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Research Article

Engagement in Games: Developing an Instrument to Measure Consumer Videogame Engagement and Its Validation

Amir Zaib Abbasi,[1] Ding Hooi Ting,[1] and Helmut Hlavacs[2]

[1]*Department of Management and Humanities, Universiti Teknologi PETRONAS, Tronoh, Malaysia*
[2]*Research Group Entertainment Computing, University of Vienna, Vienna, Austria*

Correspondence should be addressed to Amir Zaib Abbasi; aamir.zaib.abbasi@gmail.com

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The aim of the study is to develop a new instrument to measure engagement in videogame play termed as consumer videogame engagement. The study followed the scale development procedure to develop an instrument to measure the construct of consumer videogame engagement. In this study, we collected the data in two different phases comprising study 1 ($n = 136$) and study 2 ($n = 270$). We employed SPSS 22.0 for exploratory factor analysis using study 1 respondents to explore the factors for consumer videogame engagement and reliability analysis. Results of EFA resulted with six-factor solution. We further used SmartPLS 3.0 software on study 2 respondents to further confirm the six-factor solution as reflective measurement model on the first-order level, and three second-order formative constructs on the second-order or higher-order level as formative measurement model. Results of the reflective measurement model and formative measurement model evidenced that consumer videogame engagement has strong psychometric properties and is a valid instrument to measure engagement in videogame play. Results also confirmed that consumer videogame engagement is a multidimensional construct as well as a reflective-formative construct. The study is unique in its investigation as it develops an instrument to measure engagement in videogame play which comprises the cognitive, affective, and behavioral dimensions.

1. Introduction

The popularity of videogame playing has increased significantly in the last decade [1, 2]. The total consumer's expenditure on games industry has increased to $22.41 billion in 2015 [3]. Videogame playing has the potential to attract millions of individuals worldwide to play [4] and it has become an essential part of our daily lives [5]. Videogame playing causes consumers to get addicted to a videogame [6] which finally leads people to engage in videogame play [7]. This is one of the key characteristics of videogames—it creates engagement in a videogame play [8]. Hence, engagement in videogames has become an important subject of study that needs considerable attention.

Engagement in videogames has been termed as a multidimensional concept [9, 10] which can be associated with a number of other notions, for instance, immersion [4, 7, 11], flow [12], fun [13], enjoyment [14, 15], presence [16], motivations in videogame play [17], arousal [18], game engagement [19], and user engagement [20, 21].

However, several types of research have been conducted in videogame studies to explore and measure engagement in both the qualitative [7, 11, 20] and quantitative manner [4, 5, 19, 21, 22]. Among all the studies, the study by Brown and Cairns [7] was the first study to qualitatively explore the concept of immersion and define a videogame player's experiences. The study results lead to the three main factors, *engagement, engrossment,* and *total immersion,* contributing

to the construct of immersion. Another qualitative research by Ermi and Mäyrä [11] has studied the notion of immersion to recognize the essential features of game-play experience. The study came up with a new model of game-play experience called *"SCI model,"* comprising the three dimensions *sensory-immersion, challenge-based immersion,* and *imaginative immersion*. We find that the results of Ermi and Mäyrä's study have similarities with the definition of immersion given by Brown and Cairns, for instance; imaginative immersion is similar to the state of engrossment and total immersion while challenge-based immersion and sensory-immersion refer to the dimension of engagement in Brown and Cairns' study.

Jennett et al. [4] expanded the study of [7] to measure the concept of immersion quantitatively. Their study developed an instrument to measure the subjective experience of videogame play based on the dimensions of *gameflow, cognitive-absorption,* and *presence* and named it game-experience questionnaire or GEQ. Brockmyer et al. [19] have developed another scale named game engagement questionnaire or GEQ using a combination of four constructs, *flow, presence, absorption,* and *immersion,* to measure a player's engagement in videogames. Again, this study has used almost similar dimensions that were earlier used by [4]. In a similar vein, a recent study by Procci [23] has reviewed the model of the game engagement [19]. The author of the study discussed three dimensions such as *flow, immersion,* and *presence* of the game engagement questionnaire [19] to measure the subjective experience of videogame play. However, the absorption construct is more or less similar to the flow dimension, which makes the measurement less popular. According to Procci [23], a newly revised construct of game engagement comprises the dimensions *flow, presence, involvement,* and *immersion* that can be applied to examine the subjective experience of videogame play.

In previous literature, there is another available scale which was used to measure user experience in video games labeled user-engagement scale [24] that comprised of six factors—*aesthetic appeal, novelty, focused attention, felt involvement, perceived usability,* and *endurability (i.e., a user's overall experience)* [21]. The study applied the user engagement in videogame setting [24], but the structure of factors was not consistent with the original definition. The authors have also developed another scale to measure engagement in videogame learning with the combination of flow theory and cognitive load theory [22].

Hitherto, the current study has addressed past studies that have examined the past measurements of engagement scale and found that there is a critical need to develop and use engagement scale to examine player's engagement or subjective experience in videogame play. Critical review of prior studies indicates that few studies have used almost similar dimensions *flow, presence,* and *absorption* to examine the subjective experience of videogame play and measured player engagement in video games [4, 19, 23]. These studies have not properly conceptualized and operationalized the term engagement and immersion in their studies. Rather, these studies have just discussed that the constructs *flow, presence, absorption,* and *immersion* are related to immersion which can be used to measure the construct of immersion and game engagement. Besides, measurements were mainly focusing on quantifying the subjective experience of videogame play.

Secondly, several studies have stated that engagement in a videogame is a multidimensional construct [5, 9, 10, 22, 24, 25]. Among these studies, Cheng et al. [5] try to capture the meaning of engagement on a second-order construct when other studies did not analyze the concept of higher-order construct. The problem with the study by Cheng et al. [5] is that the authors have studied this construct as a reflective-reflective model. However, after critically reviewing the article, we believe that the authors have wrongly specified the construct of game immersion as a reflective-reflective model; rather, the game immersion construct seems to be a reflective-formative model. This conclusion was drawn by reviewing the following studies [26, 27] which have discussed the important decision rules for specifying the construct as reflective or formative. The following studies have precisely discussed the decision rules [26, 27]. The first rule is to look at the nature of the construct whether the latent construct is existing or formed. The second rule is to look at the direction of causality between the items and latent construct; if it is reflective, the causality is from construct to items, if it is formative then the causality is from items to the construct. The third rule is to look at the characteristics of items used to measure the construct such that if it is reflective, then the items should have a shared common theme, items are exchangeable, and deleting or adding an item does not change the meaning of the construct, whereas, if the construct is formative, items do not share a common theme, items are not replaceable, and deleting or adding an item changes the conceptual meaning of the construct.

This can be evidenced from the study [5] that, on the first order, all these dimensions of engagement *(attraction, time investment,* and *usability)*, engrossment *(emotional attachment, decreased perceptions),* and total immersion *(presence* and *empathy)* are reflectively measured as these dimensions have causality from the construct to items and each dimension has a common-shared theme with interchangeable items, whereas, on the second-order constructs, these dimensions such as attraction, time investment, and usability *(engagement)*, emotional attachment, decreased perceptions *(engrossment)*, and presence and empathy *(total immersion)* should be measured formatively, where authors of the study [5] have neglected the importance of using formative construct, because engagement is collectively formed with the following dimensions *(attraction, time investment,* and *usability)*, while engrossment is jointly made up by these dimensions *(emotional attachment, decreased perceptions)* and total immersion is together built with the following factors *(presence* and *empathy)*. Besides, these dimensions have causality from the dimension itself to the higher level, dimensions do not share a common theme, dimensions are not interchangeable, and deleting any dimension can cause a variation on higher-order construct of game immersion. On this basis, game immersion construct should be considered a reflective-formative model than a reflective-reflective model.

Thirdly, past studies have given much importance to psychological dimensions *immersion, flow, presence, involvement,* and *absorption* to measure engagement in videogames

[4, 12, 19, 22, 23]. However, these studies have not considered the importance of behavioral dimensions to measure a player's engagement in videogame play.

Hence, the current study considers the limitations of previous studies and intends to first conceptualize and operationalize the notion of engagement in videogame playing as consumer videogame engagement. Accordingly, the study aims to develop a new scale comprising both the psychological and behavioral dimensions to measure the construct of consumer videogame engagement. Moreover, the aim of the study is to validate the new scale *consumer videogame engagement* among the videogame consumers.

2. Literature Review

The present study reviews past researches that have mainly defined engagement and developed an instrument for measuring engagement in videogame studies.

2.1. Definitions of Engagement and Its Related Constructs Used in Videogames. Engagement has acquired a significant attention in several studies [19–22, 24]. Among these studies, the research by O'Brien and Toms [20] has qualitatively defined engagement as *"a value of user-experience that is dependent on numerous dimensions, comprising aesthetic appeal, novelty, usability of the system, the ability of the user to attend to and become involved in the experience and the user's overall evaluation of the salience of the experience."* However, other studies have explained the notion of engagement with other theoretical constructs; for instance, flow, presence, immersion and absorption [19], presence, immersion, involvement and flow [23], cognitive and affective dimensions [22], focused-attention, perceived usability, aesthetics, and satisfaction [24] introduced a motivational model of videogame engagement that includes *autonomy, competence,* and *relatedness* [17].

Another definitional construct that has often used interchangeably with engagement is *immersion* [28]. Both engagement and immersion constructs have been investigated by these studies [4, 5, 19, 23] to examine the subjective experience as well as player's engagement in videogame play. Among these studies, the following researches [4, 19, 23] have used almost common dimensions of *flow, presence,* and *immersion* to quantify the subjective experience and engagement in videogame play.

2.2. Existing Questionnaires on Immersion and Engagement in Videogames. A large number of studies have put their efforts on developing and measuring the construct of immersion [4, 5] and engagement [19, 22, 24]. A study by Jennett et al. [4] was the first research to study the construct of immersion to describe the subjective experience in videogame play as game engagement. The construct of immersion [4] was developed with the help of three main theoretical constructs, *flow, presence,* and *cognitive-absorption,* which are commonly used to define engaging experiences. However, this study has ignored to differentiate these constructs *flow* and *immersion* in their study questionnaire labeled game immersion questionnaire.

However, a study by Brockmyer et al. [19] has addressed this gap by introducing the distinct position of these constructs *flow* and *immersion* in the study questionnaire called *game engagement questionnaire*. The study has used the term *game engagement* rather than *game immersion* to measure the subjective experience in videogame play. According to this study, game engagement is "a general sign of game-involvement." To measure game engagement in videogame play, the studyhas developed a game engagement questionnaire by considering such theoretical constructs *absorption, presence, immersion,* and *flow.* These theoretical constructs can be conceptualized as *"a progression of ever deeper-engagement in videogame-playing."* Recently, a study by [23] has revisited the game engagement model in which the author has revised the game engagement model which was originally given by [19]. The author has identified that absorption is principally a flow. Therefore, it is better to exclude "absorption" from the game engagement model. Furthermore, the author has introduced the *"involvement"* dimension and termed it as R-GEM *(revisited game engagement model)*.

Extant reviews of literature illustrate that few studies have developed a scale for measuring engagement through a *user-engagement scale* [24], or *immersion* by the game immersion questionnaire [5]. Among these studies, Cheng et al. [5] have developed a game immersion questionnaire by immersion theory [7]. According to these studies [5, 7], immersion comprises of the three phases—*engagement, engrossment,* and *total immersion*. The study by O'Brien and Toms [21] has applied the definition of user engagement [20] to operationalize and develop the construct of user engagement. The user-engagement scale was originally developed to measure engagement in an online shopping environment by [21]. Recently, this scale was also used in the context of a videogame by [24] who found that only the four factors-*focused-attention, perceived usability, aesthetics,* and *satisfaction* have passed through the EFA test, while the remaining factors have been deleted. However, the factor structure of the user-engagement scale was not consistent with the original measurement scale proposed by [21] which comprised of six factors such as *aesthetics, focused-attention, felt-involvement, novelty, endurability,* and *perceived usability*. The same authors [22] have also measured engagement with a combination of cognitive load theory and flow theory.

To date, past studies have only considered psychological constructs to measure the subjective experience and player engagement in videogame play [4, 5, 19, 22, 23]. However, these studies are limited to measure the construct of game engagement with both psychological and behavioral dimensions. These studies [4, 19, 22, 23] have not properly conceptualized and operationalized the construct of game engagement in their studies, while some studies have wrongly specified the model [5, 24]; for instance, according to Wiebe et al. [24], the user-engagement scale is a multidimensional construct, but they measured on a unidimensional level and authors have ignored investigating it on a multidimensional level or higher-order level. In a similar vein, another study by Cheng et al. [5] has also miss-specified the construct of

immersion as a reflective-reflective model. Rather, the construct of immersion is a reflective-formative model and should be dealt with carefully.

This study considers the limitations of past studies and takes an opportunity to properly conceptualize and operationalize the construct of engagement in videogame play as consumer videogame engagement. Furthermore, the objective of this study is to validate the construct of consumer videogame engagement on a multidimensional level; it first measures the first-order construct as reflective measurement model, also known as Mode A type of analysis, and evaluates the second-order construct as formative measurement model called Mode B type of analysis in SEM-PLS.

3. Conceptualization of Consumer Videogame Engagement

This study aims to conceptualize the notion of engagement in videogames as *consumer videogame engagement*. This study follows the definition of engagement given by [29–31] to conceptualize the concept of consumer videogame engagement as *"engagement is a multidimensional construct which is subject to a context-specific expression of relevant cognitive, emotional, and behavioral dimensions."* Moreover, Hollebeek [31] has further added that engagement is a process which is revealed as a result of two-way communications between the engagement-subject (consumer/customer) and a particular engagement-object such as a product, service, or a brand, which leads to generating consumer engagement states *(cognitive, affective,* and *behavioral)*. Following the above stated definition, this study conceptualizes consumer videogame engagement as "*a psychological state that triggers due to two-way interactions between the consumer and videogame product, which generates different level of consumer engagement states (cognitive, affective and behavioral)"* [32].

4. Scale Development and Validation of Consumer Videogame Engagement

This study adopts the scale development procedure suggested by [33, 34] to operationalize and develop a scale for the construct of consumer videogame engagement. The scale development process involves the four main steps as in the following part: step one is to generate items for samples, step two involves first-time data collection and instrument-purification, and step three comprises second-time data collection and performs the reanalysis. Finally, step four is to determine the scale of consumer videogame engagement on multidimensional level and the following part explains the four steps.

A Flow Chart of Scale Development Process [33, 34]

Item generation:

(i) Specify domains of consumer videogame engagement

(ii) Literature review

(iii) Content validity

Data collection (Study 1) and purification of measures:

(i) Coefficient of alpha

(ii) Exploratory factor analysis

Data collection (Study 2) and reanalysis of measures

(i) Coefficient of alpha

(ii) Confirmatory factor analysis

(iii) Construct validity

4.1. Step One: Item Generation

4.1.1. Operationalization or Specifying Domains of the Construct "Consumer Videogame Engagement". According to the scale development procedure [33, 34], the research should be specific in defining the construct—what needs to be included or excluded in the construct. Accordingly, this study defines consumer videogame engagement as *"a psychological state that triggers due to two-way interactions between the consumer and video-game product, which generates different level of consumer engagement states (cognitive, affective and behavioral)."* This study is mainly interested in measuring consumer videogame engagement regarding consumer's cognitive, affective, and behavioral engagement in videogame playing.

Besides, Churchill Jr. [33] has suggested some techniques *(literature review, experience-surveys, focus-groups, and interviews)* that can be applied to generate initial scale items. This study applies an extensive literature review approach to get a list of scale items. According to the literature review process suggested by [33], it has been discussed that a study should clearly explain how the variable is defined and how many factors/dimensions it has.

Through conducting an in-depth literature review, this study concludes that consumer videogame engagement is a multidimensional construct that comprises the three engagement states *cognitive, affective, and behavioral*. These three engagement states are further categorized into two subdimensions, for instance, conscious attention and absorption as dimensions of cognitive engagement, while dedication and enthusiasm represent affective engagement. Lastly, interaction and social interaction together refer to the state of behavioral engagement.

This study compiles the measurement scales as already reported in the literature which is specifically relevant to the following dimensions: conscious attention, absorption (cognitive engagement), dedication, enthusiasm (affective engagement), social interaction, and interaction (behavioral engagement). The items on the following dimensions such as conscious attention, six items (items 1 to 6) from [35], item 7 from [36], and item 8 from [24] are adapted. For the absorption dimension, this study adapts the scale from [37], whereas the measurement items for dedication are organized as item 1 from [38] and item 2 to item 7 from [39] and the scale items of enthusiasm are adapted from the study of [35]. However, the items of social connection such as item 1 to item 4 from [35] and remaining items 5, 6, and 7 from [40] are adapted. Finally, the scale items on the interaction dimension

are adapted as item 1 to item 5 from [37]. In this phase, the study has generated 39 items that together measure the overall construct of consumer videogame engagement [32]. Next, this study performs the content validity on the generated 39 items.

4.1.2. Content Validity. According to [41], *content validity is a subjective but systematic assessment of how sound the domain content of a construct is explained by its indicators*. This study has invited 4 Ph.D. students and two experts specializing in Marketing to first evaluate the content of consumer videogame engagement and the relevance of 39 measurement items, second to assess the relevance of a dimension and its measuring items, and lastly to check the wording of the item content. Based on their comments and recommendations, this study revised and corrected certain items [32]. Following this procedure, the overall scale of consumer videogame engagement has satisfied the prerequisite of content validity.

4.2. Study One: First-Time Data Collection and Purification. To further purify the instrument of consumer videogame engagement, this study has collected data from teenage students and analyzes the data through internal consistency analysis and exploratory factor analysis. The reason behind the selection of teenage students is teenage students are considered the main population in studying videogame-consumption behavior, because they are not merely the first-generation of *"home-based"* console videogame-players such as *"Nintendo, Sega-Genesis, and Sony-PlayStation,"* but they are yet labeled as enthusiastic videogame-players today [42].

This study has applied a multistage sampling technique to collect the study subjects. According to [43], multistage sampling technique involves the replication of two fundamental steps; step one is listing, and the other is sampling. Initially, this study has generated a list of four main states *(Penang, Selangor, Johor, and Perak)* of Malaysia. Next, it has randomly selected one state *(Perak)* from the list of four main states of Malaysia. From the Perak state, this study has obtained a list of intuitions both colleges and universities from the following source *(*http://www.malaysiauniversity.net*)*. From this list, the study has randomly selected one public University and one private University. Within each selected university, the teenage students aged 16–19 of foundation/diploma and 1st year undergraduate programs were invited to participate in the survey. In the case of public university, the diploma students of these two faculties *(faculty of architecture, planning and survey and faculty of arts and design)* were randomly selected to participate in the study survey, while, in the private university, this study has randomly selected the foundation and 1st year undergraduate students of these faculties *(IT and Engineering stream)*.

During the phase of data collection, the study questionnaire has been distributed and collected in the classroom setting under the presence of a lecturer. In total, this study has distributed 205 questionnaires in both universities, out of which 165 questionnaires were returned with a response rate of 0.81%. Out of 165 questionnaires, this study left with 136 valid cases after deleting the missing values. The demographic profile of the respondents for data collection one (sample 1 $N = 136$) and data collection two (sample 2 $N = 270$) is given in Table 1.

Table 1: Demographic profile of respondents.

	Sample 1 ($N = 136$), % EFA	Sample 2 ($N = 270$), % CFA
Gender		
Male	55.1	63.3
Female	44.9	36.7
Age (years)		
15-16	0	1.1
17-18	16.2	19.6
19	83.8	79.3
Ethnicity		
Malay	88.2	38.1
Chinese	10.3	50.0
Indian	1.5	11.9
Education		
Secondary school student	3	11.5
Diploma/foundation student	109	28.9
Fresh undergraduate student	24	59.6
Frequency of videogame play		
Everyday	33.1	39.6
Once a week	19.1	20.4
A few times a week	47.8	40.0
Average daily hours of videogame play		
1–4 hrs/daily	66.9	71.5
Above 4–8 hrs/daily	30.1	24.1
Above 8–12 hrs/daily	2.2	2.6
More than 12 hrs/daily	.7	1.9
Answers generated in multiple response setting (percent of cases means each percentage is out of 100)		
Most genre of videogames played		
Action	68.4	64.4
Adventure	64.0	60.4
Arcade	39.7	30.7
Shooter	58.1	54.8
Role-playing	39.7	47.0
Fighting	55.9	47.0
Strategy	60.3	58.1
Sports game	45.6	34.8
Racing	60.3	45.2
Casual	22.1	22.6
Children' entertainment	14.0	11.1
Family entertainment	22.8	14.8
Flight	14.0	14.4
Other videogames/genre	8.1	6.7
Most common platform for videogame players		
Personal computer	81.6	78.5
Dedicated gaming console	43.4	23.7
Smartphone	70.6	66.7
Wireless device	20.6	22.6
Dedicated handheld device	8.1	8.1
Others	.7	0

Table 2: Exploratory factor analysis (sample 1 $N = 136$).

		Six-Factors extracted based on Eigen values						Cronbach's alpha
		1	2	3	4	5	6	
Conscious attention (Eigen value = 10.949)	ConAtten2	.863						0.893
	ConAtten1	.854						
	ConAtten3	.779						
	ConAtten4	.760						
	ConAtten5	.696						
Enthusiasm (Eigen value = 2.579)	Enthusi6		.907					0.861
	Enthusi2		.772					
	Enthusi3		.755					
	Enthusi5		.635					
	Enthusi1		.598					
Interaction (Eigen value = 1.818)	Interact4			.837				0.877
	Interact5			.801				
	Interact3			.779				
	Interact2			.715				
	Interact1			.606				
Absorption (Eigen value = 1.630)	Absorp3				.857			0.863
	Absorp2				.820			
	Absorp1				.815			
	Absorp6				.729			
	Absorp5				.663			
Dedication (Eigen value = 1.141)	Dedicate2					.797		0.834
	Dedicate4					.793		
	Dedicate3					.784		
	Dedicate5					.608		
	Dedicate7					.413		
Social connection (Eigen value = 1.084)	SocialCon3						.871	0.787
	SocialCon2						.830	
	SocialCon1						.788	

The next section has analyzed the collected data on the basis of internal consistency analysis also known as reliability analysis and exploratory factor analysis.

4.2.1. Purification: Exploratory Factor Analysis (EFA) and Reliability Analysis. The data were further analyzed through exploratory factor analysis using the *promax* rotation to drop the number of items and explore the factors for consumer videogame engagement. The items were dropped on having a loading lower than 0.40 on single factor as well as on their associated cross-loadings [44]. In total we had generated 39 items for consumer videogame engagement, but out of 39 items, we loaded 34 items to explore the factors for consumer videogame engagement. The remaining 5 items were used for redundancy analysis as discussed in the later stage and out of 5 items; only 3 items were better capturing the whole construct of consumer videogame engagement.

The result of factor analysis is shown in Table 2. Table 2 resulted with six-factor solution based on Eigen values as suggested by [45]. This study further examined the reliability of the construct which should be more than 0.70 as mentioned by [46] and Table 2 showed that all dimensions had reliability of more than .70 which means the construct met the criteria of reliability assessment.

4.3. Study Two: Second-Time Data Collection and Reanalysis of the Measurement Construct. Study two also followed the same procedure of multistage sampling technique. The only difference is that this study has extended the survey from two universities to 5 institutions. This time, the study has distributed around 365 questionnaires in five institutions, out of which the study has successfully collected 300 questionnaires with a response rate of 82%. After treating the missing values, the study was left with 270 valid responses and the demographic details of the respondents were given in Table 1. In the next section, we analyzed the confirmatory factor analysis and other validity tests on using sample 2 comprising 270 respondents.

4.3.1. Analysis. SEM-PLS *(structural equation modeling-partial least squares)* was employed to validate the measurement construct of consumer videogame engagement because

Table 3: Confirmatory factor analysis and construct validity (convergent and discriminant validity) Sample 2 (N = 270).

Construct scale	Item	Convergent validity		CR	Cronbach's alpha
		Loadings	AVE		
Conscious attention	Con.Atten1	0.854	0.72	0.93	0.91
	Con.Atten2	0.864			
	Con.Atten3	0.841			
	Con.Atten4	0.854			
	Con.Atten5	0.840			
Absorption	Absorp1	0.735	0.61	0.89	0.84
	Absorp2	0.728			
	Absorp3	0.832			
	Absorp5	0.802			
	Absorp6	0.808			
Dedication	Dedicate2	0.832	0.64	0.90	0.86
	Dedicate3	0.849			
	Dedicate4	0.819			
	Dedicate5	0.821			
	Dedicate7	0.678			
Enthusiasm	Enthusi1	0.756	0.65	0.90	0.86
	Enthusi2	0.846			
	Enthusi3	0.837			
	Enthusi5	0.813			
	Enthusi6	0.768			
Social connection	Social.Con1	0.895	0.75	0.90	0.84
	Social.Con2	0.850			
	Social.Con3	0.857			
Interaction	Interact1	0.819	0.68	0.91	0.88
	Interact2	0.808			
	Interact3	0.873			
	Interact4	0.821			
	Interact5	0.792			

consumer videogame engagement has both reflective and formative constructs [47]. This study has further employed SEM-PLS, which is currently used by many academics as it delivers a robust way to analyze the survey data [47]. Moreover, PLS has less restriction on sample size and data distribution, and it has the potential to measure the measurement model and structural model simultaneously [39]. The current study is mainly on scale validation. Therefore, structural model assessment is not applicable. The next section follows the measurement model.

4.3.2. Measurement Model. The construct of consumer videogame engagement is a multidimensional construct, which comprises the reflective-formative model. For a reflective measurement model, this study involves the estimation of internal consistency, convergent validity, and discriminant validity, whereas the evaluation of the measurement model of a formative construct follows different guidelines such as testing of multicollinearity, indicator weights, and redundancy analysis.

4.3.3. Evaluation of Reflective Measurement Model. Initially, a reflective measurement model was assessed for its convergent validity. Convergent validity was measured through factor loadings greater than 0.60 [48], composite reliability desirable at 0.70, and average variance extracted that should be at least 0.50 [41, 49]. The results in Table 3 claimed that all standards of convergent validity were met, whereas factor loadings were more than 0.60, and composite reliability and Cronbach's alpha were greater than 0.70, while AVE of all constructs exceeded the critical value 0.50.

4.3.4. Discriminant Validity. Discriminant validity of reflective constructs was evaluated through newly introduced method called Heterotrait-Monotrait ratio of correlations [50]. The criterion to evaluate the discriminant validity is to assess the HTMT value; if it exceeds the HTMT value of 0.85, then there is an issue of discriminant validity. According to Table 4, all the values passed the critical value of HTMT.85 which represents that discriminant validity is not a problem.

Table 4: Discriminant validity Heterotrait-Monotrait (HTMT).

	Absorption	Conscious attention	Dedication	Enthusiasm	Interaction	Social connection
Absorption						
Conscious attention	0.67					
Dedication	0.70	0.83				
Enthusiasm	0.81	0.71	0.74			
Interaction	0.57	0.60	0.64	0.66		
Social connection	0.41	0.57	0.49	0.55	0.62	

Table 5: Evaluation of formative constructs (full collinearity, weights, and T-value).

Construct	Measurement model	Items	Weights	VIF	T-values	P values
Cognitive engagement	Formative	ConsAtten	0.72	1.54	7.33	0.00
		Absorption	0.39	1.54	3.24	0.00
Affective engagement	Formative	Dedication	0.48	1.671	4.90	0.00
		Enthusiasm	0.62	1.671	6.35	0.00
Behavioral engagement	Formative	Interaction	0.76	1.399	10.86	0.00
		Social connection	0.36	1.399	4.16	0.00

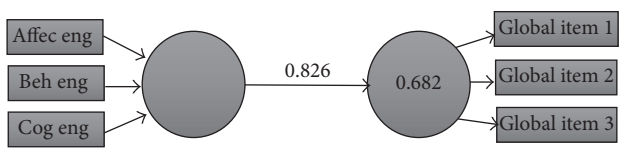

Figure 1: The result of redundancy analysis/convergent validity is shown.

4.3.5. Evaluation of Formative Measurement Model. This study has assessed the three criteria for the evaluation of formative measurement model as suggested by [41]. The first criterion to assess the convergent validity is the redundancy analysis. To do redundancy analysis in this study, the formative constructs were loaded on an exogenous latent variable named *"consumer videogame engagement"* predicting endogenous latent-variable labeled *"global measure"* that comprises the three reflective items. The path coefficient between the two constructs is desired to be at least 0.80 as recommended by [41]. The results indicated that the path coefficient between consumer videogame engagement and global measure was 0.826 as shown in Figure 1, which was higher than the threshold value and thus demonstrating that the formative constructs have achieved the convergent validity.

Additionally, this study has assessed the second criterion to check the collinearity issues in the formative constructs. The study found that there is no multicollinearity issue because of all values as shown in Table 3 are below the threshold value of 5 as suggested by [41]. The third criterion is to check the significance of the indicator weights on the designated second-order formative constructs. If indicator weights are significant then formative construct fulfills the criteria to be in the construct [41] and this study assessed the significance of indicator weights as shown in Table 5 and found that all formative constructs were highly significant at 0.00 level.

5. Discussion

The present study discussed the concept of engagement in videogame studies and also debated on previous scales of engagement in videogame literature. We reviewed each of the engagement scale and discussed its limitations and issues. We also discussed that previous measurements were limited to measure engagement from these theoretical constructs *immersion, flow, presence, involvement, and absorption*, which were more related to player's psychological engagement (cognitive engagement) in videogame playing. However, another psychological dimension such as affective engagement and behavioral dimension was largely ignored to apply in examining the player's engagement in digital game playing. Therefore, we took this opportunity to develop a new scale coined as consumer videogame engagement that had both psychological (cognitive and affective) and behavioral dimensions. To develop a scale for consumer videogame engagement, we applied the definition of consumer engagement that is generally defined as follows: engagement is a multidimensional construct which is subject to a context-specific expression of relevant cognitive, emotional, and behavioral dimensions. So, we adapted this definition in videogame context and defined the construct of consumer videogame engagement as it is a psychological state that triggers due to two-way interactions

between the consumer and videogame product, which generates different level of consumer engagement states (cognitive, affective, and behavioral). On the basis of consumer videogame engagement definition, we applied the scale development approach to develop a scale for consumer videogame engagement. During the validation process, we extracted a six-factor solution for consumer videogame engagement. We further analyzed the six-factor solution for the evaluation for reflective measurement model and then, we also assessed the six factors on their designated second-order construct such as cognitive, affective, and behavioral engagement for the evaluation of formative measurement model on second-order or higher-order level. We found that consumer videogame engagement is a multidimensional and valid source for capturing player's engagement in terms of both psychological (cognitive and affective engagement) and behavioral engagement. The newly developed and validated scale provides a better tool to assess engagement in videogame playing as it covers three aspects of player's engagement in game playing such as player's cognitive, affective, and behavioral engagement.

This study has several contributions and enhanced the studies of [4, 5, 19, 22–24] which have been particularly conducted on engagement in videogame studies. For instance, this research is first among videogame studies that have considered both psychological and behavioral dimensions to measure the construct of consumer videogame engagement. Secondly, the construct of consumer videogame engagement has been properly conceptualized as a multidimensional construct comprising cognitive, affective, and behavioral dimensions and accordingly developed a scale for measuring consumer videogame engagement. Thirdly, the scale of consumer videogame engagement has been validated as a reflective-formative model such as being reflective on the first-order and formative on the second-order. The results of the study have met both the criteria that have been suggested for the assessment of reflective and formative measurement model.

This study first conceptualized the definition of consumer videogame engagement and developed the scale for consumer videogame engagement. The data were collected in two phases. EFA and CFA were conducted to validate the scale of consumer videogame engagement. We further analyzed the consumer videogame engagement on the multidimensional level and results showed that consumer videogame engagement is a multidimensional and a reflective-formative construct.

Competing Interests

The authors declare that they have no competing interests.

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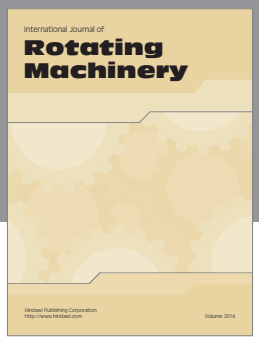

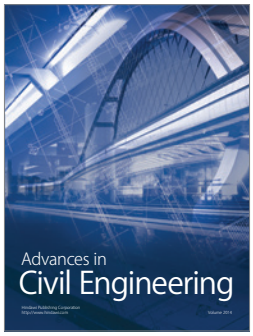

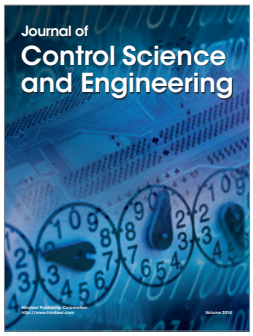

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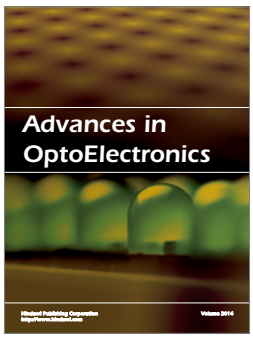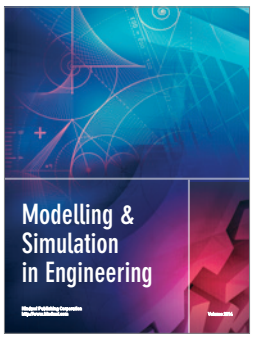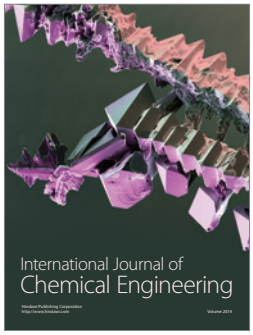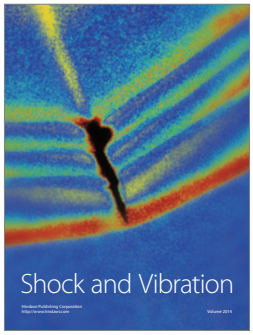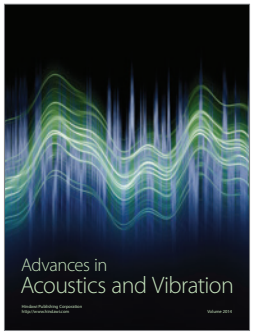
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