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Telepresence in Video Game Streaming: Understanding Viewers' Perception of Personal Internet Broadcasting

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A B S T R A C T

A new trend has been emerging in recent years, with video game live streaming becoming a meeting ground for gamers, as well as a marketing strategy for game developers. In line with this trend, the emergence of the "Let's Play" culture has significantly changed the manner in which people enjoyed video games. In order to academically explore this new experience, this study seeks to answer the following research questions: (1) Does engaging in video game streaming offer the same feeling as playing the game? (2) If so, what are the factors that affect the feeling of telepresence from viewers' perspective? and (3) How does the feeling of telepresence affect viewers' learning experience of the streamed game? We generated and empirically tested a comprehensive research model based on the telepresence and consumer learning theories. The research findings revealed that the authenticity and pleasantness of the streamer and the interaction of viewers positively affect telepresence, which in turn is positively associated with the gained knowledge and a positive attitude toward the streamed game. Based on the research findings, various practical implications are discussed for game developers as well as platform providers.

Keywords: Personal Internet Broadcasting, Telepresence, Game Streaming, Consumer Learning

Ⅰ. Introduction

Personal internet broadcasting has been gaining significant attention of late, creating a huge market in diverse genres such as news, entertainment, and hobbies (Yu et al., 2018). For example, viewers spent 292 billion minutes overall watching Twitch, and 2.2 million unique streamers broadcast their activities on the platform in 2016 (Johnson and Woodcock, 2019), making it one of the most popular

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marketing platforms, with more than 17.5 daily visitors and 400 million live streamers every month (Twitch, 2020). Among the diverse content and genre, video game live streaming has become very popular, providing a virtual meeting ground for gamers (Sjöblom and Hamari, 2017). The video game streaming medium combines the video broadcasts with a chat window, enabling communication between the streamers (BJ, creators) and viewers (users), in conjunction with the game play of the streamer (Johnson and Woodcock, 2019). Platforms such as Twitch and AfreecaTV in Korea are traditionally popular for video game live streaming, while YouTube Live has also recently been spotlighted as a video game streaming platform (Kim and Ko, 2019). According to a recent survey conducted in Korea, the viewership of personal internet broadcasting remained high at 67% of the population (Kim and Ko, 2019), and the content of online and mobile games is one of the most popular genres globally (Sjöblom et al., 2019; Yu et al., 2018).

Furthermore, video game streaming cannot be discussed independent of the emerging "Let's play" (LP) culture (Sjöblom and Hamari, 2017). Game streaming not only demonstrates the game play of the streamer, but also viewers' active feedback and comments to the streamer on "how to" and "what to" play games generate a feeling of playing games "together." On account of this interactive aspect of LP, watching two different game streaming contents of the same video game will provide a totally different experience and perspective on the game. Additionally, the concept of telepresence, the feeling of "being there" in the virtual context, is especially important in video game streaming (Huang et al., 2017). However, in the current metaverse era, converging various technology such as virtual reality and augmented reality, the previous conceptualization of telepresence should be extended and contextualized; that is, a virtual event held in the metaverse, the participants should feel the similar feeling as the offline one. For example, in the context of metaverse-mediated business meeting, the attendants should feel that they are really attending, speaking, and listening, in the meeting, not merely feeling of being there. Similarly, the current research context, video game streaming, the concept of telepresence should capture the feeling of actually playing the streamed game. Therefore, it is crucial to understand what characteristics of video game streaming make viewers tune into the stream to generate the feeling of "playing together" and eventually want to play on their own.

Given that the live streaming of video games has become the "mecca" for gamers, there is a growing interest among game developers and video game-related businesses to utilize the platform as a marketing channel. Previous studies in this context, however, have focused on the technological characteristics of the platforms; very few studies have examined platform, streamer, and viewer characteristics concurrently or their effects on viewer experience. Furthermore, viewers' learning experience of video game streaming has yet to be thoroughly examined. From the research motivation mentioned above, this study seeks answers to the following questions: (1) Does engaging in video game streaming offer a feeling of actually playing the game? (2) If so, what are the factors that affect the feeling of telepresence[1)] from viewers' perspective? and (3) How does the feeling of telepresence affect viewers' learning experience of the streamed game?

The remainder of the paper includes in-depth liter-

1) The viewer's perceived sense of actually "playing the game" through the engagement of streamed games.

ature reviews of game streaming, theory of telepresence, and consumer learning. Succeeding the theoretical background, the conceptual framework for the research is introduced. Subsequently, the research model and hypotheses are developed and presented. The research methodology of the study is explained later, followed by the results of the statistical analyses. Finally, theoretical and practical implications are discussed based on the findings of the study.

Ⅱ. Literature Review and Development of Conceptual Framework

2.1. Personal Streaming Platform and the Emergence of "Let's Play" Culture

Personal internet broadcasting platforms, such as Twitch, AfreecaTV, and more recently YouTube Live, albeit with minor difference in the looks of their interface, subscription, and reward system, similarly combine both live audio/video media and text-based chat channels (Chen and Lin, 2018). Different platforms have diverse names for streamers; BJ (AfreecaTV), YouTuber or Creator (YouTube), and Streamer (Twitch); however, they can be used interchangeably. In the context of video game streaming, "streamers" is the generally used term.

Streamers utilize the platform's broadcasting features to stream game plays real-time, where the viewers watch and engage in the stream through chatting. The typical interaction between the streamer and the viewer is as follows: The streamer talks to the viewers through the platform's broadcast audio, where viewers then try to communicate with the streamer and with each other through messages using the chat feature. The streamer attempts to read through the chat messages and responds accordingly as he/she plays. Through this interaction, the viewers can ask the streamer to perform certain behaviors in the game real-time, enabling the viewer to experience the game without purchasing it (Johnson and Woodcock, 2019).

Specifically, viewers of the game streaming are not merely watching, in terms of watching a TV or a film, but are actively sharing the whole gaming experience with the streamer, often emotionally. Such unique characteristics of game streaming characterize the "Let's Play" (LP) culture. In the LP genre of game streaming, the streamer talks a great deal and actively interacts with the viewers. It is different from competition, game reviews, and how to play, which are some of the other frequent forms of video game streaming (Sjöblom and Hamari, 2017).

Considering the interactive and complex nature of the LP culture, the streaming platform's technological quality or characteristics, the streamer's quality such as expertise and personality and the viewer's characteristics in watching video game streaming simultaneously affect viewers' perception and experience such as telepresence.

2.2. Theory of Telepresence

Telepresence refers to the sense of being in a mediated environment (Held and Durlach, 1992; Steuer, 1992) or the mental process of perceiving a mediated world as non-mediated (Lee and Griffith, 2004), or is simply defined as "perceptual illusion of non-mediation" (Lombard and Ditton, 1997). The term was first coined by Minsky (1980) in reference to teleoperation systems for remote manipulation of physical objects. It stems from the larger notion of "presence," which (Steuer, 1992) characterizes as "the key to defining virtual reality in terms of human

experience rather than technological hardware," and is widely used in research on virtual reality (Cha and Im, 2009; Faiola et al., 2013; Nelson et al., 2006; Suh and Lee, 2005).

Telepresence has become a very important concept in the virtual context. In order to identify the recent trend in telepresence-related research, we conducted comprehensive and systematic literature reviews. In selecting relevant studies, we referred to the Association for Information Systems website to identify high quality journals (Li et al., 2011). Among these journals, to extract relevant, recent studies, we searched journal articles published between 2015 and 2020 from the Web of Science online database using the keyword "telepresence." The search has finally yielded 20 articles. We examined each article to determine if it is a behavioral empirical work that investigates the relationship between telepresence and its associated constructs. Consequently, eight articles were retained, summarized in <Table 1>.

Accordingly, virtual reality contexts have been gaining popularity recently. With regard to the antecedents of telepresence, media, technology, and user characteristics have been studied, but there is no

<Table 1> Antecedents and Outcomes of Telepresence in Recent Behavioral Studies

Author (Year)	Antecedents	Outcomes	Research Context
Guo et al. (2016)	N/A	Flow (s, +)	Online learning
Huang et al. (2017)	Self-transcendence (s, +)	Flow (s, +)	Online gamers
Pelet et al. (2017)	N/A	Enjoyment (s, +), Concentration (s, +), Challenge (s, +), Control (s, +), Curiosity (s, +)	Social media
Lim and Ayyagari (2018)	Standardization of Specification (s, +), Sensory Descriptiveness (s, +), Interactivity (s, +), Feedback Quality (s, +)	N/A	E-commerce setting
Baker et al. (2019)	N/A	Perceived Usefulness (n.s.), Trust (s, +), Enjoyment (s, +)	Virtual world shopping experiences
Kim and Ko (2019)	Vividness (s, +), Interactivity (s, +)	Flow Experience (s, +)	Virtual Reality Spectatorship (VRS)
Park et al. (2019)	Media Types (Still, Motion picture, vs. VR) (s)	N/A	Product-focused Virtual Reality (VR)
Peukert et al. (2019)	Immersion (s, +)	Perceived Enjoyment (s, +)	Virtual Reality stores
Han et al., (2020)	N/A	Playfulness (s, +)	Virtual Reality shopping
Loureiro et al., (2021)	Pleasure (s, +)	Behavioral Intention (s, +)	Virtual Reality stores
Orús et al., (2021)	Content type (Real > Digital)	Ease of imagination (s, +) Visual appeal (s, +) Intention to book (s, +)	Virtual and Augmented reality
Yang and Gong (2021)	Mobile user interface (s, +), Mobile game affordance (s, +)	Meaningful engagement (s, +) Mobile game addiction (s, +)	Mobile game

Note: s = significant, n.s. = not significant, + = positive relationship, − = negative relationship

research examining streamers' characteristics. Furthermore, no study has considered these three aspects simultaneously. Flow is one of the most frequent dependent variables of telepresence; as far as we know, no studies have dealt with consumer learning-related variables concurrently in the virtual context.

As you can see in <Table 1> the previous studies on telepresence and its antecedents in the game context have focused on game players' attributes like self-transcendence (Huang et al., 2017) or game elements such as user interface and achievement, socialization, and immersion affordance (Yang and Gong, 2021). As far as we know, the academic attempt to examine telepresence in the video game streaming context and viewers' perspectives have not been done before; therefore, telepresence should be conceptualized to fit in the game streaming context, and game streamers' traits should also be considered. Such initial approach to extend the concept of telepresence to indirect users such as viewers/audience will be significant in the current VR, AR, and metaverse era.

2.3. Consumer Learning and Game as Experience Goods

Consumer learning refers to any process that changes a consumer's memory and behavior as a result of information processing (Arnould and Epp, 2006). Previous research has indicated that rich, interactive, and engaging presentations of information enhance consumer learning (Li et al., 2003; Kim and Biocca, 1997). Learning is open to external influences in that it remains vulnerable to external factors such as a consumer's familiarity with a particular product, their motivations, and the ambiguity of various information environments (Hoch and Deighton, 1989).

The process of consumer learning comprises three dimensions: cognitive, affective, and conative (behavioral) (Lavidge and Steiner, 1961). Cognitive dimensions include knowledge and usefulness about products or services, affective dimensions are positive attitudes and affections toward it, and the conative aspect involves behavioral intentions such as purchase, recommendation, and word-of-mouth. The process is sometimes sequential, beginning with cognition, proceeding through affects, and concluding with conation, but not necessarily in that order (Daugherty et al., 2008; Suh and Lee, 2005) proved that virtual experience increases product knowledge, favorable brand attitude, and purchase intention of the product.

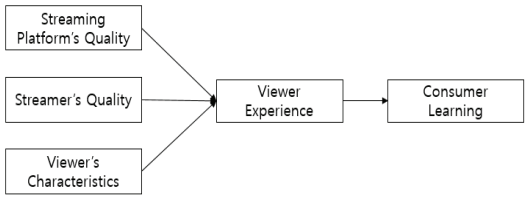
When the psychological process of consumer learning applies to video games, a rich, interactive, engaging experience plays an important role as experience goods. Similar to other media content such as movies and music, consumers cannot possibly assess the true value of the game until they have actually played it.

In this study, we assume that the richness, interactive features, and engaging presentations of games in streaming not only provide viewers with an idea of the kind of game, but also help them comprehend the game play and the kind of "fun" they may expect from actually playing the game. Video game streaming effectively reduces informational ambiguity to help viewers comprehend the game, and it motivates consumers to make wise decisions.

2.4. Conceptual Framework

From the theoretical background discussed thus far, the conceptual framework was developed. The quality of the streaming platform has been recognized to have an effect on viewer experience, the creation of telepresence toward the game. Additionally, considering the unique aspects of video game streaming,

the characteristics of both the streamer and the viewer are also considered to have an effect on viewers' perception of telepresence. As video games are experience goods, we assume that a viewer's experience of telepresence will result in consumer learning. <Figure 1> visualizes our conceptual framework discussed so far.



<Figure 1> Conceptual Framework

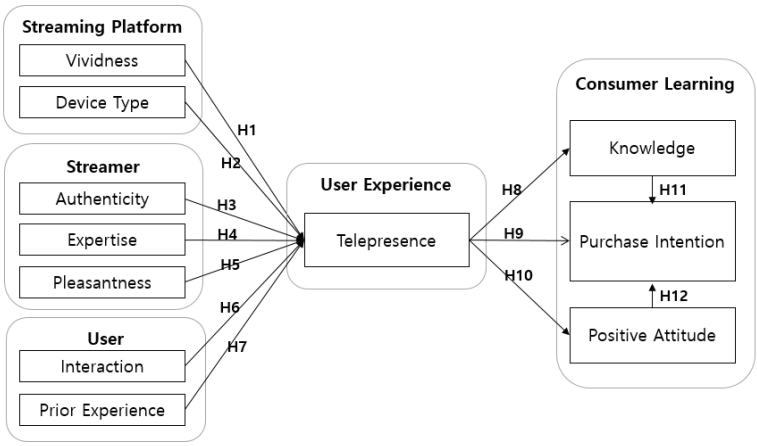
Ⅲ. Research Model and Hypotheses

Based on the conceptual framework in <Figure 1>, as well as comprehensive literature reviews on telepresence, consumer learning, and related concepts, the research model is generated as <Figure 2>.

First, the streaming platform's quality is one of the most frequently examined dimensions as antecedents of telepresence as demonstrated in <Table 1>. We included vividness such as high resolution of streaming platforms and device type (mobile or PC/laptop) in our research model. Meanwhile, other constructs frequently studied in previous telepresence research such as interactivity and feedback quality have been excluded, since it is a basic and an essential feature in current streaming platforms.

Second, the streamer's characteristics have been under-studied concepts so far; therefore, literature reviews on broadcasters, politicians, and other personalities are performed to extract proper constructs. To select appropriate variables to fit the research context from the literature-driven variable pool and check their content validity, several experts composed of ICT experts and mobile game marketers have been interviewed. Consequently, we decided to examine the role of authenticity, expertise, and pleasantness in our study considering the video game streaming context.

Third, as described in <Table 1>, the interactive features provided by the streaming platform had been frequently studied constructs in telepresence and video streaming studies; however, due to technological



<Figure 2> Research Model

advancement, interactivity became a basic and common feature of the platform; therefore, we regard interactive participation as game streaming viewers' characteristics instead of the platform's quality. User experience and consumer learning are affected by prior experience such as period, intensity, or engagement of certain products; from this perspective, we included the amount of time viewers played the streamed game as another antecedent.

Next, the focal construct of the current research, telepresence, represents viewer experience in the video game streaming context. Considering the study context, telepresence is defined as 'sense of actually playing the game', instead of 'sense of being there.'

Last, according to the consumer learning theory, knowledge about the streamed game (cognitive), positive attitude toward the game (affective), and purchase intention of the game (behavioral) are included as outcomes to telepresence.

3.1. Quality of Streaming Platform

3.1.1. Vividness

Vividness has been originally defined as the "represented richness of a mediated environment as defined by formal features; that is, the way in which an environment presents information to senses" (Steuer, 1992). In streaming platforms, the interface through which the viewers perceive the streamed game presents similar visionary and auditory cues as expected from the actual game play. The value of the imagery and auditory qualities have also been emphasized in AfreecaTV platform, for example, the streamer is afforded the ability to stream HD (high-dimension) game images (up to 2048k resolution) as the numbers of recommendations and viewers increase (i.e., as the rank of a streamer increases). Kim and Ko (2019), in the context of VR sports broadcasting, showed that the vividness of content is a significant antecedent to telepresence. Therefore, it is reasonable to assume that the quality of the streamed image and the sound of the game play a crucial role in providing a similar gaming experience, positively influencing telepresence, and thus we hypothesize:

H1: Vividness of the video game streaming is positively related to telepresence.

3.1.2. Device Type

In terms of other technological factors, the factor of the device type, whether mobile or PC/laptop device, was considered to be significantly related to the telepresence level. The two devices are very different in image size, ease of navigation, and comfort level (Kim, 2019). Therefore, we hypothesize that the differences between the two devices are associated with telepresence:

H2: Device type of video game streaming is positively related to telepresence.

3.2. Characteristics of Streamer

3.2.1. Authenticity

It is believed that people have an emotional attachment toward situations more if they are depicted accurately by the media than if they are depicted in an inaccurate manner (i.e., contain errors, dishonesty, or inconsistencies). Depictions that do not conform to natural occurrences could result in a quick discounting of immediate emotional responses, as their artificiality becomes evident (Zillmann, 2006). Furthermore, media depictions that depart from nat-

uralistic sensations will also most likely result in a psychologically distant user (Cupchik, 2002). These have been discussed in the way in which the media portrays the content; however, in the video game streaming context, the streamer's role as both the mediator of the gaming experience and the media content itself should be considered. Following this line of thought, any artificial expressions portrayed by the streamer will result in psychologically distant viewers who perceive the media content as external observers, causing a decrease in the level of telepresence toward the streamed game. Therefore, when a streamer expresses emotions based on the honest feeling he/she encounters while playing the game, it is perceived by the viewers as much more "believable," drawing in the viewers to share similar feelings and increasing the level of telepresence. In (Lee et al., 2020) recent study of politicians' twitter messages, perceived authenticity evaluates not only the messages as being sincere and/or accurate, but also assesses the candidates as intelligent and/or moral. Accordingly, we hypothesize:

H3: Authenticity of the streamer is positively related to telepresence.

3.2.2. Expertise

Previous studies regard celebrities as opinion leaders, influencers, and credible spokespersons (Kahle and Homer, 1985; Ohanian, 1990) in consumers' purchasing decisions. Additionally, consumers feel social and emotional bonds with favored famous persons, and get affected by their behaviors and attitudes (Doss, 1999; Fraser and Brown, 2002). Even though most streamers are not celebrities at first, the social bond formed between them and their viewers is similar in nature. Joo et al. (2019) proved that streamers' expertise, along with trustworthiness and likability, increases users' para-social interaction with streamers in the context of beauty contents. The viewers expect the streamer to be professional in streaming and also in the content, "game," which the streamer is offering the viewers. When a viewer's desire to confirm the credibility of the information delivered by the streamer is satisfied by the streamer's objective skillfulness and expertise in the game, the viewers are engrossed in the stream, experiencing telepresence. Effectively, the more skillful the streamer is at playing games, the greater the presence experienced by viewers. Therefore, we can hypothesize:

H4: Expertise of the streamer in playing the game is positively related to telepresence.

3.2.3. Pleasantness

Research by Berlo et al. (1969) confirmed that qualities such as boldness and grandiosity exhibited by the spokesperson in persuasive communication maximizes the effect of the message delivered. It is identified by emphatic, bold, active, and energetic features, and these may account for the pleasantness of the streamer as perceived by the viewers. Therefore, such pleasant features of the streamers or the manner in which they show the gaming experience to the viewers should play a role in viewers' involvement with the stream, affecting the level of telepresence. Likewise, entertaining aspects like the humorous appeal of live streaming and the streamers have been shown to be one of the significant drivers of both continuous watching intention and consumption intention of certain products/services (Hou et al., 2020). Accordingly, we can assume that:

H5: Pleasantness of the streamer is positively related

to telepresence.

3.3. Characteristics of Viewers

3.3.1. Interaction

According to Steuer (1992), interactivity, as an antecedent of telepresence, is defined as "the degree to which users can manipulate the form and content of a mediated environment in real time (p.84)." The technological characteristics of the medium adhering to the above factors have been identified to increase the level of telepresence in previous studies (Nah et al., 2011; Suh and Lee, 2005). In this study, we treat interactivity not as platform quality but as a viewer characteristic since interactivity is a default basic function of the streaming platform; hence we rename it "interaction." The viewers chat about and discuss with the streamer as well as other viewers the streamed game, past, current, and future game play, and other directly/indirectly related issues. Such interactions can make viewers feel they are actually playing the game; thus, we hypothesize:

H6: Interaction of the viewer is positively related to telepresence.

3.3.2. Prior experience

Given that the manner in which viewers watch the stream varies vastly, along with the contrasting motivation, the level of telepresence, as well as its effect on viewers' learning of the streamed game, will be affected by the characteristics of the viewers. It may vary among the viewers who actively engage in the stream through frequent chatting and participation in streamers' events, or there may be viewers who have played the streamed game and hence know what the gaming experience would be better than those who might have just started to learn the game through the stream. Therefore, the following hypothesis has been made:

H7: Prior game experience of the viewer is positively related to telepresence.

3.4. Telepresence and Consumer Learning

As discussed above, experiencing telepresence through media greatly increases users' understanding of the mediated content (Suh and Lee, 2005). Specifically, when the viewer engages in the stream with an increased level of telepresence, the experience also engages them in the learning processes and increases their comprehension of the streamed game. In addition, as has been discussed in the literature review of telepresence, it effects the "*memory*" of the user and can be used to "*persuade*" users, since presence positively influences message credibility (Kim and Biocca, 1997; Klein, 2003; Reeves and Nass, 1996), resulting in the positive attitude toward the game itself and increased purchase intention. Another explanation is that the experience of telepresence acts as a causal factor for arousal, the energy with which people react to media. In the gaming context, more arousal generated via the game increases the joy and excitement of the players, hence they are more likely to talk to their friends about the elevated experience. In the virtual shopping context, telepresence is positively associated with affective constructs (trust and enjoyment), but not cognitive variables (perceived usefulness) (Baker et al., 2019). Accordingly, we hypothesize as follows:

H8: Telepresence is positively related to knowledge about the streamed game.

H9: Telepresence is positively related to purchase intention of the streamed game.
H10: Telepresence is positively related to positive attitude of the streamed game.

We also hypothesize the relationship within consumer learning outcomes that the cognitive and affective dimensions of consumer learning are factors affecting behavioral aspects, as follows:

H11: Knowledge about the streamed game affects purchase intention of the game.
H12: Positive attitude toward the streamed game affects purchase intention of the game.

Ⅳ. Research Method

4.1. Measurement Items

The measurement items of research constructs used in the study are mostly based on previous studies and modified to match the video game streaming context. <Table 2> shows survey items with the relevant references; all were scored a 7-point Likert scale except prior experience.

<Table 2> Operational Definitions and Measurement Items of Research Constructs

Construct	Operational Definitions and Survey Items	References
Vividness	Definition: The degree of similarity in sensory depth and breadth of the streamed game and the actual game play. 1. I think the quality of the streamed image is adequate to understand what the game play is like. 2. I think the quality of the streamed image is satisfactory. 3. I think the quality of the streamed sound is adequate to comprehend what the game play is like. 4. I think the quality of streamed sound is satisfactory. 5. The streamed game provides similar screens as I perceive when I play the game.	Based on Kim and Ko (2019)
Device Type	Definition: The device type of video game streaming. 1. On what device do you watch video game streaming? (Mostly mobile / Mostly PC or laptop)	
Authenticity	Definition: The degree to which emotions expressed by the streamer is believable and not fake. 1. I think the expression made by the streamer about the game is believable. 2. I sympathize with the streamer's emotional expressions while playing games. 3. I think the streamer is honest in expressing emotions while playing games. 4. I think the streamer is consistent in expressing emotions about the game.	Based on Louden and McCauliff (2004)
Expertise	Definition: The degree of streamer's expertise in playing games. 1. I think the streamer is proficient in playing the streamed game. 2. I think the streamer is experienced in playing the streamed game. 3. I think the streamer has comprehensive knowledge of the streamed game. 4. I think the streamer is skillful in playing the streamed game.	Based on Choi (1999)

<Table 2> Operational Definitions and Measurement Items of Research Constructs(Cont.)

Construct	Operational Definitions and Survey Items	References
Pleasantness	Definition: The degree of streamer's pleasantness when streaming. 1. I think the streamer is entertaining. 2. I think the streamer is outgoing. 3. I think the streamer is cheerful. 4. I think the streamer is delightful.	Based on Baker et al. (2019); Broach Jr et al. (1995)
Interaction	Definition: The degree of the viewer's interaction with the streamer or other viewers. 1. I participate in chatting when watching video game streaming. 2. I have a conversation with the streamer or other viewers while watching video game streaming. 3. I express my opinion to the streamer or other viewers. 4. I tell the streamer that he/she should have played differently.	Based on Chen and Lin (2018)
Prior Experience	Definition: The period the viewer has played the video game. 1. How long have you played the video game you are currently watching? (Less than 1 month/1 – 3 months/3 – 6 months/6 – 12 months/More than 1 year)	
Telepresence	Definition: The viewer's perceived sense of actually "playing the game" through the engagement of streamed games. 1. While watching a streamed game, I feel as if I am playing the game with the streamer. 2. While watching a streamed game, I feel that I am engrossed in the game, even if I am not actually playing. 3. I can feel the emotions expressed by the streamer while watching the streamed game. 4. I think about the next move the streamer should make in the game.	Based on Kim and Biocca (1997); Park et al. (2019)
Knowledge of the streamed game	Definition: The level of a viewer's knowledge about the game after watching video game streaming. 1. I feel very knowledgeable about the game by watching the streaming. 2. I feel confident about my ability to tell others who have not played the game what the game is about. 3. If I have to purchase this game today, I would need to gather very little information in order to make a wise decision.	Based on Smith and Park (1992)
Positive attitude toward the streamed game	Definition: Viewers' positive attitude toward the games after watching video game streaming. 1. I feel more positive about the game after watching the video game streaming. 2. After watching the video game streaming, I like the game more.	Based on Li et al. (2003)
Purchase Intention	Definition: The degree of a viewer's intention to purchase (download) the game after watching the video game streaming. 1. After watching the video game streaming, I wanted to buy (download) the game. 2. After seeing the streamer playing the game, I wanted to purchase (download) it.	Based on Grewal et al. (1998)

<Table 3> Sample Characteristics (*N* = 262)

Attributes		Frequency	Percentage
Gender	Male	251	96%
	Female	11	4%
Age	Under 20	54	21%
	20 – 29	174	66%
	30 – 39	32	12%
	Over 40	2	1%
Game genre	Mobile RPGs	171	65%
	MOBA (Multiplayer Online Battle Arena)	78	30%
	Others	13	5%
Watching time per day	Less than 1 hour	17	6%
	1 – 2 hour(s)	76	29%
	2 – 3 hours(s)	75	29%
	More than 3 hours	94	36%
Experience in the streamed game	Less than 1 month	27	10%
	1 – 3 months	83	32%
	3 – 6 months	77	29%
	6 – 12 months	35	13%
	More than 1 year	40	15%

4.2. Data Collection and Sample Characteristics

An online survey was conducted involving viewers of AfreecaTV, one of the most popular streaming platforms in Korea (Kim, 2019). The survey subjects included viewers who were actually watching the video game streaming. Overall, responses from 262 viewers were acquired and used in the statistical analysis. The sample characteristics are summarized in <Table 3>.

Ⅴ. Data Analysis and Results

5.1. Measurement Model Testing

Smart PLS 2.0 was used to test the measurement and structural models. Unlike covariance-based SEM (structural equation modeling) such as LISREL or Amos, CFA (confirmatory factor analysis) tools like PLS do not assume a normal distribution of samples and can conduct statistical analyses with smaller sample sizes (Gefen et al., 2000). Convergent validity is analyzed by factor loadings, AVE (average variance extracted), and composite reliability (Chin 1998). According to existing rules, if the factor loadings and AVE values are higher than 0.5 and composite reliability and Cronbach's alpha values are higher than 0.7, the convergent validity and internal consistency are confirmed (Fornell and Larcker, 1981). To confirm discriminant validity, each item-latent construct loading is required to be higher than the cross-loadings and the square root of AVE of each construct should be larger than the correlation coefficients with other variables (Chin, 1998; Gefen et al., 2000).

<Table 4> Results of Confirmatory Factor Analysis

	Vividness	Device	Authenticity	Expertise	Pleasantness	Interaction	Prior Experience	Tele-presence	Knowledge	Positive Attitude	Purchase Intention
VIV1	**0.856**	0.170	0.459	0.482	0.417	0.277	0.048	0.301	0.276	0.329	0.304
VIV2	**0.875**	0.147	0.448	0.463	0.417	0.286	0.092	0.306	0.320	0.279	0.252
VIV3	**0.880**	0.146	0.486	0.439	0.415	0.295	0.117	0.306	0.347	0.333	0.333
VIV4	**0.855**	0.101	0.548	0.418	0.457	0.313	0.092	0.346	0.367	0.329	0.364
VIV5	**0.796**	0.125	0.475	0.441	0.378	0.315	0.016	0.341	0.309	0.235	0.285
DEV	0.160	**1.000**	0.080	0.177	0.106	0.067	0.072	0.027	0.003	0.011	−0.037
AUT1	0.489	0.041	**0.892**	0.566	0.608	0.348	0.021	0.526	0.407	0.441	0.454
AUT2	0.522	0.121	**0.902**	0.594	0.642	0.374	−0.003	0.554	0.458	0.529	0.478
AUT3	0.481	0.034	**0.902**	0.551	0.613	0.314	−0.030	0.513	0.427	0.467	0.463
AUT4	0.532	0.086	**0.863**	0.520	0.599	0.332	−0.044	0.539	0.546	0.473	0.400
EXP1	0.464	0.189	0.510	**0.870**	0.557	0.297	−0.040	0.432	0.353	0.378	0.346
EXP2	0.495	0.147	0.589	**0.902**	0.636	0.247	−0.105	0.459	0.385	0.433	0.408
EXP3	0.454	0.166	0.537	**0.881**	0.599	0.281	−0.035	0.477	0.387	0.387	0.365
EXP4	0.450	0.127	0.583	**0.889**	0.662	0.230	−0.042	0.477	0.434	0.435	0.415
PLE1	0.452	0.130	0.603	0.671	**0.839**	0.186	−0.088	0.441	0.414	0.500	0.490
PLE2	0.418	0.054	0.574	0.560	**0.820**	0.233	−0.076	0.497	0.515	0.427	0.361
PLE3	0.421	0.105	0.605	0.585	**0.916**	0.204	−0.221	0.519	0.475	0.490	0.463
PLE4	0.428	0.087	0.641	0.623	**0.920**	0.214	−0.185	0.521	0.502	0.496	0.444
INT1	0.349	0.017	0.406	0.278	0.236	**0.830**	0.067	0.407	0.340	0.283	0.238
INT2	0.347	0.078	0.371	0.331	0.252	**0.830**	0.088	0.473	0.394	0.322	0.272
INT3	0.254	0.090	0.284	0.248	0.206	**0.880**	0.034	0.459	0.426	0.270	0.265
INT4	0.173	0.017	0.168	0.058	0.046	**0.744**	0.093	0.289	0.300	0.086	0.059
PE	0.085	0.072	−0.016	−0.063	−0.166	0.082	**1.000**	−0.057	−0.049	−0.041	−0.048
TEL1	0.291	−0.001	0.506	0.413	0.480	0.423	−0.126	**0.834**	0.560	0.488	0.437
TEL2	0.264	−0.065	0.426	0.373	0.404	0.418	−0.066	**0.875**	0.599	0.484	0.402
TEL3	0.344	0.073	0.542	0.474	0.527	0.412	0.002	**0.854**	0.614	0.561	0.458
TEL4	0.368	0.076	0.541	0.493	0.494	0.455	−0.005	**0.806**	0.537	0.452	0.464
KNO1	0.337	−0.033	0.519	0.435	0.527	0.385	−0.053	0.624	**0.886**	0.578	0.538
KNO2	0.350	0.028	0.463	0.421	0.494	0.421	−0.010	0.621	**0.890**	0.562	0.437
KNO3	0.277	0.020	0.304	0.237	0.345	0.332	−0.067	0.485	**0.757**	0.379	0.344
PA1	0.338	0.017	0.514	0.436	0.536	0.264	−0.004	0.561	0.588	**0.941**	0.681
PA2	0.325	0.005	0.497	0.432	0.490	0.316	−0.074	0.550	0.556	**0.940**	0.680
PI1	0.358	−0.021	0.495	0.412	0.483	0.233	−0.051	0.480	0.486	0.666	**0.947**
PI2	0.332	−0.048	0.465	0.412	0.469	0.278	−0.041	0.514	0.517	0.709	**0.954**

As demonstrated in <Table 4>, the results of CFA showed satisfactory convergent validity, and as shown in <Table 5>, the discriminant validity of all constructs was confirmed, as each construct's square root of AVE was found to be greater than its correlation coefficients. The internal consistency of each variable was determined by examining by its Cronbach's α, and composite reliability showed satisfactory reliability.

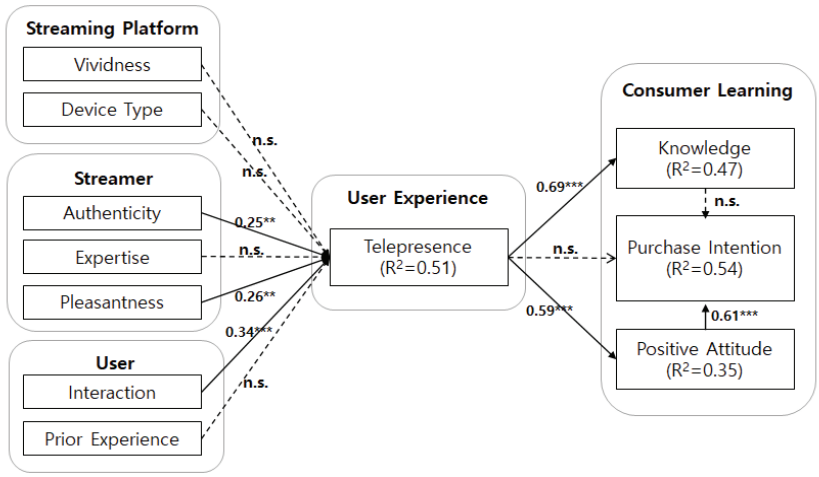
<Table 5> Discriminant Validity and Reliability of Research Constructs

	VIV	DEV	AUT	EXP	PLE	INT	PE	TEL	KNO	PA	PI
Vividness	**0.853**										
Device	0.160	**1.000**									
Authenticity	0.569	0.080	**0.890**								
Expertise	0.526	0.177	0.627	**0.885**							
Pleasantness	0.490	0.106	0.692	0.694	**0.875**						
Interaction	0.350	0.067	0.385	0.297	0.240	**0.823**					
Prior Experience	0.085	0.072	−0.016	−0.063	−0.166	0.082	**1.000**				
Tele-presence	0.377	0.027	0.600	0.522	0.567	0.507	−0.057	**0.842**			
Knowledge	0.381	0.003	0.518	0.441	0.546	0.450	−0.049	0.687	**0.847**		
Positive Attitude	0.352	0.011	0.538	0.461	0.546	0.308	−0.041	0.591	0.608	**0.940**	
Purchase Intention	0.362	−0.037	0.504	0.434	0.501	0.270	−0.048	0.523	0.528	0.724	**0.950**
AVE	0.727	1.000	0.792	0.784	0.765	0.677	1.000	0.710	0.717	0.884	0.903
Cronbach's α	0.906	1.000	0.912	0.908	0.897	0.842	1.000	0.863	0.802	0.869	0.893
Composite Reliability	0.930	1.000	0.938	0.936	0.929	0.893	1.000	0.907	0.883	0.938	0.949

Note: Diagonal values (bold) are the squared root value of AVE on each concept.

5.2. Structural Equation Model (SEM) Testing

PLS uses a bootstrapping method to test the significance of path coefficients. To test the aforementioned hypotheses, 500 sub-samples were created. As the PLS method does not show model fit indices, it is generally acceptable to measure the statistical power with R^2 values of endogenous variables using at least 0.10 as the reference value (Chin, 1998; Falk and Miller, 1992). The R^2 values of tele-



<Figure 3> Hypotheses Testing

presence, knowledge, positive attitude, and purchase intention are 0.51, 0.47, 0.35, and 0.54, respectively, which are satisfactory. The results of SEM were used to test the hypotheses of the study as shown in <Figure 3> below.

Referring to <Figure 3>, authenticity (H3) and pleasantness (H5) of streamers and viewers' active interaction (H6) are significant antecedents of viewers' telepresence perception. Surprisingly, the qualities of the streaming platform, vividness, and device type do not significantly affect telepresence. With regard to the relationship between telepresence and consumer learning, telepresence increases cognitive (knowledge) (H8) and affective dimensions (positive attitude) (H10), but not the behavioral aspect (purchase intention) (H9). Lastly, considering the relationship among consumer learning-related variables, positive attitude is positively associated with purchase intention of the streamed game, but knowledge about the game does not significantly affect purchase intention.

Ⅵ. Discussion

6.1. Research Findings and Implications

The research findings and practical implications in this research provide a few interesting points and surprising elements in terms of practical implications.

First, it has been found that none of the platform's technical features positively affects viewers' perception of telepresence. The findings are different from those of previous studies that the vividness and monitor size of the mediated content strongly affect telepresence (Kim and Ko, 2019; Park et al., 2019). A possible explanation is the viewer's stance as a passive observer, not an actual game player. Accordingly, the viewers may focus more on the streamer's performance, not on the quality of the game and the platform. Other possible interpretations would be that the high resolution of current mobile devices (smartphone or tablets) is not very different from that of PCs. Moreover, the sample characteristics of our study may be another reason why more than 65% selected "mobile RPG" as their game of choice to watch video game streaming; that is, screen size does not matter in this case. Despite these possible explanations, we have to admit that the mechanisms of triggering telepresence are very different from those of previous video game playing or virtual reality contexts. According to our research findings, the technological level of streaming platforms to make the viewers of game streaming to feel telepresence might be already reached certain levels.

Second, as for viewers' perspective, active interaction with the streamer is the most significant antecedent of telepresence. Viewers interact with the streamer, expressing their feelings and opinions mainly through chatting and receiving the streamers' replies in audio or reactions in the game. As the number of viewers increases, the level of interactivity can significantly drop. However, a well-experienced streamer can pick and choose a large number of interesting and intriguing comments from the fast-scrolling comments in the chatting room while he/she is playing the game. Specifically, the level of interaction is totally up to the streamer's ability to maximize the volume of responses. The implication of this finding can also be extended to not only the streamer, but also the platform provider. As a large proportion of the real-time broadcasting channel's revenue comes from the purchase of gifts (i.e., Afreeca TV's Star Balloon) by the viewers (used to support the channel), incentives for active commenters in the chatroom can be a good marketing

strategy for the platform provider. Taken together this finding with the insignificant effects of game streaming platform attributes on telepresence, it turns out that providing steaming platform that can smoothly and securely ensure the interaction with streamers and/or among viewers without buffering may be more urgently improved than high-definition or high-resolution of video content.

Third, regarding the streamer's characteristics, it has been found that their authenticity and pleasantness affect viewers' telepresence, suggesting that streamers are iconic figures from whom viewers expect genuineness and trustworthiness so as to identify themselves with them. In addition, viewers' fun and amusement level from the streamers' game style and comments affect telepresence, a finding that was highly anticipated. A game is basically played for fun and pleasure. LP activity may also be for fun, not for learning new game tactics and strategies. Predictably, the expertise of the streamer is not a significant factor affecting telepresence. Viewers may want to watch the streamer's funny and wacky moves and comments rather than new tricks or the detailed game introduction. Together with authenticity, it suggests that the viewers can indulge in the game more, not because a streamer plays the game at the highest level or shows new tricks and skills, but because they actually play the game in genuine settings and enjoy it thoroughly through trial and error. These results represent the unique characteristics of LP, which are different from competition streaming or how-to-play genre and video game streaming.

Lastly, viewers' experience of telepresence by engaging in the video game streaming was found to have a positive effect on knowledge and lead to a positive attitude of consumer learning of the streamed game. Effectively, by engaging in the game streaming, viewers can gather information to learn what the gaming experience would be like and to form positive emotions toward the game. However, the feeling of telepresence did not directly generate the desire to own and play the game; behavioral intention to personally own and play the game was generated through positive behavior toward the game. Effectively, the streamer can provide knowledge and positive attitude toward the game, but the acquired knowledge may not necessarily always lead to the viewer's positive attitude toward the game. Knowledge acquired could be satisfactory to judge the pros and cons of the game, showing the streamer's power as an influencer. Overall, behavioral intention, the ultimate output of consumer learning process and one of the most important factors regarding business perspectives, is indirectly affected by telepresence mediated by the effect of positive attitude. Therefore, in further studies examining the relationship between telepresence and consumer learning related variables, the sequential relationship of variables could be considered.

When the implications of the aforementioned findings are interpreted by game developers who want to use the video game streaming platform and LP culture as a marketing vehicle, a few other interesting implications are made. First, the LP channels can be a very effective marketing route to introduce a new game. As engaging in the streamed games successfully elicits telepresence, it can be considered that in addition to such viewing affecting their attitude toward the game, viewers are not merely watching but also expressing a desire to actually play the game by increasing their knowledge. Therefore, if done well, the video game streaming platform and LP culture can be utilized by game developers as an effective channel for marketing games directly to gamers.

Second, game developers should realize the power of streamers who can orchestrate the game in a way

they want to show. That is, it can be said that viewers are very susceptible to how the streamers show their gaming experience. The streamer can be a double-edged sword. An ideal streamer as a marketer could be described as a pleasant and genuine entertainer who can efficiently interact with as many viewers as possible, without the necessity to become an expert with the highest level of game skills. Above all, the choice should be those who see the value of the game.

Lastly, as telepresence positively affects the consumer learning of the streamer, a mutual win-win relationship between game developers and streamers can be formulated to improve game quality by reflecting viewers' opinions. A better understanding of viewers' reactions by analyzing their comments may result in adding new game features or tactics that can attract more viewers and more potential purchasers.

6.2. Theoretical Contribution

This study's main academic contribution is to initiate the urgent research need to understand viewers' behavior and attitude in personal internet broadcasting, especially in the video game streaming area, where not many empirical studies have been conducted. This study is also significant in that it introduced "telepresence" as a focal construct to understand the relationship between viewers' behavior/attitude and their antecedents. While previous research (Daugherty et al., 2008; Suh and Lee, 2005) divided product experience as direct experience (physical contact), indirect experience (secondary sources), and virtual experience (VR interface), engaging in game streaming finds no place in the above categorization. The viewers learn about the game without direct physical contact; however, sensory modalities such as orientation, vision, and hearing are used. It is in nature similar to any other secondary sources of media except for the fact that telepresence is formed through the engaging experience of the streaming platform. In addition, unlike previous research, which focused mainly on the technological features of the media and participation of internet broadcasting, the characteristics of the "streamer" and "viewer" were included by defining them as non-technological antecedents that affect telepresence.

6.3. Limitations of the Study and Future Directions

Even though this study carried out a series of psychometric analyses of most research variables, device type and prior experience variables were excluded from validity testing because they are single-item measures. While we believe that the measurement errors from these variables are minimal since they are not a latent construct but a very clearly defined formative measure, their non-significant loadings may be a result of their being single-item measures.

In addition, the research findings show that the variables that have been proven to significant antecedent of telepresence in previous studies, especially streaming platforms quality, did not appear to be significant in this study. In order to revalidate this findings, further studies are necessary to examine which dimensions should be improved preferentially using various research methods such as importance-performance analysis.

Despite these limitations, we believe that this study provides a starting point in academically approaching the phenomenon of "Let's Play" culture, which is different from other video game streaming such as competition or how to play. As far as we know,

this is the first attempt to examine the roles of streaming platforms, streamers, and viewers, all as antecedents of telepresence, and the effect of telepresence on consumer learning.

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