.* (2007) found 88.4% of students prefer e-assessment, Gilbert *et al.* (2011) found 92% of the students approved that e-assessment helped their learning. A similar study in the Indian context is a rarity. In this backdrop it is pertinent to assess students’ perception on e-assessment, their responses of awareness, ability, acceptability, benefits and complications in implementing this new assessment method to make the process smooth, enhanced and student-centered.

Theoretical framework

Isaías *et al.* (2014) said digital technologies allow the construction of a virtual environment of learning where the possibility of interaction and communication is encouraged. But, King and Boyatt (2014) said effective online learning requires strategic leadership, pedagogical and technical support, and awareness of new responsibilities for both teachers and students. Hence, in this study, we adopted the “model of acceptance and usage of e-assessment (MAUE)” (see Figure 1) developed by Sadaf *et al.* (2012) based on the technology acceptance model (TAM) developed by Davis (1985) to examine the acceptance and utilization of e-assessment by academics. The TAM shows that people’s attitude and intention to use the technology are essential for its effective use. The MAUE divided the inducing factors into three broad determinants: attitude, subjective norm and perceived behavioral control. Attitude is further divided into three sub-factors – perceived usefulness, perceived ease of use and compatibility. Subjective norm addresses the impact of social influences like peer influence or supervisors’ influence. Perceived behavioral control means people’s perception of the ease or difficulty of performing the behavior of interest which is further divided into sub-factors like self-efficacy, resource facilitating conditions and the system of information technology (IT) support. This study investigated several issues regarding students’ perceived ease of use like awareness, affective attachment, ability, validity, practicality, security and academic utility.

Methods of investigation

This study followed a descriptive quantitative methodological approach to assess the extent to which e-assessment is adopted among Indian students and the domains that affect students’ perception regarding its adoption. This study used an online survey designed to collect relevant information since Creswell (2008) said surveys are always suitable strategies of inquiry within quantitative approaches. An online survey was used owing to the COVID outbreak and prolonged lockdown in educational institutions with strict social distancing measures. Besides, it is a time-saving, easy, effective and cost-effective method with the potential to reach geographically dispersed large sections of participants to obtain data, and it ensures the anonymity of the respondents (Wright, 2005).

Sites and participants

The target audience was higher education students from all over India in order to get a holistic picture of the e-assessment scenario in higher education. To collect the necessary data

Source(s): In Sadaf *et al.*, 2012

Figure 1.
The model of
acceptance and usage
of e-assessment

for the investigation, a survey questionnaire was framed in Google Forms that has become a popular survey administration app encouraging paperless research work. The survey was disseminated among 200 higher education students pursuing several bachelor's or master's stream of studies under different universities belonging to different genders, four different streams of studies (humanities, social science, science and law), economic backgrounds and geographical regions and was translated in five different regional languages besides English. The participants were selected via a sample of convenience. Details of the demographic data of the participants are presented in [Table 1](#).

Research tools

Online questionnaire

Researchers developed a questionnaire having 40 question items (see [Appendix I](#)) to measure students' perception of e-assessment in eight different domains – awareness domain (item no. 1–5), perceived usefulness domain (item no. 6–10), perceived ease of use domain (item no.

Table 1.
Demographic details of
the study participants

Demographic	Frequency(N)	Percentage (%)
<i>Gender</i>		
Male	140	70
Female	60	30
<i>Academic qualification</i>		
Graduate	105	47.5
Postgraduate	95	42.5
<i>Stream of study</i>		
Humanities	61	30.5
Social science	59	29.5
Science	42	21
Law	38	19
<i>Family economic condition (yearly income in Indian rupees)</i>		
<1 lakh	22	11
1–3 lakh	130	65
>3lakh	48	24

11–15), compatibility domain (item no. 16–20), peer influence and superior influence (item no. 21–25), self-efficacy domain (item no. 26–30), resource facilitation domain (item no. 31–35) and IT support domain (item no. 36–40), covering all important factors as proposed in the MAUE model adopted as a conceptual framework for this study. The overall measured internal consistency (Cronbach’s α) was 0.95, and the domain-wise internal consistencies were 0.86, 0.85, 0.78, 0.92, 0.85, 0.88, 0.91 and 0.89, respectively. Cronbach’s alpha is a coefficient that describes how well a group of items focuses on a single idea or construct (Cronbach, 1951). A five-point Likert scale was employed to measure participants’ level of perception on each question, with higher scores indicating better and positive perception toward e-assessment. Reverse scoring was done for negatively worded question items (for item no. 11, 12, 13, 14, 15, 32, 34 and 35). The questionnaire was converted to the digital Google Forms platform and sent to the participants. The mean scores and SD of total and each e-assessment domain were summarized separately.

Data collection

The questionnaires were available to the participants for completion for about one month, from March 30 to April 30. A pilot version of the online surveys was initially administered to a limited number of respondents with different characteristics to establish the effectiveness of the designed tools. Testing the survey design helped ensure that the used terms were easily perceived, as well as to check for validity (i.e. the items were asking what we wanted to learn) and consistency. Member checking was also used to check the accuracy of the data collected. All 200 responses were collected and considered for data analysis.

Data analysis

Data were analyzed in accordance with each research approach, and the results were presented in several tables. Descriptive as well as inferential statistics were applied and the data analysis was steered on SPSS-22 (Statistical Package for the Social Sciences). The benefit of its use is that it is conceivable to register and analyze data in a variety of ways at an inordinate speed (Bryman and Cramer, 2011). The analysis of the data comprised descriptive statistical analysis, factorial analysis, *t*-tests and one-way ANOVA tests.

Results

The data were analyzed holistically and for eight different domains as well relating to students' perception of e-assessment, and the results are presented in Table 2 that shows students' overall perception toward e-assessment ($M = 117.4$, $SD = 9.06$) is moderately high. Factorial analysis of the scores reveals that the awareness domain ($M = 10.5$, $SD = 5.11$) has the lowest mean score followed by the perceived usefulness domain (12.22, $SD = 4.02$), IT support domain ($M = 13.32$, $SD = 4.88$), resource facilitation domain ($M = 13.69$, $SD = 5.11$), perceived ease of use domain ($M = 20.11$, $SD = 4.53$), compatibility domain ($M = 22.76$, $SD = 5.24$), peer influence and superior influence domain ($M = 21.87$, $SD = 4.64$), and the self-efficacy domain ($M = 23.56$, $SD = 5.54$) has the highest score.

The frequency distribution of the scores in Figure 2 shows a positive skewness ($S_{kp} = 0.5$) that indicates that the distribution is fairly symmetrical or moderately skewed, meaning the mean score is moderately higher than the median score and mode which indicates that maximum scores are of average level, meaning maximum students have an average level of perception toward e-assessment.

Table 3 presents the differences of perception among different demographic variables which shows boys ($M = 109.6$, $SD = 4.98$) hold better perception than girls ($M = 101.3$,

Table 2.
Primary factor
loadings, means and
standard deviations
perception
scores ($N = 200$)

Factors	Mean(M)	Std. deviation (SD)	Primary factor loadings
a Awareness domain	10.5	5.11	0.59
b Perceived usefulness domain	12.22	4.02	0.65
c Perceived ease of use domain	20.11	4.53	0.83
d Compatibility domain	22.76	5.24	0.87
e Peer influence and superior influence	21.87	4.69	0.85
f Self-efficacy domain	23.56	5.54	0.91
g Resource facilitation domain	13.69	5.11	0.71
h IT support domain	13.32	5.11	0.69
Overall perception	104.9	5.54

Figure 2.
Frequency analysis of
perception
scores ($N = 200$)

Table 3.
Differences of
perception among
demographic variables

Demographic variable	Mean	Std. Deviation
<i>Gender</i>		
Boys	109.6	4.98
Girls	101.3	5.18
<i>Academic qualification</i>		
Graduate	102.54	5.87
Postgraduate	113.21	4.54
<i>Stream of study</i>		
Humanities	99.98	5.77
Social science	104.77	5.54
Science	117.23	5.21
Law	109.61	5.19
<i>Family economic condition (yearly income in Indian rupees)</i>		
<1 lakh	105.76	5.11
1–5 lakh	109.31	5.65
>5 lakh	112.8	5.24

SD = 5.18), postgraduate students ($M = 113.21$, $SD = 4.54$) also hold a better perception than graduate students ($M = 102.54$, $SD = 5.87$); expectedly students reading science ($M = 117.23$, $SD = 5.21$) show the highest perception followed by students reading law ($M = 109.61$, $SD = 5.19$), social science ($M = 104.77$, $SD = 5.54$) and humanities ($M = 99.98$, $SD = 5.77$). The difference in perception among several economic condition groups of students is also notable: the students having average annual income more than 5 lakh show the highest perception ($M = 112.8$, $SD = 5.24$) followed by the group having family income 1–5 lakh (109.31, $SD = 5.65$) and the group having family income below 1 lakh ($M = 105.76$, $SD = 5.11$).

The t -test result in Table 4 shows that the difference of perception between boys and girls is statistically significant ($t = 2.39$, $p = 0.009 < 0.05$) which means this difference is not attributed to chance; rather, there are significant reasons behind this though the reasons were not investigated in this study. The t -test result in Table 5 shows that the differences in perception between graduate and postgraduate students is also statistically significant ($t = 3.61$, $p = 0.002 < 0.05$).

The ANOVA and post hoc analysis results in Table 6 show that the difference of perception among students of four different streams of studies is also statistically significant

Table 4.
 t -test results
comparing differences
in perception between
boys and girls

	N	Mean	SD	t -cal	t -crit	df	p	Decision
Boys	140	109.6	4.98	2.39	1.65	124	0.009*	Reject
Girls	60	101.3	5.18					

Note(s): $p = 0.009 < 0.05$

Table 5.
 t -test results
comparing differences
in perception between
graduate and
postgraduate students

	N	Mean	SD	t -cal	t -crit	df	p	Decision
Graduates	105	102.54	5.87	3.61	2.97	193	0.002*	Reject
Postgraduates	95	113.21	4.54					

Note(s): $p = 0.002 < 0.05$

Table 6.
ANOVA and post hoc
analysis results
comparing differences
in perception among
students of different
streams

ANOVA					
	Sum of squares	df	Mean square	Calculated F	Sig.(p)
Between groups	38.85	3	3112.95	0.36	0.019*
Within groups	5673.64	192	23.62		

Post hoc test			
I (stream)	J (stream)	Mean difference (I-J)	Sig
Humanities	Social science	3.70000*	0.002
	Science	3.90000*	0.014
	Law	2.70000	0.674
Social science	Humanities	3.70000*	0.002
	Science	-4.10000*	0.009
	Law	-3.50000*	0.001
Science	Humanities	3.90000*	0.014
	Social science	-4.10000*	0.889
	Law	0.60000	0.664
Law	Humanities	2.70000	0.674
	Social science	-3.50000*	0.001
	Science	0.60000	0.664

Note(s): $p = 0.019 < 0.05$ **Note(s):** * The mean difference is at the 0.05 level

($F = 0.36, p = 0.019 < 0.05$). The ANOVA and post hoc analysis results in [Table 7](#) show that the difference of perception among students of three different economic groups is also statistically significant ($F = 0.82, p = 0.004 < 0.05$).

Discussion

Students' overall perception of e-assessment

The findings of this survey revealed that Indian higher education students' overall perception of e-assessment was of moderate level or slightly lower than medium level. They

Table 7.
ANOVA and post hoc
analysis of results
comparing differences
in perception among
students of different
economic backgrounds

ANOVA					
	Sum of squares	df	Mean square	Calculated F	Sig.(p)
Between groups	49.7	2	24.19	0.82	0.004*
Within groups	5842.1	194	30.11		

Post hoc test			
I (FIC)	J (FIC)	Mean difference (I-J)	Sig
<1 Lakh	1-3 Lakh	4.60000*	0.036
	>3Lakh	4.80000*	0.024
1-3 Lakh	<1 Lakh	-4.60000*	0.036
	>3Lakh	0.30000	0.889
>3Lakh	<1 Lakh	-4.80000*	0.024
	1-3 Lakh	-0.30000	0.889

Note(s): $p = 0.004 < 0.05$, FIC – Family income condition

* The mean difference is at the 0.05 level

felt it could be better for them in many directions though they were found dubious mainly due to their lack of confidence in computer skills. More importantly, students showed better perception in the domains like self-efficacy, subjective norms, capability domains or in perceived ease of use, but they figured low in domains like awareness, perceived usefulness, IT support or resource facilitation. Majority of students felt stress in using computer during examinations, and they felt a lack of concentration during online exams, a potential disadvantage of e-assessment as pointed out in [Whitlock and Brasher \(2006\)](#). Hence, they prefer traditional paper–pen mode more over e-assessment. But they were found having a strong belief in the validity, practicality, security and teaching–learning potential of e-assessment which they believed could do good to their learning and upcoming career. The most appealing thing about e-assessment is its being free from human errors which makes it more reliable to the students positively affecting its perceived ease of use and efficacy. The students feel more secure about their grades online. It provides feedback to the students and helps them to understand their actual progress. Students also showed good perception in peer influence, an important factor in the MAUE ([Sadaf et al. 2012](#)). Most of the students believed e-assessment could add value to their learning which agrees with the study of [Sorensen \(2013\)](#) who said that students feel e-assessment plays a role in higher education in adding value to their learning. Majority of students (60%) believed online marking was more accurate because they do not suffer from human error, still a considerable number of students (40%) were found who were critical of the online multiple-choice question and the effectiveness of this type of examination. Significantly, students accept with a vast majority (88%) that the COVID pandemic was a positive catalyst compelling students and institutions to resort to e-learning and e-assessments. The question remains in their minds about safety issues as well. The devices that are used in this process, using those for a long time can harm health. But these technological devices are used in the other daily works as well. So, the supporters of it can raise the point that we cannot live our lives without technology anyway. Also, e-assessment has to be technically problem free to be more effective. Only 20% students agreed on the issue that in e-assessment there is less scope to adopt malpractices than to do so in paper-based assessments, meaning they were sensitive toward security and integrity issues associated with e-assessment as claimed as a potent disadvantage in several past studies like [Mellar et al. \(2018\)](#), [Hillier \(2014\)](#), [Kocdar et al. \(2018\)](#).

Impacts of e-assessment were found influencing students differently according to their gender, academic level, stream of study and economic condition. Boys were found having better perception than girls, postgraduates were found having better perception than graduate students, students of science and law streams of studies were found having better perception than the students of social science and humanities, and students from stronger economic background had better perception than students of lower economic background which agree with the findings of [NSS \(2018\)](#), and [Kundu and Bej \(2021\)](#) supporting deep digital divide and an unequal distribution of e-resources among different social strata.

Students' appraisal level of e-assessment

This investigation found that students' level of awareness regarding e-assessment system is not sufficiently high as evident from the low scores in the awareness domain (see [Table 2](#)). A deep analysis of the responses showed that 81% students agreed that their awareness of e-assessment is limited, 78% students agreed that they did not know pros and cons of it, and 81% disagreed that they had been provided regular information on e-assessment by their colleges/universities. This finding is also indicative of low adoption level of e-assessment in the Indian higher education system. This poor appraisal level has been negatively affecting students' perceived usefulness domain, and these were basically the results of poor

perception in the IT support domain and the resource facilitation domain. Majority of students (77%) agreed that their computer skill is not adequate for e-assessment and notably 85% students found not having a computer for personal use at home.

Students' low perception in awareness and IT skill has been producing in them stress and fear, making them feel uncomfortable with the online examinations, and it can make it hard to concentrate as it is a new system; still, they are welcoming e-assessment in higher education as evident from their responses. Majority of students believe e-assessment is effective in making them future ready for a bright career; it is easy and time saving; it will terminate the favoritisms and will add value to their learning. They are hopeful that e-assessment will get popularity with the increased dissemination of e-learning. Thus, the acceptability of e-assessment among Indian higher education students is of medium level where they think it to be good for their future; still, they felt stress and hopelessness due to their inability in overcoming their weakness in computer operation.

Coronavirus disease 2019 effects on students' perception level

It is obvious that the COVID pandemic has a far-fetching effect on the global academic arena as well as in India (Kundu and Bej, 2021), and this investigation also endorses the authors' claims that COVID was instrumental in bringing positive changes among academics to accept e-learning and e-assessment. The COVID compulsions were really effective in making online education productive with an instant result. Surprisingly 95% students strongly said COVID compelled them to make themselves adopt e-assessment. Besides it was effective to put a positive peer influence on students that was inspirational for them to adopt e-assessment with a positive note. This COVID was found as a good sub-factor to influence the subjective norm factor for e-assessment. This high perception among students regarding e-assessment may be due to this unprecedented time of the pandemic, and this may be deduced from the majority of students' (88%) strongly agree response found on the question that in normal time I used to at ease with the paper-pencil mode of assessment with.

Perceptual differences among demographic variables

The investigation revealed students' perception of e-assessment vary significantly depending on students' gender, academic grades, stream of study and economic condition. Boys showed better perception than girls, and this difference was found statistically significant. Several reasons may be attributed to this difference, like historical Indian inequalities based on gender and caste (Desai *et al.*, 2010), the orthodox mindset that thinks educating a female child is a bad investment because she is bound to get married and leave her paternal home one day (Gender inequality in India, 2017), gender acting as an influencing factor in technology adoption as men are claimed to be more technologically adept compared to women (Goswami and Dutta, 2016), women having a less positive attitude toward computers in general (Tondeur *et al.*, 2016), there remaining a gender difference in the place of use of computers in India (Basavaraja and Sampath, 2017).

Perception varies depending on students' stream of studies as well. Science students felt themselves more comfortable with e-assessment than students of law, humanities or social science. This difference was also found statistically significant that supports the observation of O'Brien and Marakas (2009), Zwass (2019), and Verhoeven *et al.* (2020) that students who are interested in scientific research and/or want to become researchers will be more open to mastering ICT skills and/or will make greater use of computers and the Internet for their studies than other students will.

A significant difference of perception was also observed among students belonging to several economic groups, and a positive correlation between economic health and students'

perception of e-assessment was simply noted as the students' perception was found to decrease with the decrease of their economic condition though statistical significance of this finding was not investigated in this study. Though the reasons were not investigated in this study, it may be assumed that students from strong economic background enjoy good environment for their study that help them to be efficient in digital equipment as well which is not the case with the poor students who do not have a computer and who first saw a computer in their college laboratory. This finding echo the study of [Gustafsson *et al.* \(2018\)](#) and [Thomson \(2018\)](#) that reported the positive correlation between socioeconomic status and academic achievement. Several studies (e. g. [Scheerder *et al.*, 2017](#); [Desjardins and Ederer, 2015](#); [Fraillon *et al.*, 2014](#); [Hohlfeld *et al.*, 2013](#); [Hatlevik and Cristophersen, 2013](#); [Senkbeil *et al.*, 2013](#)) have categorically mentioned that socioeconomic status of a student has a positive correlation with his ability of ICT literacy, access and use.

Conclusion

The study concludes that COVID was instrumental in attracting Indian students toward e-assessment and enhancing their interest. During this time students' overall perception of e-assessment was found of moderate level though this perception level varies depending on students' sex, academic level, stream of study and economic backgrounds. A mixed response from them was collected. Of the eight domains investigated, students showed better perception in the perceived usefulness, perceived ease of use, compatibility, subjective norms and self-efficacy domains, while they cut a sorry figure in domains like awareness, resource facilitation and IT support. The study found, stress and allied fear of ICT skills as the major limitation that refrain students from adopting it intensively. The implementation of e-assessment in primary and secondary level may help students respond differently with more conviction and skill than now, when they are observing it for the first time at their tertiary college level. Finally, the study found that e-assessment has left a positive impact on students' perception of e-assessment. Indian students have been living in an atmosphere where there is a lot of insufficiency in respect of infrastructure or innovative measures. They lack IT skills that only add stress in operating a computer, still they are welcoming e-assessment in higher education because they feel it to be the time's demand as the world is moving toward paperless documentation, and e-assessment is the close associate of e-learning.

Implications

The report has a wide implication concerning the information relating to Indian students' perception of e-assessment. It depicts a clear picture of students' readiness to adopt this new mode of assessment based on the MAUE framework, provides the necessary information to the implementation authorities, and thus helps in the effective incorporation of e-assessment in education. It could provide information regarding the limitations and strengths of e-assessment as students feel that it is of wide use during this pandemic time. In this era of advanced technology, e-assessment can add value to the evaluation system. Paper-pencil-based assessment requires more staff loads and working hours along with security issues, human errors, chances of partialities and faulty question papers. These uncertainties can be eliminated with the use of e-assessment. In a country like India e-assessment is an area with much potential to cater to the huge enrollment of upcoming students in higher education as it reveals the prodigious importance of monitoring the development of the students, thus allowing the teachers to follow the results of the students throughout the semester and not only at the end of the year and preparing them for a professional future. This process is more all-inclusive as it considers all the actions, works, reports, portfolios and forums developed.

Currently, e-assessment might be more appropriate as opposed to traditional assessment since it has the potential to curtail stress among students, improve decision-making among administrators, and decrease costs and time. As an invention, it has the possibility of enhancing learning and teaching at higher education institutions, and this is only possible if the institutions put suitable assessment policies and procedures in place. This study is helpful for future research also and will serve as a ready reference for them to direct this study in several other aspects like teachers' perception, institutional perception, policy makers' perception or finding correlation among these different aspects.

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Appendix 1

Perception of E-Assessment								
Measurement: Strongly Disagree=1, Disagree=2, Neutral=3, Agree=4, Strongly Agree=5								
			1	2	3	4	5	
Attitude	Awareness domain	1	I am well acquainted with e-assessment.					
		2	I feel I am an expert in e-assessment process.					
		3	E-assessment has been a regular phenomenon in my college/university.					
		4	I am provided regular information on e-assessment by my college/university.					
		5	I feel I am aware of pros and cons of e-assessment.					
	Perceived usefulness domain	6	I feel online assessment is just as secure as paper-based assessment.					
		7	I am confident that my grades for online assessments are secure.					
		8	I feel there is less scope to adopt malpractices in e-assessment than with paper-based assessments.					
		9	I feel online exams are fairer than paper-pen exams and free from human errors.					
		10	I feel the technology used in online assessments is reliable from security concerns.					
	Perceived ease of use domain	11*	I feel stress using a computer during examination.					
		12*	I can solve simple technical problems during ICTs use.					
		13*	I fear that e-assessment in my university will ruin my career.					
		14*	I feel more comfortable in paper-pen mode of assessment than e-assessment.					
		15*	I feel problems in concentrating on the online questions.					

	Compatibility domain	16	E-assessment is appropriate for my subject area.					
		17	Online exams don't just test my knowledge of the subject, but IT skills as well.					
		18	Online exams will help me in preparing myself for online recruitment examinations.					
		19	Online exams are easy to assess, time saving and easy to evaluate.					
		20	Being objective or multiple-choice type, e-assessment is unable to reflect my true level of knowledge.					
Subjective norm	Peer influence & Superior influence	21	During COVID my peers have adopted e-assessment with a compulsion.					
		22	My university offered e-assessment as the only option left with us during pandemic.					
		23	In normal time I used to like paper-pencil mode of assessment.					
		24	I was also comfortable with paper-pencil mode prior to COVID intrusion.					
		25	COVID pandemic compelled me to make myself adopt with e-assessment.					
Behavioral control	Self-efficacy domain	26	I believe the potential for immediate feedback with online exams could help me learn more.					
		27	I believe e-assessments can do things quickly that paper-based assessments can't.					
		28	I believe e-assessment add value to my learning and future career.					
		29	I believe by making quick assessment online exams provide help to the overall teaching- learning.					
		30	I believe online assessment should go hand-in-hand with e-learning (e.g., using Dashboard).					
	Resource facilitation domain	31	E-assessments use less paper, which is important to me.					
		32*	I feel technical problems make online exams impractical.					
		33	I feel there are serious health and safety issues with online exams.					
		34*	I feel online exams are more easily accessible than paper-based exams.					
		35*	I feel my college/university don't have adequate e-assessments infrastructure.					
	IT support domain	36	I can use ICT tools e.g., computer, software, internet efficiently.					
		37	I feel I am not ready for a computer-based examination.					
		38	I have a computer for personal use at my home.					
		39	I regularly use internet, email, social networks, YouTube etc.					
		40	I feel I have adequate computer knowledge to face e-assessment.					

* Questions for reverse scoring

Name: _____ Gender: ☐ Male ☐ Female

Age: ☐ 16-20 ☐ 21-25 ☐ Above 25

Education Level: ☐ Undergraduate ☐ Post Graduate

Major: ☐ Humanities ☐ Social science ☐ Science ☐ Law

Stage of Study: ☐ 1st Year ☐ 2nd Year ☐ 3rd Year

Average Yearly Income (family): ☐ <100000 ☐ 100000-300000 ☐ >300000

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