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Integrating gamification and instructional design to enhance usability of online learning

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Abstract

The current study investigates the interaction of Gamification, and Instructional Design to enhance the Usability of e-Learning in higher education programs. The study also examines the mediating role of Instructional design. Data were collected from a self-structured questionnaire from the academicians and was analyzed through Structural Equation Modelling (SEM). The results of the study confirmed that gamification is a multi-dimensional construct significantly predicted by elements, game dynamics, motivation, and game mechanics. Further, Instructional design partially mediates the relationship between gamification and usability of e-learning. This research demonstrates that Gamification can enhance the learning environment for e-learning students. This study will also inspire educators and course developers to give due consideration to the instructional design and gamification of an online course. The research findings will motivate educators/instructors/course developers to give equal importance to instructional design and gamification as well as to the content.

Keywords E-learning · Education · Education for sustainability · Distance learning · Instructional Design · Gamification · Usability of e-learning · Mediation

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1 Introduction

Technology has a tremendous impact on Education. E-learning is one of the most popular venues for student learning which is made available by contemporary technology (Rodrigues et al., 2018a, 2018b; Sangeeta and Tandon, 2020; Yeung et al., 2021). As university measures, new norms of social distance, and lockdown were implemented instantly with the health emergency (COVID-19) across the world which not only affected behavior of students and lecturers but also shifted from traditional classrooms to e-learning platforms (Coman et al., 2020; Mittal et al., 2021; Tandon et al., 2021). However, a lack of student involvement across an e-learning system is a common issue among professors when developing study material for a system (Pakinee, 2021). When employing intelligent educational technologies, it is still quite typical for pupils to get disengaged or bored throughout the learning process (Rodrigues et al., 2018a, 2018b). On the other hand, gamification, as well as its applications and consequences in the field of Artificial Intelligence in education, is gaining popularity since it offers a new way to engage and inspire students, allowing them to achieve a flow hroughout the learning process (Huotari and Hamari, 2017). The term "gamification" was coined in the digital media sector, but it wasn't widely accepted until late 2010. Since then, much of the research on gamification in educational systems has focused on conceptualization, modelling, and the impact of use (Bittencourt, 2018; Landers et al. 2018). The notion of gamification has been around for over a century. Gamification has recently been a hot subject among educators as a result of recent technological advancements and a rising interest in innovative human methods of education. The primary goal of gamification in education is to further engage students in education through a game in which a scoreboard, leaderboard, and change feedback create a gamified atmosphere in a non-gaming context (Hamari et al., 2014; Fitzgerald and Ratcliffe, 2020). Technology adaption and gamification can provide a pleasant learning environment that can replace the time-consuming learning method by improving the efficacy, potency, and motivation of e-learning. In a highly gamified curriculum, learners are captivated by fun and rewarded with data and ability. Gamification's application in education is growing in popularity. Gamification in e-learning refers to a set of processes and activities carried out in a non-game setting to address educational issues by employing gamified design principles and elements, resulting in increased ease of use, user engagement, knowledge retention, learning, and usability, as well as an impact on system evaluation and usefulness (Lopes, 2019). The majority of gamification studies show that it has a favorable influence on people (Dikcius et al., 2021; Hsu and Chen, 2018; Huotari and Hamari, 2017).

Gamification is becoming more popular in e-learning as a new technology that may boost motivation and user engagement with simple virtual incentives such as badges, points, awards, challenges, leaderboards, progress monitoring, and experience points. (Denny, 2013; Kristiansen et al., 2019; Çakıroğlu et al., 2017; Aguiar-Castillo et al., 2020). If the education experience is rewarding by itself, only then gamification can enhance it. Learners who have high intrinsic motivation may be demotivated by extrinsic recognition (the over-justification effect). Hence gamification elements may be optional but need to be carefully designed in e-learning.

Previous researchers have validated the execution of gamification and its impact on accomplishments by students (Hsu and Chen, 2018; Huotari and Hamari, 2017) but there are limited attempts to study usability of e-learning (O'Donovan et al., 2013; Barata et al., 2013; Cheong et al., 2014; Kumar and Tandon, 2022). Even the role of academicians is highly neglected in the literature available. Further, the mediating role of instructional design is still unexplored. Therefore, this research fills the gap by not only validating the relationship between gamification and usability of e-learning but also validates the mediating role of Instructional design by considering a sample of academicians.

Though gamification has been explored in previous studies and the extant literature has validated its significance in making e-learning interesting (Denny, 2013; Kristiansen et al., 2019; Çakıroğlu et al., 2017; Aguiar-Castillo et al., 2020) but further research is required to assess the impact of gamification on Usability of e-learning along with mediating role of Instructional design, a gap which this research tries to address. Therefore, this research tries to answer the following research questions:

a) Which facets of gamification influence usability of e-learning?
b) What is the impact of gamification on usability of e-learning?

Therefore, the purpose of this research is to add new knowledge to the existing literature of gamification by examining its relationship with Instructional design by considering the sample of academicians. The study is one of the initial studies exploring the mediating role of Instructional design between gamification and usability of e-learning.

The rest of the paper is six-fold. In the next section theoretical framework is discussed. Following sections discuss the hypotheses development, research methods and discussions. Finally, a conclusion has been made by highlighting the implications, limitations and future research directions. Please add in the Reference Section the following reference: Kumar, P., & Tandon, U. (2022). Factors Impacting Educators' Intention Towards E-Learning Adoption. ECS Transactions, 107(1), 6561.

2 Theoretical framework

To comprehend the concepts, the present study incorporates two existing theories of consumer behavior. The first theory used to conceptualize the Instructional design is Mayers' Theory (Mayer and Anderson, 1992) while the second theory Self-determination theory, developed by Deci and Ryan (1985), used to conceptualize gamification.

2.1 Mayers' cognitive theory of multimedia

Mayer and Anderson (1992) conceptualized the multiple representation concept, which says that the simultaneous use of audio and images can enhance e-learning. Using several mediums rather than a single medium allows for more effective storage and processing of information throughout the learning process (Mayer and Anderson, 1992). This theory emphasizes that humans can only grasp a specific amount of data in

a channel at any given time, and that mental representations are actively generated to make sense of incoming data. Mayer defined three types of memory stores: 'sensory' accepts inputs and retains them for a short time; 'working' processes information and develops mental constructions called 'schema'; 'long-term' keeps knowledge gained. According to this theory, multimedia presentation of words, pictures, and auditory information is not interpreted by the brain independent of each other; instead, logical mental constructs are produced by dynamically selecting and organizing them (Mayer and Moreno, 2003, p. 43). Richard (2002**)** conducted focused research based on the cognitive theory of multimedia learning. Additionally, the study also confirmed a few preliminary principles focusing on instructional design which cultivates multimedia learning. These principles include the "multiple representation principle," which emphasizes that explanations should be in words and pictures rather than just words, "the contiguity principle," which emphasizes simultaneous representation of similar words and pictures, and "the coherence principle," which emphasizes that the explanation should be in words and pictures rather than just words. To increase effective learning, researchers developed multimedia instructional design approaches based on cognitive load theory (Mayer, 2017; Moreno and Mayer, 2007).

2.2 Self-determination theory

Self-determination theory (Deci and Ryan, 1985) has been used to conceptualize gamification. The theory of self-determination (SDT), which encompasses the concepts of extrinsic and intrinsic drive, is one of today's most influential motivation theories. Extrinsic motivation is described as doing something because it leads to a certain result, whereas intrinsic motivation is defined as doing something because it is inherently exciting or delightful. Intrinsic motivation describes behaviours that are carried out "for the sake of it or because they are inherently intriguing and delightful." Extrinsically driven behaviours are those carried out for reasons other than their inherent satisfaction, and joys, whereas intrinsically driven behaviours are those that are done for reasons other than their inherent satisfaction, and pleasures (Ryan and Deci, 2020).

Gamification and Game- based learning though used interchangeably in e-learning are quite different. The former is the application of game mechanics in a non-game context while later utilizes game elements for teaching specific skills to the learners to achieve specific learning goals (Hamari et al., 2014; Zichermann and Cunningham, 2011). The popularity of gamification has rapidly increased in the last decade, wherein educationists and web- designers have successfully used gamification to engage/motivate users (Kapp, 2012; Enders and Kapp, 2013). Gamification in e-learning combines course material with game features to make the session more engaging. In compared to the basic appearance and feel of the learning content alone, game components such as progress bars and different levels drive the student more. Complex aspects such as badges, points, and coins fulfill the basic desire for gathering while also keeping learners interested. Collecting points on scoreboards may build a sense of competitiveness, which further drive the learner to outperform their classmates, increasing engagement and competition. Commonly used Game Elements in e-learning are categorized as:

- Scores are indicators of the level of performance and instill a sense of achievement.
- Levels: Each movement to a higher level indicates the increase of complexity in content along with the proficiency of the learner.
- Badges are the reminder of learner achievements as they progress through each level.
- Leader boards are used to motivate learners to score higher than their peers and thereby promote healthy competition.

Personalization of e-learning enables effective adaptation to user demands, resulting in enhanced satisfaction. E-learning will become more customizable in the future as it gains momentum. Artificial intelligence should be used to assist e-learning personalization. Artificial intelligence, on the other hand, requires appropriate data. Rewards are synonymous with trophies or badges in most gamified frameworks (achievements). But winning a badge is not enough and the users will show off their accomplishments. In order to achieve desired objectives, learners are urged to undertake various tasks in e-Learning systems. As a result, progress monitoring and reward systems may be used in e-Learning to boost user motivation and engagement, but they must conform to all stages of eLearning system development: analysis, design, development, and assessment. (Yamani, 2021). Educators may use artificial intelligence to discover specific behaviour, trends, big errors, and other behavioral traits in e-learning students. As a result of this knowledge, gamification may be used to tailor e-learning to the individual needs of students by motivating them. Thus, gamification may be considered an extrinsic motivator by influencing students to continue e-learning.

2.3 Usability of e-learning

Appraising the usability of e-learning is an important task due to the multiplicity of learners, developments in technology, and significant fluctuations in learner-trainer interaction. These radical changes pose challenges and instill the need to define, and modify learning applications (Ghai and Tandon, 2021). Zaharias and Poulymenakou (2006) insisted the hat usability of e-learning cannot be compared with the work-related usability paradigms. Therefore, the usability of e-learning needs to be studied by considering the learners' attitudes. Notess (2001) argued that evaluating e-learning usability may move usability practitioners outside their comfort zone. In fact, the usability of e-learning is directly related to Instructional design as suggested by Ghai and Tandon (2021). Therefore, usability developers must acquaint themselves with the learning pedagogies and learning theories before designing any e-learning application. Therefore, this research tries to understand the impact of gamification and usability of e-learning along with instructional design thereby providing a holistic way to both learners as well as academicians.

3 Hypotheses development

3.1 Gamification

Gamification in e-learning promotes motivation (Deterding et al., 2011), and engages students (Zainuddin et al., 2020; Koivisto and Hamari. 2019; Panagiotis et al., 2016) leading to an improvement in academics (Koivisto and Hamari 2019). In the domain of education, intrinsic motivation leads to better outcomes as compared to extrinsic motivation (Ryan and Deci, 2020). Previous research studies considered a significant association between games, and positive attitude (Koivisto and Hamari, 2019; Boyle et al., 2012). Due to these encouraging results in behavioral change of students, gamification is being progressively adopted in the e-learning domain. Research by Dunlosky et al., (2013) confirmed that roughly 79% of learners prefer gamified content over conventional content, and approximately 65% find solely gamified information to be more engaging. According to a recent analysis of academic gamification research, virtually all studies found that gamification works, albeit the results vary depending on the framework or environment (Hamari et al., 2014; Zainuddin et al., 2020; Koivisto and Hamari 2019). Gamification has beneficial impact on education, with improved engagement, motivation, and enjoyment being the most common outcomes (Ghai and Tandon, 2021; Díaz-Ramírez, 2020). Users prefer a gamified approach to learning because it stimulates and makes the learning process fun, (Connolly et al., 2012; Kumar and Tandon, 2022). The majority of research indicated that, above all, games may be an effective learning tool, but that their success is largely dependent on the use of numerous game qualities and their execution (Connolly et al., 2012; Hamari et al., 2014; Panagiotis et al., 2016). Points, challenges, successes, leader boards, badges, levels, and time-based activities are all common game components in non-game systems. (Enders and Kapp, 2013; Zainuddin et al., 2020). Most of the studies have insisted upon the positive aspects of gamification but its relation to the usability of e-learning is still unexplored. Following theories have been proposed based on the.

H1: Gamification is a multi-dimensional construct significantly predicted by Game Elements, Game dynamics, Motivation, and Game Mechanics.

H2: Gamification will have a significant positive association with usability of e-learning among academicians.

3.2 Instructional design

Due to online streaming technologies and video conferencing, virtual education, and advancements in the internet there is a remarkable increase in adoption of correspondence courses. Some teaching formats exist in which students and instructors do not participate in person, as opposed to other platforms in which real-time meetings take place via computers when both parties are located in different locations (Wang et al., 2020). Instructional design is a systematic approach for developing educational programs in a consistent, and dependable manner (Branch and Kopcha, 2014). Education is viewed as a collection of structured and controlled systems that must deal with change in the form of students, academic fields, and contextual settings.

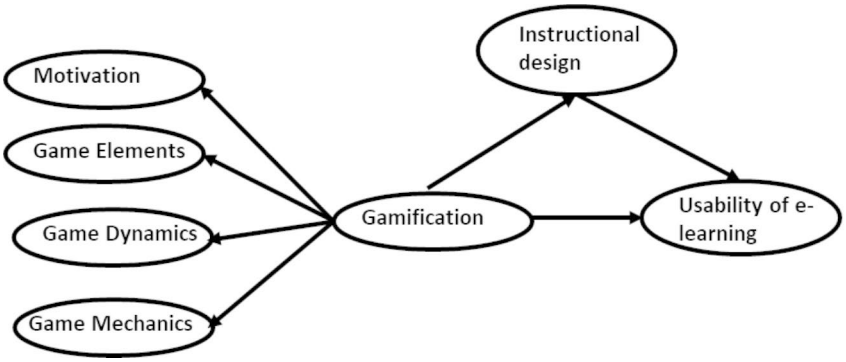

Fig. 1 Proposed Model

Learners bring their previous experiences, which represent a complex network of concepts, to this construct and engage with the education system to digest knowledge that influences their own existing networks (Caskurlu et al., 2021). Instructors benefit from using a systematic instructional design model because it focuses on the learner, supports effective instruction, provides a systematic way to address learning problems, fosters coordination among all instructional components and stakeholders, and makes diffusion and adaptation easier. Learner's co-construct knowledge because of newer instructional design techniques that places a greater emphasis on learner experiences (Sandanayake et al., 2021). The creation of a usability evaluation approach for e-learning applications, which combines web and instructional design factors, is also linked to an affective learning component, i.e. intrinsic learning motivation. As a result, the current practice was expanded by concentrating on cognitive and emotional factors that influence e-learning usability. The outcomes of the two empirical studies above, which assessed the usability of e-learning courses in corporate settings, give vital evidence that usability practitioners may reliably use this technique to evaluate the design of e-learning apps (Ghai and Tandon, 2021). Thus, the related hypothesis is:

H3: Instructional design mediates the relationship between gamification and usability of e-learning among academicians.

Based on the above discussion, the following model (Fig. 1) has been proposed:

4 Research Methodology

This section has been divided into four sub-sections namely: Sampling strategy, Instrumentation, Data collection procedures, and Demographic profile of the respondents.

4.1 Sampling strategy

Mixed method sampling approach was followed so as to reach an adequate sample size as well as to reduce bias caused by adopting a single method of study (Teddie

and Yu, 2007). Both convenience and snowball sampling techniques were adopted as non-probability sampling techniques. Further, non-probability sampling techniques have been adequately applied by previous studies on e-learning (Mittal et al., 2021; Tandon et al., 2021).

Adequate sample size is required for performing structural equation modelling (SEM). Previous studies suggested that the ratio of a number of respondents to the total number of scale items can be as low as 10 to 1 (Schreiber et al., 2006) or even 5 to 1 (Bentler and Chou, 1987). Further, the total number of variables also guides the sample size as per the previous study by Sugden et al., (2000). Thus, the sample size (n = 382) was deemed adequate for the analyses performed in this study. Extant literature reflects that as the sample size becomes large the results become more reliable and generalizable (Sugden et al., 2000).

4.2 Instrumentation

4.2.1 Instrument development and scales

The study was conducted on the academicians undertaking various graduate and postgraduate courses in various Institutes and Universities in the Northern States of India. Five State public and private Universities were taken as samples that switched to online teaching and learning due to COVID 19. The scale items of gamification were extracted from the previous studies of Díaz-Ramírez (2020) and Högberg et al., (2019) while the study of Zaharias and Poylymenakou (2009) lend support to frame scale items of usability and instructional design (Annexure 1). These items were modified in the context of e-learn ing. These items were measured from a scale of 1–5 where 1 indicated "Strongly disagree" and 5 indicated "Strongly agree." The language of a few items was modified as recommended by an expert panel composed of 3 University Professors, and 2 graphic designers. Due to word duplication, a few scale items were restructured, and revised, while others were removed.

4.2.2 Scales

Gamification The scale assessing Gamification was divided into four sub-constructs namely, motivation, game elements, game mechanics, and game dynamics. Items in these sub-constructs were modified to make them easily understandable. For example, separate scale items were framed for all the sub-constructs (motivation, game elements, game mechanics, and game dynamics) by taking support from the previous study by Díaz-Ramírez (2020). Sub-construct motivation had four scale items that focussed upon the motivating factors leading to quick learning. One item MOT4 (Gamification motivates participation in group activities which enhances knowledge) is a modified scale suggested by experts. Similarly, sub-construct game elements comprised of five-scale items. These items focused on excitement and enjoyment by including game elements in deliverable content. This sub-construct also included items such as "Gamified activities promote independent learning" thereby suggesting the significance of game elements in facilitating e-learning. Game dynamics also had five scale items signifying the role of points, badges, and leader boards in facilitating

e-learning. Game mechanics had three scale items indicating accomplishment and engagement achieved while using gamified elements in e-learning.
The construct "Instructional design" had five scale items. Item IDD 3 (Presentation of gamified content with readable fonts of instructional content influence to learn better) was also suggested by academicians while conducting a pilot study. Other scale items are (a) Well organized instructional material improves my learning experience, (b) Relevant instructional material enhances flow of learning, (c) Presentation of instructions in a course influences the learner's interest, and (d) Composition of the instructional material based on the gamified principles lead to flexible learning.

The dependent variable i.e. Usability comprised of nine scale items. Items of usability included questions on gamified visuals, interactive tools, high quality graphics, and interactive tools. In this construct also, "Proper navigation structure of gamified content aids in understanding of the concept" was suggested by experts, and was thus incorporated to have a deep and better understanding of the impact of gamified content in improving usability of e-learning.

4.3 Data collection procedures

Subsequently, an online link was generated covering scale items of Usability, Gamification, and Instructional design. This link was circulated through the websites of the Universities, as well as among faculty groups in the selected Universities. Only those respondents who had incorporated gamified activities in their courses were considered for this research. A filter question was added in the google link asking respondents whether do they use gamified content for teaching online? The link ended for those respondents who responded "No". 413 responses were received in total. After examining the responses, a few irrelevant and strange responses were removed and a total of 382 responses were retained for further analysis.

To overcome common method bias, Harman's one-factor test was used (Harman, 1976). With Varimax rotation, an exploratory factor analysis (EFA) was performed. The results indicated 31.46% of variance was explained in the factor, which is below the recommended value of 50% and thus suggests the absence of common method bias.

4.4 Demographic profile and characteristics of respondents

Table 1 indicates the demographic profile of respondents. Out of 382 respondents 51.8% were males and remaining 48.16% were females. Of all the respondents, 38.49% were doctorates followed by 33.77% postgraduates, and 27.74% graduates. The age ranged from 25 to 30 with 20.95%, 31–40 with 64.92% and above 40 with 14.13%. 25.09% of the academicians were delivering e-learning modules from the last two years while 47.48% had online teaching load of 11–15 h.

Table 1 Demographic Profile

Demographic Characteristic N = 382	Response	Percentage
Gender		
Male	198	51.8
Female	184	48.16
Education Qualification		
Graduates	106	27.74
Postgraduates	129	33.77
Doctorates	147	38.49
Age		
25–30	80	20.95
31–40	248	64.92
Above 40	54	14.13
Modules delivered online		
Less than 1 year	68	17.77
1 year – 2 years	142	37.14
More than 2 years	172	45.09
Online classes per week (hrs)		
<Less than or equal to 10 h	140	36.54
11–15 h	181	47.48
More than 15 h	61	15.97

5 Results

5.1 Measurement model

The data analysis process followed a two-step investigative approach. Confirmatory Factor Analysis (CFA) was performed to assess the reliability and validity of scale items followed by Structural Equation Modelling (SEM) to empirically test the hypotheses framed. SEM was preferred over other approaches because it incorporates numerous conventional methodologies into a single software package, such as correlation, multiple regression, and factor analysis (Lowry and Gaskin, 2014). Furthermore, SEM allows for the comparison of conceptual models with facts. This comparison yields fit statistics that evaluate both the model and the data (Lowry and Gaskin, 2014). As a result, SEM was used to estimate various, and interconnected dependences in a single study.

CFA using AMOS 24.0 was conducted on all the constructs. The measurement model was validated on the basis of Convergent validity, Internal consistency, and Discriminant validity (Hair et al., 2010). Table 2 displays the results of the measurement model. To evaluate the convergent validity of the exogenous and endogenous constructs, the standardized loadings of the constructs and Average Variance Extracted (AVE) were considered (Hair et al., 2010). The standardized loadings of 0.6 or higher suggesting that the items exhibit validity. AVE value also exceeded 0.5 indicating adequate convergent validity as suggested by Fornell and Larcker, (1981). The internal consistency was addressed by computing composite reliability (CR). The value of composite reliability for all the con-

structs was 0.7 which is above the threshold value as suggested by Fornell and Larcker (1981).

Table 2 indicates the results of measurement model and results indicate the following:

a. (a) All standardized loadings > 0.6 indicates that all the items are reliable (Hair et al., 2010),
b. (b) All Average Variance Extracted values > 0.5 indicates convergent validity (Hair et al., 2010), and.
c. (c) All Composite Reliability values > 0.7 indicates internal consistency (Hair et al., 2010).

Further, Table 3 indicates discriminant validity as square root of AVE was more than inter-item correlations (Hair et al., 2010). Thus, it can be concluded that all the measurement items loaded considerably into their related constructs and the measurement model achieved convergent validity.

5.2 Structural model

To acquire good findings from the measurement model, the hypothesized model was calculated for all constructs of gamification (see Table 4; Fig. 2).

Game elements had substantial support (β = 0.899, p = 0.000) and emerged as the strongest predictor of gamification in e-learning. Game dynamics (β = 0.868, p = 0.000) followed by motivation (β = 0.835, p = 0.000), indicating both as significant predictors of e-learning. This finding highlighted that the game dynamics' also had a major impact on gamification. Game mechanics, on the other hand, had comparatively less loadings as compared to remaining facets of gamification (β = 0.783. p = 0.000). Therefore, we accept the hypothesis H1 which indicates that "*Gamification is a multi-dimensional construct significantly predicted by Game Elements, Game dynamics, Motivation and Game Mechanics."*

Finally, H2, which states that gamification leads to usability of e-learning received significant support (β = 0.731. p = 0.000). Various fit indices are considered to understand how well the data fits in the model and whether data is credible or not (Hair et al., 2010; Kline and Tamer, 2016). Table 4. explains the model fit indices emerged as a result of the analysis performed. The first evaluation criteria is Chi-square test. For the Chi-squared to degrees of freedom ratio test, smaller values indicate better the model fit; this implies that the difference between observed and expected covariance is small. CMIN/df was 2.658 here indicating small difference between observed and expected covariance. The goodness of fit index (GFI); non-normed fit index (NFI); incremental fit index (IFI), which adjusts NFI for sample size and degrees of freedom; and comparative fit index (CFI) should all be greater than 0.90 for a well-fitting model. All these values were above 0.9 in this case pointing towards a good model fit. The root mean square error of the approximation (RMSEA) values of less than 0.08 are indicative of adequate fit which is 0.045 in this case. All the values of these indices reached their thresholds, implying overall good model fit.

Table 2 Measurement Model

		Std. Estimate	Std. Error.	Critical Ratio.	Average Variance Extracted	Composite Reliability
Motivation	MOT1	0.772				
Mean=4.330	MOT2	0.737	0.06	14.504		
S.D=0.614	MOT3	0.731	0.067	14.372	0.576	0.844
	MOT4	0.793	0.068	15.724		
Game Elements	GME1	0.668				
Mean=4.266	GME2	0.653	0.078	11.555		
S.D=0.611	GME3	0.732	0.095	12.77	0.51	0.838
	GME4	0.787	0.09	13.589		
	GME5	0.721	0.097	12.604		
Game Dynamics	GMD1	0.721				
Mean=4.299	GMD2	0.686	0.07	12.914		
S.D=0.624	GMD3	0.787	0.076	14.839	0.531	0.85
	GMD4	0.718	0.081	13.535		
	GMD5	0.728	0.079	13.713		
Game Mechanics	GMM1	0.789				
Mean=4.235	GMM2	0.796	0.073	16.379	0.618	0.829
S.D=0.711	GMM3	0.773	0.071	15.817		
Instructional Design	IND1	0.693				
Mean=4.386	IND2	0.775	0.085	13.851		
S.D=0.601	IND3	0.786	0.084	14.033	0.586	0.876
	IND4	0.773	0.083	13.812		
	IND5	0.796	0.083	14.192		
Usability of e-learning	USB1	0.779				
Mean=4.396	USB2	0.716	0.065	14.75		
S.D=0.606	USB3	0.787	0.061	16.556		
	USB4	0.708	0.06	14.566		
	USB5	0.746	0.064	15.496	0.549	0.916
	USB6	0.727	0.057	15.024		
	USB7	0.773	0.061	16.18		
	USB8	0.655	0.063	13.288		
	USB9	0.765	0.06	15.988		

All of the fit indicators point to a good match (Table 4). As a result, the proposed model offers a logical depiction of the structures that underpin the observed data.

5.3 Model after mediation

Hypotheses 3 ascertained that Instructional design mediates the relationship between gamification and usability of e-learning. Table 5 indicates the mediating impact of Instructional design. The direct effect of gamification on usability before applying mediation was ($\beta=0.737$. $p=0.000$), but after applying mediation, the direct impact of gamification on usability of e-learning remained significant but was reduced ($\beta=0.481$, $p=0.000$) thereby indicating partial mediation. The indirect effect between gamification and usability is also significant ($\beta=0.256$, $p=0.000$) indicating partial

Table 3 Correlation Matrix

	Motivation	Game Elements	Game Dynamics	Game Mechanics	Usability of e-learning	Instructional Design
Motivation	***0.758***					
Game Elements	0.689**	***0.714***				
Game Dynamics	0.600**	0.669**	***0.728***			
Game Mechanics	0.624**	0.679**	0.628**	***0.786***		
Usability of e-learning	0.590**	0.650**	0.651**	0.590**	***0.765***	
Instructional Design	0.565**	0.621**	0.670**	0.658**	0.662**	***0.740***

**. Correlation is significant at the 0.01 level (2-tailed).

mediation. To confirm the mediation, the Sobel test was performed (MacKinnon et al., 2007). The value of the Sobel test statistic with Instructional design as a mediator was 2.081 and was significant at $p < 0.013$. These results imply that Instructional design depicts a partial mediating effect on the relationship between gamification and usability of e-learning (Fig. 2).

6 Discussion and implications

This research builds a theoretical model by examining the complex linkages that exist between gamification, Instructional design, and usability of e-learning among academicians. Due to limited studies to date, this research makes an earnest attempt to understand the mediating role of Instructional design thereby validating Mayers' theory and Self-determination theory.

In a riposte to the first research question, all the four facets (motivation, game elements, game dynamics and game mechanics) loaded heavily on construct gamification. This finding corroborates with the previous studies (Kristiansen et al., 2019; Çakıroğlu et al., 2017; Aguiar-Castillo et al., 2020). This indicates the significance of game elements such as comment badges, feedbacks in understanding not only the concepts but also making the lectures exciting which in-turn improves the involvement of students. Incorporating game elements, such as game fiction enhances interactions among students which improves academic performance (Zainuddin et al., 2020). This was followed by other facets of gamification like game dynamics, motivation and game mechanics. This finding supports the results of previous studies which laid emphasis on the significance of these facets to promote learning both in online and offline mode (Connolly et al., 2012; Hamari et al., 2014; Panagiotis et al., 2016). Therefore, facets of gamification need to be included to make sessions thought-provoking and challenging.

Results further support direct and significant relationship between gamification and usability of e-learning. Previous research studies have also insisted upon the fact that a gamified module is much more inspiring, exciting, and easy to comprehend (O'Donovan et al., 2013; Barata et al., 2013; Cheong et al., 2014). Therefore, it becomes important to solve the queries of students with respect to visuals, func-

Table 4 Structural Model

			Std. Estimate	SE.	CR.	P	Results
Motivation	◊	Gamification	0.835				Supported
Game Elements	◊	Gamification	0.899	0.049	22.03		Supported
Game Dynamics	◊	Gamification	0.868	0.051	20.904		Supported
Game Mechanics	◊	Gamification	0.783	0.061	17.863		Supported
Gamification	◊	Usability of e-learning	0.737	0.053	16.218		Supported

Goodness of fit statistics CMIN/df=2.658, GFI=0.958, NFI=0.976, AGFI=0.921, RFI=0.978, TLI=0.984, CFI=0.966, RMSEA=0.045, *** significant at 0.001 probability level, **significant at 0.01 probability level

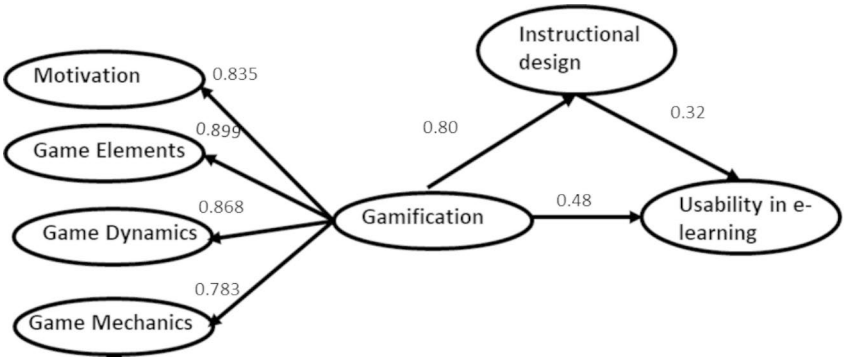

Fig. 2 Model after Mediation

Table 5 Mediation results

No.	Hypotheses	Direct effectβ	Total effectβ	Indirect effectβ	P value	Remark
H4	Gamification∀Instructional design∀ Usability of e-learning	0.481	0.737	0.256	0.000	Partial mediation

Goodness of fit statistics CMIN/df=2.721, GFI=0.956, NFI=0.966, RFI=0.952, TLI=0.969, CFI=0.978, RMSEA=0.065

tionality of gamified content, and perceptiveness of learning systems in e-learning (Thowfeek and Salam, 2014). The basic purpose of e-learning is to boost student-teacher interactions, rapid feedback, completion of tasks on-time etc. which may be fulfilled by adequate usage of facets of gamification which in turn enhance usability of e-learning. Obtaining rewards, points foster competitive spirit, and improve engagement.

The significant contribution of the study to establish the mediating effect of Instructional design between gamification and usability of e-learning. Instructional design partially mediates the relationship indicating its significance in e-learning. The findings, therefore, extend the contribution of Mayers' theory in understanding Instructional design and usability of e-learning. Emergence of significant and positive impact on usability validates SDT theory and gamification is considered as an extrinsic motivator in e-learning context. The findings also indicate that SDT contributes to gamification and e-learning domain by simplifying concepts, making complicated phenomenon easier to understand, amended control over learner and motivating learner to study diverse subjects.

The study has implications for academicians and well as universities focusing on e-learning due to COVID – 19. This study will help to improve the learning environment for e-learning students that facilitates better knowledge retention. As gamification provides instant feedback, hence universities and education institutions need to train academicians to gamify content for better engagement, recall, and retention. Gamification in e-learning entices, motivates, challenges, and empowers learners so they willingly achieve higher objectives. This study sheds light on the novelty of gamified learning as a game-changer and key enabler of motivation, engagement, and

user experience but also its impact with instructional design. This research encourages educators and course producers to think about the instructional design and gamification of an online course. The study's findings encourage educators/instructors/course creators to prioritize instructional design and gamification alongside content. This study can be utilized by the instructional designers to adopt the concepts of Gamification elements into their teaching and learning course curriculum and shift the student-centered learning more effectively. All of these factors that affect and touch learners (better learning experience, improved recall and retention, accelerating behavioural change, and so on) can result in a large performance benefit for the institute/ organization.

7 Limitations and future directions

The study has some limitations that could be considered future research avenues. The model could be extended by adding visual design and gamification elements. As data were collected from the academicians only, future studies may consider the viewpoints of students and graphic artists. A comparative analysis covering both cohorts (academicians and students) may provide interesting insights. It can also be replicated on larger samples and in other developing nations to improve the model's generalizability. It could be beneficial to validate demographic variables as moderators. Future studies may also include other dependent variables like satisfaction, and behavioral intention to see the model's applicability.

8 Annexure 1 (Scale Items) Motivation

MOT1	Gamification leads to quick learning
MOT2	Gamification promotes feeling of sense of achievement
MOT3	Gamified content makes me motivated to learn novel concepts
MOT4	Gamification motivates participation in group activities which enhances knowledge
	Game Elements
GME1	Gamified activities lead to excitement among students.
GME2	Enjoyment in group activities through Gamification promotes learning
GME3	Gamified activities promote independent learning
GME4	Competition with others in Gamification promote learning
GME5	I can master difficult tasks through Gamified content
	Game Dynamics
GMD1	Rewards/Points/Badges in Gamification motivate to participate more actively
GMD2	Timely feedback instil confidence
GMD3	Obtaining rewards through Gamified activities promote learning of technical subjects too
GMD4	Game dynamics (rewards, achievements etc.) increase academic performance

GMD5	Achievement of peers in Gamified activities motivate to participate more actively
	Game Mechanics
GMM1	Game Mechanics (Progress-bars, leader-boards etc.) in Gamification leads to the competitive spirit
GMM2	Game mechanics in Gamification leads to foster engagement
GMM3	Game Mechanics in Gamification leads to sense of accomplishment
	Instructional Design
IDD1	Well organized instructional material improves my learning experience
IDD2	Relevant instructional material enhances flow of learning
IDD3	Presentation of gamified content with readable fonts of instructional content influence to learn better
IDD4	Presentation of instructions in a course influences the learner's interest
IDD5	Composition of the instructional material based on the gamified principles lead to flexible learning
	Usability
USB1	Gamified visuals help to learn better
USB2	Clear message with multimedia promotes understanding of the subject
USB3	Easy to read course instructions leads to usability
USB4	Interactive tools help to learn fast
USB5	Text, style and color og gamified content help to understand the technical concept.
USB6	Gamified content helps me to master technical details of module
USB7	Gamified quizzes are enjoyable.
USB8	Use of high quality graphics in .facilitates online learning
USB9	Proper navigation structure of gamified content aids in understanding of the concept

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The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.