

Storifying a Serious Mobile Game: Exploring Players' Perception of Storification Features, Narrative Engagement, and Behavioral Intentions

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ABSTRACT

Storifying gameful designs helps to engage players with desirable behavioral implications via enhanced narrative experience, the benefits of which are particularly prominent for developing serious mobile games to overcome their technical and contextual constraints. To understand the multifaceted nature of players' narrative engagement with storified gameplay and provide guidance for future designs accordingly, in the present study, we conducted an online survey ($N = 238$) among users of eQuoo, a mobile app developed for improving users' well-being with heavy storytelling components. With reflective-formative partial least squares modeling, we found participants' evaluation of eQuoo's storification features was positively associated with their narrative presence and identification in a statistically significant manner, which were further positively associated with their future use intention of and purchase intention on eQuoo. The findings with respect to the third dimension of narrative engagement examined in the study, suspension of disbelief, however, were comparatively inconsistent. Theoretical and design implications were discussed for future research and practice on storification and gamification on mobile platforms.

CCS CONCEPTS

• **Applied computing** → **Psychology**; • **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

Storification, Gamification, Serious mobile game design, Narrative engagement, Behavioral intention



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1 INTRODUCTION AND RELEVANT WORK

1.1 Storification in Serious Mobile Game

Storification—the use of emotion-evoking and sense-making stories [27], is a rising technique applied to pedagogical practices that promises to engage people with learning processes and improve their learning outcomes [3]. Its potential naturally converges with another related domain—*gamification* that leverages important game elements to create meaningful and engaging gameful experience to facilitate both individual and societal development, be they about full-fledged serious games or applications involving a small selection of relevant game elements [25]. As such, storifying gameful designs is considerably beneficial as it fosters effective narrative communication and makes intended goals more relevant towards sustained player engagement with pertinent causes [14].

Compared to computer games, mobile game designs are confronted with more challenges to realize the needed level of player engagement due to both technical constraints such as small screen size and restricted touch input [22], and situational distractions in that mobile gaming usually affords greater flexibility to free players from completing a game session in one sitting [2]. Taken further, compared to mobile games that are primarily designed for entertainment purposes and thereby less subject to worries about player engagement, serious games that triangulate learning, play, and fidelity [45] requires more sophisticated design thinking to retain a certain level of player engagement to fulfill its pedagogy-oriented purposes. Against these backdrops, incorporating and improving storytelling with quality storification features into serious mobile game designs is particularly important and serves as a promising remedy as it would engage players with not only the mechanics part of gameplay, but also the absorbing and vivid narratives.

Then, what kind of storification features can be brought into serious mobile game designs? Research on persuasive storytelling yields two interconnected definitions of narrative. One is storyline-focused that conceptualizes narrative as “the suggestion of a character or characters and the representation of an event or events,” while the other definition amplifies the experientiality in narrative processing by considering it as “a portrayal of the inner world of a character—his or her views, perspectives, emotions, motivations, or goals [16]” [4] (p.201). Despite their conceptual nuances, two critical components emerge to separate narrative from other message formats, respectively a themed plot and relevant acting characters. Accordingly, storification features in a mobile game are also expected to be categorized into either storyline-oriented (e.g., plots, events) or character-oriented (e.g., character profile, character avatar) genres, and these two types of features individually or collectively have potential to influence how players experience their storified mobile gameplays.

Over the years, researchers have proposed various theoretical models to explain narrative effects from the perspective of storyline-and/or character-induced psychological experience, ranging from the transportation-imagery model [21] and the extended elaboration likelihood model [49] to the more recent exploratory emphasis on deictic shift in narrative processing [26]. These models contrast narrative with rhetorical persuasion tactics and highlight the pivotal role of narrative engagement in augmenting the narrative effects. As a multidimensional construct, narrative engagement seeks to capture one’s cognitive and affective processing of story contents [8, 19]. Some dimensions describe general experience with the narrative, while other dimensions might be specific to the processing of the storyline, or to the in-story character [8, 12, 19]. In what follows, we discuss three interconnected dimensions particularly important to storifying user experience with mobile games designed primarily for non-entertainment purposes, respectively narrative presence, suspension of disbelief, and identification.

1.2 Narrative Presence, Suspension of Disbelief, and Identification

The game world is an alternate space to the real world, adding a storytelling component to which is nothing but reinforcing such as a distinction by putting players mentally into a space with possibly greater contrast to their daily life. In this respect, it is important to blur the mental boundary between the game world and the real world so that players can fully enjoy the in-game narrative experience. As such, Busselle and Bilandzic [8] proposed the concept *narrative presence*, defined as “the sensation of being present in a narrative world due to comprehension processes and perspective taking” (p.325), as a crucial component of the desired narrative engagement. This construct emphasizes readers’ experience with every aspect of the storytelling, a perfect combination of which helps to mentally involve, or *transport* them into the storyworld so as to influence their story-induced cognition, emotion, and behaviors [18, 20].

In light of the two components of a narrative, that is, storyline and character, there are accordingly two inherent threats to psychologically achieving the needed level of narrative presence, and thereby narrative engagement. For storyline, while stories are

crafted by writers, some of which might be based on real events, it is not uncommon to alter and/or exaggerate some parts of the story contents to create sensational values [33] and increase the vividness [9]. Albeit effective in cognitively and effectively engaging readers, such practices also risk boomeranging if the contents are perceived deviating from the reality too much. Such lack of perceived realism has various evaluative manifestations, including readers considering events depicted in the story as not plausible, uncommon, or not factual compared to real life events, and considering the story itself of poor quality and full of inconsistent details [10]. These disbeliefs in turn, will trigger more elaborate processing of story contents that prompts readers to scrutinize encountered information in the story to a greater extent, which interrupts narrative engagement [7]. Hence, engaging players into narrative gameplays requires their *suspension of disbelief* that functions as a form of perception of realism [32] to facilitate uncritical processing of story contents [6] to avoid compromising narrative experience.

In addition to the storyline, players usually have an avatar as their in-game representation; in narrative games, this player-controlled avatar is most likely the central character of a story. Depending on game designs, this avatar can be similar or dissimilar to oneself on aspects such as physical appearance, personality traits, life experience, and interpersonal styles, among others. Such differences can potentially lead players to be more aware of their self-identity as distinctly separate from their in-game avatar’s, which might prevent them from engaging with the gameplay by taking the avatar’s perspectives [15, 56]. Therefore, the idea of merging one’s own identity with media characters, that is, *identification*, is considered as an important enabler in enriching mediated experience [11]. More specifically, identification is not only a significant gateway to absorbing players into the game world [34], but also a prominent mechanism underlying narrative effects [13] as documented in empirical research.

Taken together, narrative presence, suspension of disbelief, and identification with in-game avatar constitute three important dimensions of players’ narrative engagement with the storified gameplay in general, the story content, and the central in-story character. Naturally, better-designed storification features will help to enhance the desired narrative engagement. We therefore predict the positive association between players’ perception of storification features and their narrative engagement as follows:

H1: Players’ perception of character-focused storification features is positively associated with their (a) narrative presence, (b) suspension of disbelief, and (c) identification with in-game avatar.

H2: Players’ perception of storyline-focused storification features is positively associated with their (a) narrative presence, (b) suspension of disbelief, and (c) identification with in-game avatar.

1.3 Narrative Engagement and Behavioral Intentions

Enhancing players’ narrative engagement during gameplays has important behavioral implications for serious mobile game designs and development. Serious games, after all, are designed to convince users of believing in and acting upon respective promoted causes [37]. Yet, recent work on game-based interventions has cautioned designers to “not to make the serious game too serious” that risks

patronizing users [50]. Persuasion literature also offers complementary insights about the downsides of conventional persuasive tactics such as logic-based argumentation that can easily incite people’s defensive reactions including counterarguing [40] and psychological reactance [41]. Against these backdrops, leveraging the power of storification in serious mobile games—a form more vivid and entertaining than “serious” tactics, brings in natural advantages of encouraging players to continue following the game’s lead via enhanced narrative experience [49] that helps to overcome resistance to persuasion [38]. Hence, we predict that a higher level of narrative engagement is associated with stronger intention to continue using the mobile app that features a storified serious game. State formally:

H3: Players’ continued use intention of the mobile app that features a serious game is positively associated with their (a) narrative presence, (b) suspension of disbelief, and (c) identification with in-game avatar during the gameplay.

In addition to future use intention, nowadays many mobile apps provide premium plans for users to unlock advanced features with additional costs. Then, can increased narrative engagement lead to stronger purchase intention on the app that hosts a storified serious game? Empirical research on branding and consumer behavior suggests so such that narrative engagement with storified messages is positively associated with consumers’ purchase intention of branded products [17, 39]. Yet, the purchase intention of mobile games goes beyond simple storytelling because it also involves users’ other utility-oriented considerations such as playfulness, price, and reward [29], and game level and free items [31]. Therefore, the expected narrative influence, if any, might not be sufficiently salient to alter one’s purchase intention. To probe this relationship, we propose a research question (RQ) as follows instead:

RQ1: How is players’ purchase intention on the mobile app that features a serious game associated with their (a) narrative presence, (b) suspension of disbelief, and (c) identification with in-game avatar during the gameplay?

2 METHOD

To test the hypotheses and answer the research question, we conducted an online survey among users of *eQuoo*, a serious mobile game app designed for helping people develop their emotional health and build resilience [51]. It is a choose-your-own-adventure type game where each level first teaches specific skills related to emotional health, and then the player has to use those skills and select suitable options for their character in fictional story world scenarios to complete levels. This app was chosen for it heavily utilizing storytelling elements in designing the gameplay to introduce the core content and engage players. It has also been used as the study context in previous research on serious mobile games [35], making it a solid base for relevant studies including the present one. The study protocol followed the pertinent university’s ethical guidelines and was evaluated by the ethics committee prior to data collection.

2.1 Participants

A total number of 406 *eQuoo* users signed up and consented to participate in our study. After removing those who failed the attention check (including all partial responses) and those who were considered as outliers (more details in the *Data processing and analysis* section below), the final dataset for analysis consisted of 238 participants. In the sample, there were 164 participants who self-identify as female, 43 as male, 6 as non-binary, 2 as transgender female, 1 as transgender male, and 8 preferring not to answer with a few missing responses. The median age of all participants was 33 years ($SD = 10.8$, $Min = 17$, $Max = 80$).

2.2 Data Collection

2.2.1 Procedure. *eQuoo* users were recruited via an ad banner in the app that was shown to them when they had finished the first five levels of the game, ensuring that the participants all had roughly equal amount of playing time and active engagement with the game. After providing their informed consent, participants answered the survey in randomized block orders. Upon completion, they were directed to a website to receive their compensation voucher for a one-year subscription to the *eQuoo Next Generation* (i.e., the next edition of the game). The data collection took place from July, 2021 to April, 2022, during the Covid-19 pandemic.

2.2.2 Measures. Unless indicated, all the items were measured on seven-point Likert scales where 1 = strongly disagree and 7 = strongly agree.

To measure players’ evaluation of main storification features in *eQuoo*, we created six features based on both key elements of general fiction literature [36] and *eQuoo*-specific characteristics (e.g., the presence of the *eQuoo* guide named Joy). For each feature, we asked participants to rate the extent to which they considered it of good quality (1 = very poor and 7 = very good) and important (1 = very unimportant and 7 = very important) in their use of *eQuoo*.

To measure narrative engagement, we prepared six items for narrative presence adapted from the MEC spatial presence questionnaire (MEC-SPQ) [53] and Busselle & Bilandzic [8], four items for suspension of disbelief adapted from MEC-SPQ [53], and six items for identification adapted from Cohen [11]. To measure behavioral intentions, we prepared four items for future use intention of *eQuoo* adapted from Venkatesh et al. [52] and four items for future purchase intention of *eQuoo* adapted from Yoo & Donthu [58]. Entire subscales from these inventories were used in compiling the full inventory used in this survey.

The detailed instrument and descriptive statistics are listed in Table 1.

2.3 Data Processing and Analysis

Preprocessing of the data was handled in R 4.2 [42] and Rstudio 2022.02.3 [46] using *tidyverse* [55] and *careless* [57] packages. To ensure data quality in this lengthy survey that was filled out primarily on mobile devices, two methods were used to filter out respondents not paying full attention to filling out the questionnaire. First, the survey included some attention check items and wrong answers to those items were filtered out. This removed 158 primarily partial respondents from the data set. Second, a response pattern-based

Table 1: Measurement Items

Variable	Items	M (SD)
Perceived quality of storification features	The characters in the eQuoo stories.	5.10(1.28)
	The characters you were assigned to play in eQuoo.	5.00(1.35)
	The eQuoo guide; Joy.	5.15(1.27)
	The plots and events in the eQuoo stories.	5.27(1.27)
	The ideas and themes discussed in the eQuoo stories.	5.83(1.13)
	The places and settings in which eQuoo stories are set.	5.04(1.41)
Perceived importance of storification features	The characters in the eQuoo stories.	5.32(1.24)
	The characters you were assigned to play in eQuoo.	5.13(1.45)
	The eQuoo guide; Joy.	5.44(1.38)
	The plots and events in the eQuoo stories.	5.62(1.22)
	The ideas and themes discussed in the eQuoo stories.	6.17(1.01)
	The places and settings in which eQuoo stories are set.	4.85(1.54)
Narrative Presence	While using eQuoo, my body was in the room, but my mind was inside the world created by its stories.	3.90(1.28)
	eQuoo feels like a new world, and that world disappeared when I stopped using the app.	
	At times while using eQuoo, the story world was closer to me than the real world.	
	I felt as though I was physically present in the environment of the eQuoo stories.	
	It seemed as though I actually took part in the action of the eQuoo stories.	
	I felt like I was actually there in the environment of the eQuoo stories.	
Suspension of Disbelief	While using eQuoo, I concentrated on whether there were any inconsistencies in the eQuoo stories. (R)	4.37(1.39)
	While using eQuoo, I didn't really pay attention to the existence of errors or inconsistencies in the eQuoo stories.	
	While using eQuoo, it was not important for me whether the eQuoo stories contained errors or contradictions.	
Identification	When eQuoo characters succeeded I felt joy, but when they failed, I was sad.	4.71(1.07)
	eQuoo stories affected me emotionally.	
	While using eQuoo, I could feel the emotions the characters portrayed.	
	While using eQuoo, I felt I could really get inside the characters' head.	
	At key moments in the eQuoo stories, I felt I knew exactly what the characters were going through.	
Use Intention	While using eQuoo, I wanted the characters to succeed in their actions.	
	I intend to continue using eQuoo apps in the future.	5.62(1.00)
	I will try to use eQuoo apps in my daily life.	
	I plan to continue to use eQuoo apps.	
Purchase Intention	I want to use eQuoo apps.	
	I will definitely spend money on an eQuoo app.	2.65(1.50)
	I intend to spend money on an eQuoo app.	
	It is likely that I will use money on an eQuoo app.	

filtering was conducted by calculating the streaks of identical responses, and then filtering out respondents who had streaks longer than 2 standard deviations ($SD = 7.77$) above the average streak length ($M = 11.13$, $Mdn = 9$). This method acknowledges that streaks of some length are natural and should not be removed as outliers, and places a statistical threshold above which they are considered as outliers. This outlier removal removed 10 additional respondents, leaving a total sample size of 238 for the analysis.

The reflective-formative Partial Least Squares (PLS) model was built in R using *SEMInR* package [44] and plotted using *DiagrammerR* package [30]. PLS is considered a suitable structural modeling

method for data with moderate sample sizes, complex models, and does not assume normally distributed data [23, 24].

In our proposed model, we chose to model higher-order storification features in a *formative* rather than *reflective* manner because they had not been defined a priori in the study. As a result, the formative part features two composite variables, respectively (1) character-focused storification influenced by players' ratings of non-player characters (NPCs as in "The characters in the eQuoo stories" measurement item), player-controlled character (PC as in "The characters you were assigned to play in eQuoo"), and guide ("The eQuoo guide; Joy"), and (2) storyline-focused storification influenced by players' ratings of plots and events ("The plots and

events in the eQuoo stories”), ideas and themes (“The ideas and themes discussed in the eQuoo stories”), and places and settings (“The places and settings in which eQuoo stories are set”).

Indicator reliability was checked and items loading under 0.6 were rejected including one item from *Suspension of Disbelief* scale and one from *Purchase Intentions*. Internal consistency reliability of the scales was assessed with ρ _C, *Cronbach’s alpha*, and ρ _A which all passed the recommended threshold of 0.7 [23] except ρ _A for *Suspension of Disbelief* scale which was barely below 0.7 (see Table 2). We therefore consider the internal consistency reliabilities for the used measures sufficient. Convergent validity of each construct was assessed with average variance extracted (AVE) score that was above the recommended threshold [23] of 0.5 for each scale (see Table 2).

Discriminant validity between the measures was assessed using heterotrait-monotrait ratio (HTMT) of correlations [28] and found to be below 0.9 and therefore acceptable for conceptually similar constructs [28], see Table 3. Variance Inflation Factor (VIF) was used to assess indicator collinearity, and no collinearity problems were detected (all VIFs <5, see Table 4). The indicator weights and confidence intervals were bootstrapped with 10000 samples.

3 RESULTS

Figure 1 and Table 5 presents key standardized path coefficients and bootstrapped CIs.

In support of H1(a) and H1(c), participants’ evaluation of character-focused storification features was positively associated with their narrative presence and identification with in-story character in a statistically significant manner. The proposed association with suspension of disbelief, however, was found weak and statistically non-significant as shown in Table 5, thus rejecting H1(b).

Likewise, in support of H2(a) and H2(c), participants’ evaluation of storyline-focused storification features was positively associated with their narrative presence and identification. The association with suspension of disbelief was also positive ($\beta = 0.210$) with the 95% CI [-0.007, 0.422] indicating that there was more likely a true positive association in the population. Relatively, the standardized coefficients suggest a stronger positive association between the storyline-focused storification features (compared to the character-focused ones) and the three narrative engagement dimensions.

For the association between narrative engagement and behavioral intention, supporting H3(b) and H3(c), we found that a higher level of suspension of disbelief and identification was statistically significantly associated with stronger intention of continued use of eQuoo in the future. Comparatively, the association between identification and use intention was stronger ($\beta = 0.446$). With respect to narrative presence, the association was weaker and the 95%CI [-0.058, 0.272] indicated that a positive association was more likely to be observed in the population.

In answering RQ1, we found a moderate positive association between narrative presence and purchase intention with statistical significance. The association between identification and purchase intention was found also likely to be positive in the population (95%CI [-0.064, 0.272]). For suspension of disbelief, however, the association was found to be more likely negative in the population (95%CI [-0.221, 0.037]).

4 DISCUSSION

Through an online survey among eQuoo users, we found overall, better character- and storyline-focused storification features helped to foster users’ narrative engagement with serious mobile gameplay, and the heightened narrative engagement was in most cases further associated with stronger use intention of and purchase intention on eQuoo in the future. Among the three dimensions of narrative engagement examined in the study, those positive associations were rather consistent for narrative presence and identification. Comparatively, for the storification—narrative engagement sequence, the evaluation of storyline-focused storification features was found more strongly correlated with narrative engagement than that of character-focused features, suggesting more prominent influence imposed by the storyline than the in-story character on enhancing players’ narrative experience. For the narrative engagement—behavioral intention sequence, narrative presence was more strongly correlated with purchase intention and identification more strongly correlated with use intention, suggesting their differential impacts on players’ behavioral intentions. That is, feeling being there in the storyworld (i.e., narrative presence) might help players immerse themselves and enjoy the narrative and gameplay to a greater extent, while feeling identified with the in-story character (i.e., identification) helps to establish a deeper player-character connection that prompts players to continue investing in the gameplay and enriching that connection. These findings altogether add to existing literature on storifying serious mobile games, narrative engagement, and gamification by identifying narrative processing mechanisms critical to different aspects of player experience and associated behavioral consequences.

Suspension of disbelief, unlike the other two dimensions of narrative engagement, was found having statistically nonsignificant, relatively weaker, or even directionally opposite correlations with storification features or behavioral intentions. The nonsignificant and weaker associations could be explained by people’s general tolerance of small inconsistencies and/or flaws in a story as long as they do not preclude narrative understanding [5, 54]. Hence, the level of suspension of disbelief was less subject to players’ evaluation of character construction and eventual descriptions, and the resultant use intention of the storified gameplay examined in the present study. For the negative association between suspension of disbelief and purchase intention, we speculate that the engendered critical processing of the story looking for its inconsistencies and errors might instead challenge players in their storified gameplay. In consequence, more disbelief of the story contents actually increased their interest in the story, enticing them to willingly make additional purchases in the future to follow up as if they were to solve a puzzle.

4.1 Theoretical and Design Implications

Taken together, our findings contribute to three lines of research. First, while previous research on storification has often investigated its utility in formal pedagogical contexts such as transforming students’ physical learning space to improve their academic performance [3], our study builds on prior relevant work [1] and extends its application to a relatively informal context, that is, a mobile platform with the goal of improving users’ psychological well-being.

Table 2: Reliabilities

	alpha	rhoC	AVE	rhoA
Character-focused storification	0.805	0.873	0.699	1.000
Storyline-focused storification	0.759	0.814	0.611	1.000
Narrative Presence	0.863	0.897	0.597	0.893
Suspension of Disbelief	0.682	0.819	0.605	0.784
Identification	0.836	0.880	0.551	0.839
Use Intention	0.838	0.892	0.676	0.857
Purchase Intention	0.943	0.963	0.898	0.951

Table 3: Heterotrait-Monotrait Ratio (HTMT) of Correlations

	Character	Plot	Narrative Presence	Suspension of Disbelief	Identification	Use Intention	Purchase Intention
Character	-						
Storyline	1.023	-					
Narrative Presence	0.583	0.603	-				
Suspension of Disbelief	0.155	0.254	0.191	-			
Identification	0.672	0.672	0.866	0.248	-		
Use Intention	0.609	0.642	0.540	0.367	0.664	-	
Purchase Intention	0.362	0.423	0.425	0.075	0.370	0.357	-

Table 4: Variance Inflation Factor (VIF)

	Narrative Presence	Suspension of Disbelief	Identification	Use Intention	Purchase Intention
Character	2.573	2.573	2.573		
Storyline	2.573	2.573	2.573		
Narrative Presence				2.363	2.363
Suspension of Disbelief				1.036	1.036
Identification				2.387	2.387

The results will enrich research on storification and game-based learning with insights drawn from eQuoo users' perceptions of critical storification features in a gameplay and how those perceptions might affect users' narrative engagement—an experiential state important to facilitating desirable cognitive, affective, and behavioral outcomes.

Second, our study contributes to research on gamification across mobile platforms. In addition to features relevant to game mechanics and rules that focus on agent-invoked actions [48], our results provide perspectives from storytelling, in particular character- and storyline-related features, along with induced narrative experience that potentially could influence users' app-specific behavioral intentions. We found on mobile platforms, different storification features exerted distinct impacts on users' various dimensions of narrative engagement, which was further differentially associated with their use intention and purchase intention. This finding thus implicates the necessity to take the characteristics of mobile contexts into consideration when incorporating storified game designs.

Third, we found that the three dimensions of narrative engagement—narrative presence, suspension of disbelief, and identification were correlated with eQuoo users' behavioral intentions in dissimilar ways. Those variances further corroborate the multidimensional nature of narrative engagement [8, 19] and implicate the importance of treating each sub-dimension as a theoretically unique construct when examined in future research.

Going beyond, our study also identified diverse pathways towards positive outcomes for game designers and mobile app developers who plan to include storified elements. The consistent and prominent findings with respect to storyline-focused storification features indicates the benefits of improving the quality of story plots with novel manifestations when designing storified serious mobile games in the future. In addition, designers and developers should also consider their endpoints of interest when promoting narrative gameplays in that users' future app-related intention of use and purchase might be correlated, but they are sometimes influenced by different indicators of different magnitudes.

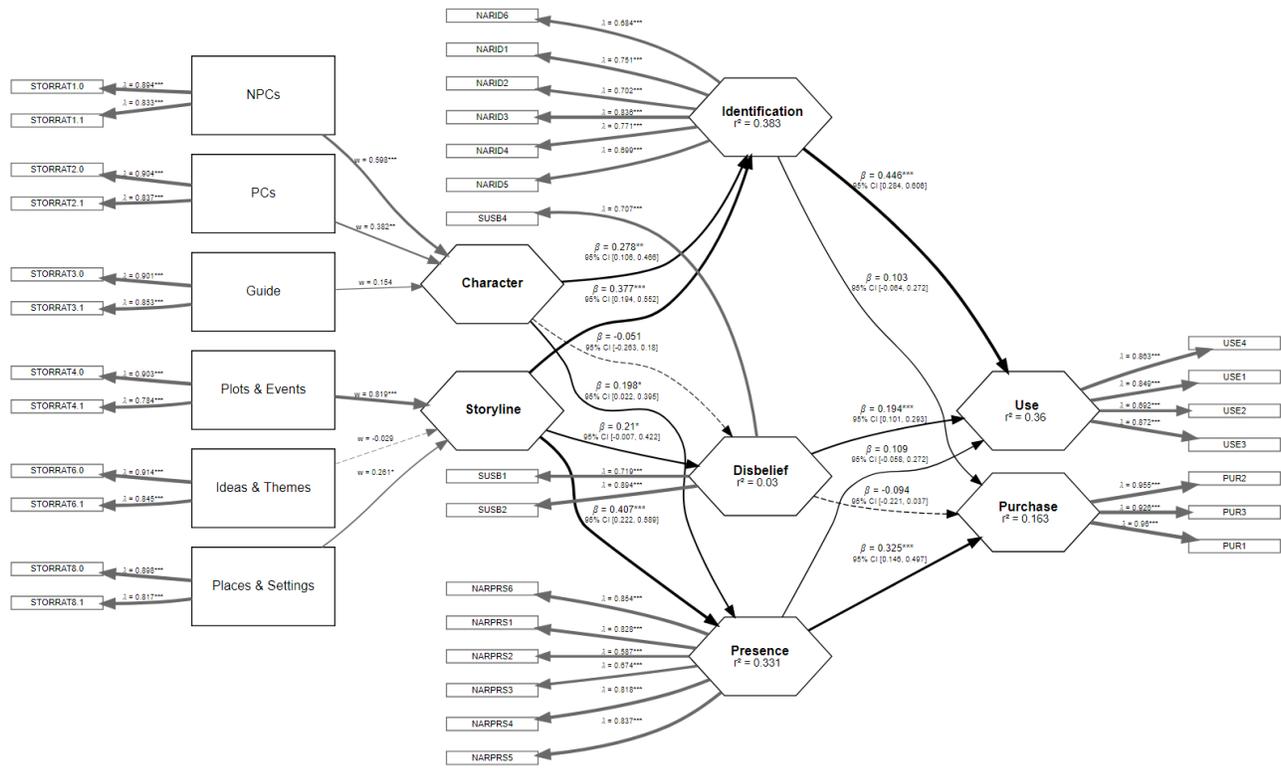


Figure 1: PLS model

Table 5: Standardized Path Coefficients and Bootstrapped Confidence Intervals (CI)

Proposed Paths	β	<i>t</i> -value	<i>p</i> -value	2.5% CI	97.5% CI
NPCs → Character	0.942	24.883		0.842	0.987
PCs → Character	0.871	17.421		0.755	0.949
Guide → Character	0.672	8.830		0.511	0.809
Plots & Events → Storyline	0.981	52.009		0.927	0.998
Ideas & Themes → Storyline	0.473	4.99		0.281	0.653
Places & Settings → Storyline	0.804	14.257		0.678	0.899
Character → Narrative Presence	0.198	2.062	.020	0.022	0.395
Character → Suspension of Disbelief	-0.051	-0.460	.667	-0.263	0.180
Character → Identification	0.278	3.026	.001	0.106	0.466
Storyline → Narrative Presence	0.407	4.377	.000	0.222	0.589
Storyline → Suspension of Disbelief	0.210	1.946	.026	-0.007	0.422
Storyline → Identification	0.377	4.122	.000	0.194	0.552
Narrative Presence → Use Intention	0.109	1.292	.099	-0.058	0.272
Narrative Presence → Purchase Intention	0.325	3.683	.000	0.146	0.497
Suspension of Disbelief → Use Intention	0.194	3.946	.000	0.101	0.293
Suspension of Disbelief → Purchase Intention	-0.094	-1.425	.922	-0.221	0.037
Identification → Use intention	0.446	5.495	.000	0.284	0.606
Identification → Purchase intention	0.103	1.203	.115	-0.064	0.272

4.2 Limitations and Future Work

To further improve storified gameful designs and explore the role of narrative engagement, researchers could address the limitations of our study and continue this line of inquiry in future work. First major limitation is that the current study was quite specific in scope. We examined six general storification features and formally modeled them into two broad genres based on the definitions of narrative [4]. Albeit a good starting point, this approach could benefit from more empirical validations. Therefore, it is encouraged to investigate storification features at a more granular level also with theory-driven thinking and pinpoint how they would be correlated to one's narrative experience.

Also, in the present study, we focused on just three dimensions of narrative engagement critical to augmenting players' experience with storified gameplays in our specific study context. Yet, the narrative persuasion literature informs the presence of other salient dimensions including narrative understanding and emotional engagement [8, 19]. Future research then, could continue probing the antecedents and outcomes of those other dimensions in storification and gamification towards a more systematic understanding of narrative engagement in mobile serious gaming contexts. Additionally, as only single app was examined in this study, the current results are primarily applicable to the users of eQuoo, which cautions the generalization of the results. Further research is necessary to see to what extent these findings hold in other storified mobile apps, and to extend the scope to other storification features, narrative engagement dimensions, player types, and other relevant factors in this complex topic.

While the recruitment via ad banner in the app after first five levels ensured that the respondents had roughly similar experience with the app, it also introduced some level of selection bias where the persons willing to participate in the survey were those who have felt the app was somehow meaningful use of their time. Furthermore, as this was an uncontrolled survey-based study, many potential confounding factors could affect the results, for example, the special conditions of Covid-19 pandemic during which the data was collected and its effects on mental health, emotional well-being, and the need for finding self-management tools that could be used under different degrees of isolation. These limitations are all presumably reflected in the results also, and they should be interpreted with that in mind. To continue this line of research into storification of serious mobile games, more controlled studies, preferably longitudinal with proper control groups, are needed in the future.

Finally, the self-report use intention of and purchase intention on eQuoo examined in our study need to be interpreted carefully in light of the intention-behavior gap that challenges the assumption that intentions always lead to actual behaviors [47]. In particular with respect to the purchase intention—purchase behavior sequence, various concerns beyond simple evaluations of a mobile game per se, such as financial risk assessment and worries about overspending [43] can impede the realization of concrete behaviors. Therefore, in future studies, proper longitudinal studies are needed to establish the connection between behavioral intention and actual behavior in the context of serious storified mobile games to investigate the influence of storification features and narrative engagement.

5 CONCLUSION

In conclusion, in the current study, we explored how mobile game players evaluated the quality and importance storification features in shaping their in-game experience that might further influenced their behavioral and purchase intentions. Our findings implicated future research, practice, and design of storified serious mobile games with unique perspectives from players' psychology. We then encourage researchers to extend our study to further examine pathways toward favorable post-game outcomes with a more representative sample, more controlled study setup that attenuates the influences of confounding factors, and a more diverse selection of game contexts to help yield generalizable findings with respect to storification and gamification.

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REFERENCES

- [1] Sanne Akkerman, Wilfried Admiraal, and Jantina Huizenga. 2009. Storification in History education: A mobile game in and about medieval Amsterdam. *Computers & Education* 52, 2 (2009), 449–459.
- [2] Sky LaRell Anderson. 2019. Touchscreen travelers: Hands, bodies, agency, and mobile game players. *Convergence* 25, 1 (2019), 77–94.
- [3] Isabella Aura, Lobna Hassan, and Juho Hamari. 2021. Teaching within a Story: Understanding storification of pedagogy. *International Journal of Educational Research* 106 (2021), 101728.
- [4] Helena Bilandzic and Rick Busselle. 2013. Narrative persuasion. *The Sage handbook of persuasion: Developments in theory and practice 2* (2013), 200–219.
- [5] Saskia Böcking. 2008. Limits of Fiction? From Suspension of Disbelief towards a Theory of Tolerance for the Usage of Fictional Films.
- [6] Saskia Böcking. 2008. Suspension of disbelief. *The international encyclopedia of communication* (2008).
- [7] Rick Busselle and Helena Bilandzic. 2008. Fictionality and perceived realism in experiencing stories: A model of narrative comprehension and engagement. *Communication theory* 18, 2 (2008), 255–280.
- [8] Rick Busselle and Helena Bilandzic. 2009. Measuring narrative engagement. *Media psychology* 12, 4 (2009), 321–347.
- [9] Yu-Hung Chien and Wen-Te Chang. 2015. Effects of message framing and exemplars on promoting organ donation. *Psychological Reports* 117, 3 (2015), 692–702.
- [10] Hyunyi Cho, Lijiang Shen, and Kari Wilson. 2014. Perceived realism: Dimensions and roles in narrative persuasion. *Communication research* 41, 6 (2014), 828–851.
- [11] Jonathan Cohen. 2001. Defining identification: A theoretical look at the identification of audiences with media characters. *Mass communication & society* 4, 3 (2001), 245–264.
- [12] Sonya Dal Cin, Mark P Zanna, and Geoffrey T Fong. 2004. Narrative persuasion and overcoming resistance. *Resistance and persuasion* 2, 175–191 (2004), 4.
- [13] Anneke De Graaf, Hans Hoeken, José Sanders, and Johannes WJ Beentjes. 2012. Identification as a mechanism of narrative persuasion. *Communication research* 39, 6 (2012), 802–823.
- [14] Sebastian Deterding. 2016. Make-believe in gameful and playful design. In *Digital make-believe*. Springer, 101–124.
- [15] Edward Downs, Nicholas D Bowman, and Jaime Banks. 2019. A polythetic model of player-avatar identification: Synthesizing multiple mechanisms. *Psychology of popular media culture* 8, 3 (2019), 269.
- [16] Monika Fludernik. 2002. *Towards a 'natural' narratology*. Routledge.
- [17] Jason Freeman, Lewen Wei, Hyun Yang, and Fuyuan Shen. 2022. Does in-Stream Video Advertising Work? Effects of Position and Congruence on Consumer Responses. *Journal of Promotion Management* 28, 5 (2022), 515–536.
- [18] Richard J Gerrig. 2018. *Experiencing narrative worlds: On the psychological activities of reading*. Routledge.
- [19] AM Graaf, JAL Hoeken, JM Sanders, and JWJ Beentjes. 2009. The role of dimensions of narrative engagement in narrative persuasion. *Communications* 34, 4 (2009), 385–405.
- [20] Melanie C Green and Timothy C Brock. 2000. The role of transportation in the persuasiveness of public narratives. *Journal of personality and social psychology* 79, 5 (2000), 701.
- [21] Melanie C Green and Timothy C Brock. 2003. In the mind's eye: Transportation-imagery model of narrative persuasion. In *Narrative impact*. Psychology Press,

- 315–341.
- [22] Holly Grothues, Andrea Abney, and Ryan Boughter. 2022. Mobile Game Usability: Design and Research. *Game Usability: Advice from the Experts for Advancing UX Strategy and Practice in Videogames* (2022), 311.
- [23] Joseph F Hair Jr, G Tomas M Hult, Christian M Ringle, and Marko Sarstedt. 2021. *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage publications.
- [24] Joseph F Hair Jr, G Tomas M Hult, Christian M Ringle, Marko Sarstedt, Nicholas P Danks, and Soumya Ray. 2021. Partial least squares structural equation modeling (PLS-SEM) using R: A workbook.
- [25] Juho Hamari. 2007. Gamification. *The Blackwell Encyclopedia of Sociology* (2007), 1–3.
- [26] Anne Hamby, David Brinberg, and James Jaccard. 2016. A conceptual framework of narrative persuasion. *Journal of Media Psychology* (2016).
- [27] Lobna Hassan, Sebastian Deterding, J Tuomas Harviainen, and Juho Hamari. 2019. Fighting Post-truth with Fiction: An Inquiry into Using Storification and Embodied Narratives for Evidence-Based Civic Participation. *Storyworlds: A Journal of Narrative Studies* 11, 1 (2019), 51–78.
- [28] Jörg Henseler, Christian M Ringle, and Marko Sarstedt. 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science* 43, 1 (2015), 115–135.
- [29] Kuo-Lun Hsiao and Chia-Chen Chen. 2016. What drives in-app purchase intention for mobile games? An examination of perceived values and loyalty. *Electronic commerce research and applications* 16 (2016), 18–29.
- [30] Richard Iannone. 2022. *DiagrammeR: Graph/Network Visualization*. <https://CRAN.R-project.org/package=DiagrammeR> R package version 1.0.9.
- [31] Moonkyoung Jang, Rumi Lee, and Byungjoon Yoo. 2021. Does fun or freebie increase in-app purchase? *Information Systems and e-Business Management* 19, 2 (2021), 439–457.
- [32] Qihao Ji and Arthur A Raney. 2016. Examining Suspension of Disbelief, Perceived Realism, and Involvement in the Enjoyment of Documentary-Style Fictional Films. *Projections* 10, 2 (2016), 125–142.
- [33] Yahui Kang, Joseph Cappella, and Martin Fishbein. 2006. The attentional mechanism of message sensation value: Interaction between message sensation value and argument quality on message effectiveness. *Communication Monographs* 73, 4 (2006), 351–378.
- [34] Dong Dong Li, Albert Kien Liau, and Angeline Khoo. 2013. Player–Avatar Identification in video gaming: Concept and measurement. *Computers in Human Behavior* 29, 1 (2013), 257–263.
- [35] Silja Litvin, Rob Saunders, Markus A Maier, and Stefan Lüttke. 2020. Gamification as an approach to improve resilience and reduce attrition in mobile mental health interventions: a randomized controlled trial. *PLoS one* 15, 9 (2020), e0237220.
- [36] lucycrichton. 2018. The Seven Elements Of A Successful Story. <https://www.thepeoplesfriend.co.uk/2018/09/13/the-seven-elements-of-a-successful-story/>. Accessed: 2022-07-31.
- [37] David R Michael and Sandra L Chen. 2005. *Serious games: Games that educate, train, and inform*. Muska & Lipman/Premier-Trade.
- [38] Emily Moyer-Gusé and Robin L Nabi. 2010. Explaining the effects of narrative in an entertainment television program: Overcoming resistance to persuasion. *Human communication research* 36, 1 (2010), 26–52.
- [39] Thanh-Thao Nguyen and Bianca Grohmann. 2020. The influence of passion/determination and external disadvantage on consumer responses to brand biographies. *Journal of Brand Management* 27, 4 (2020), 452–465.
- [40] Richard E Petty, Zakary L Tormala, and Derek D Rucker. 2004. Resisting persuasion by counterarguing: An attitude strength perspective. (2004).
- [41] Brian L Quick, Lijiang Shen, and James Price Dillard. 2013. Reactance theory and persuasion. *The SAGE handbook of persuasion: Developments in theory and practice* (2013), 167–183.
- [42] R Core Team. 2022. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>
- [43] Aina Ravoniarison and Cédric Benito. 2019. Mobile games: players’ experiences with in-app purchases. *Journal of Research in Interactive Marketing* (2019).
- [44] Soumya Ray, Nicholas Patrick Danks, and André Calero Valdez. 2022. *seminr: Building and Estimating Structural Equation Models*. <https://CRAN.R-project.org/package=seminr> R package version 2.3.2.
- [45] Pauline Rooney. 2012. A theoretical framework for serious game design: exploring pedagogy, play and fidelity and their implications for the design process. *International Journal of Game-Based Learning (IJGBL)* 2, 4 (2012), 41–60.
- [46] RStudio Team. 2022. *RStudio: Integrated Development Environment for R*. RStudio, PBC, Boston, MA. <http://www.rstudio.com/>
- [47] Paschal Sheeran and Thomas L Webb. 2016. The intention–behavior gap. *Social and personality psychology compass* 10, 9 (2016), 503–518.
- [48] Miguel Sicart. 2008. Defining game mechanics. *Game studies* 8, 2 (2008), 1–14.
- [49] Michael D Slater and Donna Rouner. 2002. Entertainment—education and elaboration likelihood: Understanding the processing of narrative persuasion. *Communication theory* 12, 2 (2002), 173–191.
- [50] Ton AM Spil, Vincent Romijnders, David Sundaram, Nilmini Wickramasinghe, and Björn Kijl. 2021. Are serious games too serious? Diffusion of wearable technologies and the creation of a diffusion of serious games model. *International journal of information management* 58 (2021), 102202.
- [51] PsycApps Ltd (UK). 2022. eQuoo. <https://www.equoo.com/>
- [52] Viswanath Venkatesh, James YL Thong, and Xin Xu. 2012. Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *Management Information Systems Quarterly* 36, 1 (2012), 157–178.
- [53] Peter Vorderer, Werner Wirth, Feliz Ribeiro Gouveia, Frank Biocca, Timo Saari, Lutz Jäncke, Saskia Böcking, Holger Schramm, Andre Gysbers, Tilo Hartmann, et al. 2004. MEC Spatial Presence Questionnaire. (2004).
- [54] Patrick Weber and Werner Wirth. 2014. When and how narratives persuade: The role of suspension of disbelief in didactic versus hedonic processing of a candidate film. *Journal of Communication* 64, 1 (2014), 125–144.
- [55] Hadley Wickham, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D’Agostino McGowan, Romain François, Garrett Golemund, Alex Hayes, Lionel Henry, Jim Hester, Max Kuhn, Thomas Lin Pedersen, Evan Miller, Stephan Milton Bache, Kirill Müller, Jeroen Ooms, David Robinson, Dana Paige Seidel, Vitalie Spinu, Kohske Takahashi, Davis Vaughan, Claus Wilke, Kara Woo, and Hiroaki Yutani. 2019. Welcome to the tidyverse. *Journal of Open Source Software* 4, 43 (2019), 1686. <https://doi.org/10.21105/joss.01686>
- [56] Kevin D Williams. 2010. The effects of homophily, identification, and violent video games on players. *Mass Communication and Society* 14, 1 (2010), 3–24.
- [57] Richard D. Yentes and Francisco Wilhelm. 2021. *careless: Procedures for computing indices of careless responding*. R package version 1.2.1.
- [58] Boonghee Yoo and Naveen Donthu. 2001. Developing a scale to measure the perceived quality of an Internet shopping site (SITEQUAL). *Quarterly journal of electronic commerce* 2, 1 (2001), 31–45.