



A study of the factors influencing the viewers' satisfaction and cognitive assimilation with livestreaming commerce broadcast in Hong Kong

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Abstract

With the rapid development of livestreaming commerce in China, consumers spend an increasing amount of time watching and purchasing on the platform. This study examines the development of customer satisfaction and cognitive assimilation through live streaming by considering the drivers from perceived serendipity, affective and cognitive perspectives. Consumer value, which consists of utilitarian, hedonic, and social components, is an appropriate framework to adopt in studying effects of livestreaming commerce broadcast, because it includes all major benefits of watching livestreaming simultaneously. Survey data were collected from 453 respondents with livestreaming shopping experience in Hong Kong. Partial least squares structural equation modeling was applied to test the proposed relationships in this study. Our results suggest that the perceived serendipity, quality of presentation and social presence of livestreaming shopping can enhance customers' satisfaction and cognitive assimilation through consumer values. The findings can help practitioners design more effective approaches for livestreaming e-commerce.

Keywords Livestreaming commerce · Serendipity · Perceived values · Cognitive assimilation · Quality of presentation · Social presence · Viewer's satisfaction

1 Introduction

Due to the advancement of information technology in the past decade, online sellers can now present their products in a more interactive manner, such as via livestreaming. Livestreaming commerce is a business model in which sellers or influencers sell products via online video streaming, which involves video content, real-time communication and consumption [85]. Livestreaming commerce enhances

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the authenticity, visualization, interactivity, and enjoyment of online shopping [4]. China's livestreaming e-commerce industry has undergone tremendous growth since 2015. Taobao.com, the largest e-commerce website in China, has enabled livestreaming commerce since April 2016. In 2020, Taobao generated over US\$60 billion through livestream commerce [1]. Due to the COVID-19 pandemic, many businesses have used live-streaming to reach existing and new customers during lockdowns, which is expected to accelerate the development of livestream e-commerce in the near future [21].

In contrast to traditional e-commerce websites, livestreaming involves an interactive, entertaining and synchronous environment that enables real-time interactions between streamers and viewers as well as between viewers [34]. Some international sellers, such as Walmart and Amazon.com, have become aware of the benefits of livestreaming and have launched their own livestreaming commercial activities and platforms. Social media sites, such as Facebook and Instagram, have also incorporated more functions related to livestream e-commerce. Additionally, in response to the COVID-19 pandemic, traditional retailers in Hong Kong have seized the opportunity presented by livestreaming during lockdowns to reach existing and new customers [21]. Small or medium-sized sellers can also use livestreaming to forge connections with consumers, which can effectively expand their business [35].

The rapid growth of livestreaming commerce has generated new opportunities and challenges for academics, businesses and consumers [108]. The success of livestreaming commerce may be explained by their various multimedia functions including real-time presentations [34], interactive games, virtual gifts [102], and interaction between streamers and viewers [82]. Livestreaming can increase the persuasiveness of marketing communications, as consumers can engage in real-time chatting with streamers, which motivates them to devote their attention to the presented products. Viewers can derive trust in product quality based on the streamer's good reputation, which can effectively increase their purchase intention [93]. To enhance the effectiveness of livestreaming in e-commerce, it is important for marketers to examine how streamers attract customers, build relationships with them and enhance their satisfaction.

Although livestreaming e-commerce is receiving more attention from practitioners as a rising trend in digital strategy, research in this area remains limited [25]. Researchers have applied various theoretical perspectives, including consumer motivation theories [4], Stimulus-organism-response (SOR) frameworks [94] and celebrity endorsement perspectives [69], to examine the influence of livestreaming on consumers. They have investigated consumers' motivation to watch the broadcast or shop via livestreaming [3, 93] and the effects of live streaming on sales [6]. Many of these studies focus on examining the factors determining the viewer's intention of watching livestreaming but limited attention has been paid to investigate the impact of livestreaming on their cognitive and affective states. Some studies suggested that live streamers make connection between the consumers and product in livestreaming and their presentation and social presence are fundamental to attract consumers [59]. The current study enriches the literature by recommending a framework that incorporate consumer value theory and Elaborative Likelihood Model (ELM) to assess how quality of presentation and social presence of live streamer influence

cognitive assimilation and satisfaction of viewers [96]. In addition, an analysis of perceived serendipity of livestreaming is conducted to clarify the antecedents that may influence quality of presentation, social presence and perceived value of the live streaming. Considering the creative and interactive nature of livestreaming, perceived serendipity experience and social presence have been conceptualized as the individual experience resulting from watching livestreaming [65]. Accordingly, practical suggestions can be provided to streamers.

In sum, this research focuses on the perspective of ELM combined with the consumer value theory, reveals the role of the live streamer's influence on cognitive and affective aspects of the consumer purchase process. The section below first describes the development and key features of livestreaming commerce in Hong Kong and China. Then, the ELM and consumer value theory are used to establish a model to test how perceived serendipity, quality of presentation, and social presence promotes consumers' perceived value, satisfaction and cognitive assimilation of the livestreaming broadcast. Empirical testing of this model is conducted through the survey data collected from consumers who have participated in livestreaming commerce. The paper concludes with a discussion of the theoretical and managerial implications of our findings.

2 Theoretical background and hypotheses

2.1 Livestreaming E-commerce

Livestreaming e-commerce refers to e-commerce activities and transactions conducted via livestreaming videos on various types of platforms [96]. Livestreaming e-commerce uses various stimuli to persuade potential consumers to make purchases. Through social media or livestream platforms, streamers use a virtual space to provide viewers a channel to watch and interact with a streamer [94]. During the process of watching livestreaming videos and making purchases, consumers have real-time interactions with the sellers and other viewers; this allows them to obtain dynamic and accurate information, enjoy entertaining presentations by conventionally attractive streamers and develop social relationships with the participants [82]. Thus, livestreaming e-commerce integrates product information, entertainment and social activities in a seamless manner.

The key components of livestreaming e-commerce include live streamers, livestreaming platforms and logistical support. There are various types of live streamers, with different backgrounds, areas of expertise, reputations and presentation styles. Live streamers, who are typically either Key Opinion Leaders (KOL) or Key Opinion Customers (KOC), exert a strong influence on the decision-making processes of their viewers due to content authenticity and reliability. Live streamers also have their own streaming styles, specialties, niches and attractiveness levels [107]. Streamers can present commercial information in an attractive manner, introduce products to customers through rich experiences and address their needs in online settings.

Live streamers may use different channels to conduct livestreaming commerce, including e-commerce sites (e.g. Taobao), mobile apps with integrated livestreaming features and social networking sites with livestreaming features (e.g. Facebook Live). Livestreaming platforms have expanded from traditional e-commerce platforms to more diversified social media platforms in China. For instance, in March 2016, Taobao.com launched Taobao Live, the first livestream e-commerce platform, which had over 400 million active users in 2020 [81]. Many social media platforms and mobile apps, including short video platforms (such as TikTok and Kwai), group-buying platforms (Pinduoduo) and online advertising platforms (e.g. Little Red Book), also introduced livestreaming features in 2020. These apps and platforms have different positioning strategies and levels of emphasis on the development of livestreaming strategies. For example, Duo Duo Live primarily focuses on selling agricultural products, jewelry and apparel, while Jing Dong aims to offer high-quality products and to foster an upper-class clientele [80]. Streamers in China may utilise different platforms to reach their target customers and create livestreaming experiences.

However, since the penetration rates of the livestream e-commerce apps are low in Hong Kong, local streamers mainly rely on traditional social media platforms, such as Facebook Live, to host livestreaming programmes [21]. Viewers may find it inconvenient to place their orders, as the social media platforms are not integrated with the e-commerce platforms of the products. As a result, some streamers may invite viewers to join groups in instant messaging apps, such as Whatsapp and Telegram, so that they can continue to connect with the viewers and provide better services to them [21]. These online groups allow live streamers remind their viewers the launch of live stream broadcast, interact with them after the programme, provide various customer support services, and promote other products to the customers.

Live streamers influence consumers not only by providing product information, demonstrating how the products can be used [36] and presenting positive images [5] but also by engaging in social interactions with live streamers and co-viewers [96]. This article attempts to use consumer perceived value theory and ELM to analyse the influence of different elements of livestreaming on viewers. The consumer value theory has been widely discussed and employed by various researchers to predict consumers' decisions and behaviours. It is suitable for this study, as consumers may gain various forms of value through livestream commerce. For example, consumers may attempt to gain intrinsic and emotional rewards, such as enjoyment (hedonic value), external rewards such as useful product information (utilitarian value) and internal rewards such as social relationships (social value) [105]. In addition, ELM is used to examine the persuasiveness of livestreaming, as viewers are influenced by both the arguments and information presented by live streamers [34] and the cues associated with the peripheral route, such as the trustworthiness and attractiveness of live streamers and other viewers [25].

This study uses cognitive assimilation and customer satisfaction to assess the impact of livestreaming on viewers' cognitive and affective states. During the live streaming e-commerce process, the live streamer plays a key role in influencing viewer's purchase decisions. The live streamer provides a comprehensive and detailed introduction to the product, which not only reduces the time and cost for

consumers to understand the product but also enhances the “credibility” of the product quality [6]. Cognitive assimilation refers to the mental processes by which people adjust their thoughts, beliefs or attitudes after they interact with stimuli [20]. In the context of livestreaming, viewers are exposed to various stimuli and environmental cues, including product messages, attractive presentations and social interactions, and they may acquire information during the process of interacting with these elements in livestreaming contexts [95]. Thus, this construct is an appropriate measure to the persuasiveness of livestreaming programme. Live streamers also stimulate the viewers' emotional response and increase their favorability in the streamers and their recommended products. Customer satisfaction is regarded as an affective response that results from the evaluation of whether a product provides a pleasurable level of fulfillment of customers' needs and desires [27].

2.2 Consumer value theory

Consumers' perceived value refers to the overall evaluation of the perceived costs and benefits of consumption [103]. In addition to consumers' perceptions of 'net valuation', consumer perceived value can refer to perceptions of the potential benefits of a product [87]. Following this definition, consumer perceived value has typically been operationalised as a multidimensional construct [13]. For example, Sheth et al. [79] classifies consumer values into five different categories, including functional, emotional, social, conditional and epistemic value. Many studies regarding internet consumer behaviour have applied the framework of functional values, hedonic values and social values to classify consumer values [44, 101]. Livestreaming videos offer users with various kinds of experiences, including visual content and social interactions between live streamers and other audiences. In this study, consumer value is conceptualised as a multidimensional hierarchical second-order model, as proposed by Lin et al. [52]. Consumer value, which consists of utilitarian, hedonic and social components, is an appropriate framework to adopt in studying live streaming, as it encompasses all the major benefits of watching livestreaming simultaneously.

Utilitarian value, which refers to consumers' perceptions regarding the achievement of goals involving making purchases, is generally considered the most important component of consumer-perceived value [109]. Utilitarian value can be derived from functional benefits related to money, time, usability and convenience [48, 66]. The contents of live-streaming programmes encompass various types of information, such as descriptions of product features and assessments of products, which can help consumers make more informed purchasing decisions [55, 58]. In addition, streamers may offer consumers opportunities to purchase products at lower prices and to receive product promotions. To enhance the effectiveness of livestreaming e-commerce, some platforms also allow viewers to make purchases immediately without switching to other apps or platforms. Therefore, consumers can derive utilitarian value from livestreaming e-commerce via various components, including product information, product offers, monetary savings and convenience [85].

Hedonic value refers to the emotional benefits customers derive from using a product or service, including elements such as fun and enjoyment [79]. Consumers may derive hedonic value through various types of online activities, such as seeking and using online services [17], co-creation activities [63] and livestreaming commerce [67]. In a livestreaming commerce programme, hedonic value has different sources. It can be generated from the physical attractiveness of the streamer; from the creative, humorous or intriguing contents of the videos; or from interactions between streamers and other viewers.

Social value refers to the enhancement of consumers' social well-being and inter-personal relationships when using a product or service [74]. Social value can be obtained from the association with people with higher social status [83] and the improvement of one's self-image [42]. Livestreaming broadcasts enable not only useful and creative real-time viewing experiences but also opportunities to communicate and interact amongst streamers and other audiences. These interactions may promote the development of social relationships amongst streamers and the audience [5], thereby creating social value for the audience. Consumers may also obtain social value, such as enhanced self-esteem and social relationships, by means of social identification with reputable streamers and viewers [37].

Consumers' perceived value is one of the key factors in predicting consumers' decisions and behaviours [41]. For example, consumers' perceived value is positively related to consumers' intentions to adopt new products [87], willingness to repurchase products [13, 40] and willingness to adopt mobile apps [33]. In the livestreaming context, consumers may agree to buy a product if they believe that the products shown can help them achieve their goal [59]. Hedonic value is also a major contributor to media use and technology adoption [99]. Individuals adopt a particular technology or service if they perceive using it to be enjoyable. Several studies have confirmed that hedonic values or motivations are positively related to engagement in livestream shopping activities [4, 62, 93]. Social identification with a seller and other viewers enhances a customer's participation and interaction on social networks [2], as well as their long-term relationship with the seller [37]. Following friendly social communication, consumers perceive that livestreaming broadcasts can meet their social needs and are likely to build trust with streamers, which can enhance their cognitive simulation. Thus, we hypothesise the following:

H1a The perceived value of livestreaming broadcast has a positive relationship with consumers' cognitive assimilation in relation to live streamers.

Customers feel satisfied when their perceived expectations are fulfilled by the outcomes of the experience [39]. Through livestreaming, customers gain value and trust from various elements, including useful commercial information, the attractiveness of the streamer, interesting presentations, social interactions, an efficient order system and supportive customer service [19]. Value appraisals may induce emotional responses (satisfaction) and coping behaviours, such as repurchase intentions. Some studies in mobile commerce contexts have demonstrated

that perceived value exerts a significant effect on customer satisfaction [92]. Thus, the following hypothesis has been formulated:

H1b The perceived value of livestreaming broadcast has a positive relationship with consumers' satisfaction with livestream broadcast.

2.3 Elaboration likelihood model (ELM)

ELM is a dual process theory examining the effectiveness of persuasive communications [71]. The ELM has been applied to various studies in online contexts regarding the persuasiveness of web design [16] and online advertising [75]. Persuasion may be executed through a central route based on 'thoughtful consideration of the true merits of the information' or a peripheral route based on cues, such as source attractiveness [70]. The ELM suggests that the central route, namely information processing, exerts a stronger influence on attitudinal change in high elaboration likelihood states, while audiences tend to be persuaded by peripheral cues if they are in low elaboration likelihood states.

This study applies ELM to the context of livestream commerce. ELM suggests that argument quality is the key component of persuasive power [70]. Argument quality can be defined as the quality of presentation in the context of livestreaming, which is related to the information's completeness, accuracy and clarity. The quality of presentation can be enhanced in different ways. For example, streamers may enhance the quality of presentation by utilising an interactive and multimedia-based format to present commercial information [93], share their experiences with viewers [38] and customise their presentation based on feedback from viewers [37].

The quality of presentation is important to users and exerts an impact on users' information adoption and purchase intentions [59]. Quality presentation enables customers to be engaged and involved, which stimulates a feeling of mental involvement [50]. This can result in a shift in belief regarding the persuasion topic cognitive assimilation [86] and the satisfaction of users [90]. High quality presentation with complete, clear and accurate information can satisfy the information needs of viewers and appeal to the utilitarian values of viewers.

As demonstrated by some research in the retail sector, customers are more satisfied with services provided by salespersons with high task competence, as their product knowledge can minimise customers' uncertainty [57]. The hosts of live shopping streams are often regarded as experts with a high degree of competence to provide reliable information and useful purchase suggestions [10]. In this case, live streamers play the dual roles of host and salesperson, making strong arguments that can result in consumer satisfaction. Moreover, streamers' vivid demonstrations may enhance the information's persuasiveness [45]. Thus, we hypothesise the following:

H2a The quality of presentation is positively correlated to consumers' perceived value of livestreaming.

H2b The quality of presentation is positively correlated to consumers' cognitive assimilation with the live streamer.

H2c The quality of presentation is positively correlated to consumers' satisfaction with the livestreaming broadcast.

Livestreaming is characterised by its strong element of social presence and rich emotional cues, thus making products more physically and temporally proximal to customers and more emotionally arousing. Thus, peripheral cues take the form of the social presence that appears on the livestream broadcast. Social presence refers to 'the extent to which a medium allows users to experience others as being psychologically present' [26]. Perceived social presence has been demonstrated to affect people's behaviour in an online environment, including their mobile messaging usage [64], social media activities [31] and participation in online communities [78]. Perceived social presence can enhance customers' positive cognitive, affective and behavioural reactions [26].

With higher social presence, customers tend to be more engaged in watching livestream videos and more willing to make the purchases [58]. Social presence increases perceptions of the usefulness of information [31] and enjoyment [14]. Perceived social presence can reduce the psychological distance between customers and streamers [18], thus enhancing the trust and sense of intimacy between customers and streamers [24]. In this regard, the following hypotheses can be proposed.

H3a Social presence is positively correlated to consumers' perceived value of livestreaming.

H3b Social presence is positively correlated to consumers' cognitive assimilation with the live streamer.

H3c Social presence is positively correlated to consumers' satisfaction with the livestreaming broadcast.

2.4 Perceived serendipity

Serendipity refers to the accidental discovery of interesting information by consumers, which can be characterised as innovative, unusual or surprising [8]. The feeling of serendipity can create positive emotions and enhance customer satisfaction [73]. Perceived serendipity may influence various customer behaviours by stimulating customers' unplanned spending [89], fostering positive customer engagement [12], increasing perceived enjoyment [106] and amplifying the likelihood of purchasing products [68]. Consumers browsing serendipitous websites are more likely to enjoy their shopping experience and engage in information acquisition [61].

Livestream broadcasts are perceived as serendipitous when the streamers present surprising and interesting information, utilise creative presentation styles and offer unexpected promotional activities. In such contexts, the information provided by the

live streamers may be regarded as positive and useful [65]. Serendipity can enhance viewers' perceived value in relation to livestreaming. For example, live streamers may enhance the perceived utilitarian values of viewers by offering discounts or gifts-with-purchase, providing interesting new information or presenting information in creative ways. Streamers who create surprising and pleasurable experiences can attract viewers' attention [43]. Perceived serendipity can influence the quality of presentation and perceived feeling of social presence. Research regarding online reviews has confirmed that serendipitous suggestions enhance participants' sociality perceptions of the system, such as being helpful, friendly and competent [65]. Thus, we hypothesise the following:

H4a Perceived serendipity is positively correlated to the consumer's perceived values of livestreaming.

H4b Perceived serendipity is positively correlated to the quality of presentation.

H4c Perceived serendipity is positively correlated to social presence.

2.5 Gender differences in livestreaming behaviour

Previous studies have identified gender as a significant demographic variable that can influence customer behaviour [46, 51]. According to gender schema theory, males and females have different decision-making styles [84]. For example, males tend to be task- and result-oriented, while females tend to be more social and relationship-oriented [77]. In one study regarding servicescape, male customers were more likely to be influenced by clearly revealed clues on physical servicescape compared to female customers [49]. In livestreaming settings, the effect of presentation quality on cognitive assimilation is stronger for male customers than for female customers. Thus, we hypothesise the following:

H5a The influence of quality of presentation on cognitive assimilation and satisfaction is stronger for male than for female customers.

H5b The influence of social presence on cognitive assimilation and satisfaction is stronger for female than for male customers.

3 Research methodology

3.1 Participants

The data have been collected by the Enterprise and Social Development Research Centre and Proactive Think Tank Limited. Participants were recruited via different

e-commerce, social media pages and livestreaming websites.¹ This yielded 1006 valid responses. Amongst the 1006 samples, 453 respondents watched livestreaming videos within three months. The data from these 453 participants were used for analysis. The demographic characteristics of the sample included age (over 90% aged between 21 and 60), gender (72.6% female) and educational level (60.0% with a tertiary qualification). Considering the use of livestreaming e-commerce, participants can be described as highly interested as well. When asked about their use of livestreaming, 36.2% of them reported spending more than 3 h watching livestreaming every week, and 65% of them reported making purchases after livestreaming programmes (Table 1).

3.2 Instrument

The study employed a quantitative method using an online questionnaire to gather primary data from target participants. To measure the constructs specified in the proposed model, we selected appropriate multi-item scales from previous studies, making some modifications to fit the context of livestreaming e-commerce. All items, reliability scores and scale sources are available in Table 2. All scales used a five-point Likert format, where 1 = strongly disagree and 5 = strongly agree.

3.3 Data analysis

The objective of this study was to examine the key determinants of consumers' cognitive assimilation and satisfaction with livestream-watching. The analysis was undertaken via partial least squares (PLS) using Smartpls 4.0. PLS is a general technique for analysing path models involving latent constructs. A PLS model is specified by two sets of linear relations: the measurement model in which refers to the relationships between the latent and the manifest variables (items); and the structural model where the hypothesised relationships between the latent variables [76]. Thus, the application of PLS-SEM requires a two-phase process [60]. The first entails assessing the measurement's reliability and validity, and the second involves evaluating the structural model [28]. PLS-SEM is an analytical technique that is commonly used in research regarding information systems, new technology and marketing [32], because PLS-SEM can handle both formative and reflective variables, and have fewer restrictions regarding sample size and residual distributions. Furthermore, it is a suitable method to analyse complex models involving causal direct and indirect relationships and to assess multi-item constructs [60].

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Table 1 Profile of Respondents

Item	Watch live-streaming video within 3 months (total: 453)	
	No	%
<i>Gender</i>		
Male	124	27.37
Female	329	72.63
<i>Age</i>		
Below 21	11	2.43
21–30	55	12.14
31–40	112	24.72
41–50	136	30.02
51–60	114	25.17
61 or above	25	5.52
<i>Education</i>		
Primary or below	4	0.88
Secondary	177	39.07
Tertiary	89	19.61
University	114	25.17
Post-graduate	69	15.23
<i>Family status</i>		
Married	251	55.41
Single	163	35.98
Divorced/separated	28	6.18
Widowed	11	2.43
<i>Occupation</i>		
Student	17	3.75
Housewife	82	18.10
Executives	81	17.88
Managers	41	9.05
Professional	90	19.87
Administrative	45	9.93
Sales	39	8.61
Others	58	12.80
<i>Income level (Monthly)</i>		
< HKD10000	89	19.65
HKD10000-19999	105	23.18
HKD20000-29999	84	18.54
HKD30000-39999	69	15.23
HKD40000-49999	38	8.39
> HKD50000	68	15.01

Table 2 Results of measurement model

Constructs and items	Mean	SD	Standard-ized load-ings
<i>Perceived serendipity</i> ($CA = 0.830$, $CR = 0.831$, $AVE = 0.748$)			
PS1 When watching a live-stream, I can often see unexpected contents	3.567	0.484	0.875
PS2 When watching a live-stream, I often find interesting and surprising information	3.572	0.454	0.904
PS3 When watching a live-stream, there is a lot of valuable information more than what I want to know in searching online Source: Lu and Cheng [56]	3.411	0.508	0.813
<i>Social Presence</i> ($CA = 0.776$, $CR = 0.777$, $AVE = 0.692$)			
SP1 There is a sense of human contact in live streaming shopping	3.657	0.371	0.821
SP2 There is a sense of personalness in live streaming shopping	3.362	0.446	0.874
SP3 I can keep in touch with the streamer and others during the live streaming Source: Sun et al. [85]	3.138	0.534	0.799
<i>Quality of Presentation</i> ($CA = 0.837$, $CR = 0.848$, $AVE = 0.753$)			
QP1 Live streaming shopping makes the product attributes visible to me	3.721	0.363	0.881
QP2 Live streaming shopping makes information about how to use products visible to me	3.814	0.372	0.872
QP3 Live streaming shopping helps me to visualize products like in the real world Source: Xu et al. [97]	3.647	0.385	0.850
<i>Perceived Utilitarian Value</i> ($CA = 0.845$, $CR = 0.845$, $AVE = 0.764$)			
PUV1 Live streaming helps me to find the information I would like to collect	3.563	0.443	0.870
PUV2 Live streaming can help me collect information in a more effective way	3.581	0.433	0.890
PUV3 Live streaming can help me address misgivings Source: Chen et al. [9]	3.408	0.484	0.861
<i>Perceived Hedonic Value</i> ($CA = 0.866$, $CR = 0.868$, $AVE = 0.790$)			
PHV1 I feel pleasure from using online streaming	3.446	0.457	0.849
PHV2 I experience enjoyment from using online live streaming	3.541	0.449	0.893
PHV3 I have fun using online live streaming Source: Chen et al. [9]	3.442	0.496	0.923
<i>Perceived Social Value</i> ($CA = 0.908$, $CR = 0.908$, $AVE = 0.845$)			
PSV1 I use online live streaming to make the acquaintance of new friends	2.709	0.613	0.930
PSV2 I would like to use online live streaming to expand my social circle	2.698	0.593	0.934

Table 2 (continued)

Constructs and items	Mean	SD	Standardized loadings
PSV3 I try to use online live streaming to make contact with people I am interested in Source: Chen et al. [9]	2.927	0.609	0.893
<i>Cognitive Assimilation</i> ($CA = 0.881$, $CR = 0.882$, $AVE = 0.738$)			
CA1 My existing understanding regarding products/services is likely to be influenced through streamer information	3.667	0.385	0.890
CA2 My current knowledge regarding products/brands is likely to be influenced by streamers	3.715	0.373	0.864
CA3 My perceived value of the product can be transformed by streamer environmental cues	3.571	0.399	0.877
CA4 My preference of the product can be changed by streamer interaction Source: Xu et al. [95]	3.481	0.434	0.803
<i>Customer Satisfaction</i> ($CA = 0.853$, $CR = 0.853$, $AVE = 0.772$)			
SAT1 Overall, I am satisfied with my experience of using live streaming for purchase	3.577	0.365	0.867
SAT2 I am sure I made the correct decision in using live streaming for purchase	3.410	0.415	0.899
SAT3 I have obtained several benefits derived from my participation in live streaming for purchase Source: Zhang et al. [104]	3.327	0.424	0.870

Table 3 Discriminant validity—Fornell–Larcker criterion

	CA	SAT	PUV	PHV	PSV	PS	SP	VI
CA	0.859							
SAT	0.490	0.879						
PUV	0.370	0.461	0.874					
PHV	0.372	0.529	0.576	0.889				
PSV	0.262	0.406	0.369	0.368	0.919			
PS	0.425	0.517	0.577	0.677	0.409	0.865		
SP	0.556	0.707	0.325	0.428	0.420	0.434	0.832	
VI	0.565	0.619	0.407	0.417	0.242	0.441	0.631	0.868

Table 4 Discriminant validity—heterotrait-monotrait ratio (HTMT ratio)

	CA	SAT	PUV	PHV	PSV	PS	SP
SAT	0.557						
PUV	0.427	0.541					
PHV	0.423	0.614	0.673				
PSV	0.288	0.462	0.420	0.414			
PS	0.493	0.614	0.688	0.798	0.471		
SP	0.666	0.869	0.400	0.523	0.499	0.541	
VI	0.648	0.728	0.475	0.483	0.274	0.522	0.790

4 Findings

4.1 Assessment of measurement model

The measurement model was used to examine reliability and validity (Hair et al., 2017). Cronbach's alpha and composite reliability (CR) were used to evaluate the internal consistency reliability. The Cronbach's Alpha (from 0.776 to 0.908) and the CR (from 0.777 to 0.908) of each construct are larger than the threshold of 0.70, confirming the internal consistency reliability [76]. The average variance extracted (AVE) was used to assess the convergent validity. As shown in Table 2, all the AVE values are higher than the required 0.5 level (from 0.692 to 0.845), verifying the convergent validity [22]. The Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT ratio) were used to assess the discriminant validity. As shown in Table 3, the correlations between the two constructs are all smaller than the square root of the construct's AVE, which fits the criterion and verifies the discriminant validity. Table 4 also indicates that all the HTMT ratios are smaller than the threshold of 0.9, also indicating a high discriminant validity of different distinct constructs [29].

As this study collected all the data from a single setting, common method bias (CMB) was addressed through procedural and statistical techniques. First, the items were re-arranged, and the wordings were refined after the pilot study [72]. Two statistical analyses were performed to evaluate the potential common

Table 5 Assessment of common method bias

Path coefficient/ R^2	Without marker	With marker
PV → CA	0.140	0.136
PV → SAT	0.278	0.278
QP → PV	0.073	0.071
QP → CA	0.322	0.318
QP → SAT	0.221	0.222
SP → PV	0.189	0.187
SP → CA	0.284	0.282
SP → SAT	0.431	0.431
PS → QP	0.441	0.431
PS → SP	0.434	0.425
PS → PV	0.594	0.592
R^2 of CA	0.400	0.401
R^2 of SA	0.606	0.606
R^2 of PV	0.547	0.548

Table 6 Overall quality of model

DV	R^2	VIF of each IV
Cognitive assimilation	0.400	Perceived value: 1.383 Quality of presentation: 1.741 Social presence: 1.825
Satisfaction	0.606	Perceived value: 1.383 Quality of presentation: 1.741 Social presence: 1.825
Perceived value	0.547	Perceived serendipity: 1.307 Quality of presentation: 1.763 Social presence: 1.751

method bias, including a Harman one-factor test [72] and a full collinearity test [30]. The total variance for a single factor was 43.3%. When a complete set of factors was present in the model, 77.94% of the variance was explained. This outcome suggested that having a serious CMB was unlikely. The full collinearity test also suggested that the VIF was lower than the 5.0 threshold [30]. According to Chin et al. [11], the common method bias can be assessed by the measured latent marker construct approach. Table 5 compared the path coefficients and r^2 of the model with and without the markers. The changes of the path coefficients and r^2 are not significant (less than 10%), which show that common method bias is not a serious issue in this study. Based on the results of these tests, we are confident that issues related to common method bias were not a concern in this study.

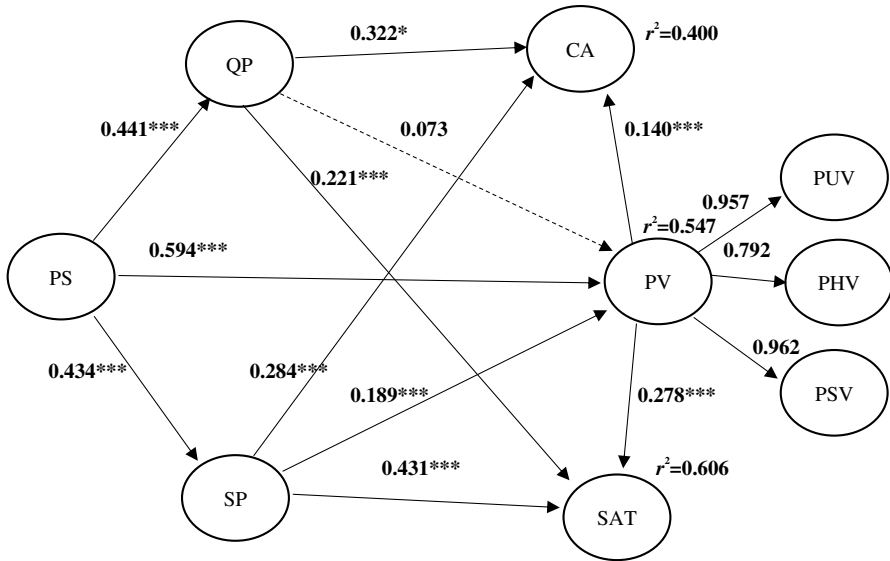


Fig. 1 Result of structural model

Table 7 Significance testing results of the structural model path coefficients

Hypotheses	Path	Path coefficient	t-value	Sign	f ²	Supported
H1a	PV → CA	0.140	3.541	***	0.023	Yes
H1b	PV → SAT	0.278	7.093	***	0.141	Yes
H2a	QP → PV	0.073	1.834	0.067	–	No
H2b	QP → CA	0.322	4.082	***	0.099	Yes
H2c	QP → SAT	0.221	4.412	***	0.071	Yes
H3a	SP → PV	0.189	4.568	***	0.045	Yes
H3b	SP → CA	0.284	3.774	***	0.074	Yes
H3c	SP → SAT	0.431	8.248	***	0.258	Yes
H4a	PS → QP	0.441	8.603	***	0.241	Yes
H4b	PS → SP	0.434	8.563	***	0.233	Yes
H4c	PS → PV	0.594	16.923	***	0.597	Yes

* $p < .05$; ** $p < .01$; *** $p < .001$

4.2 Assessment of structural model

The quality of the structural model was assessed using various indicators, including a collinearity assessment, the significance and relevance of structural model relationships, the r-square (R^2) for exogenous-endogenous relationships and the effect size and predictive relevance of the model [29]. With VIF ranging from 1.307 to 1.825, which is below the threshold of 5, collinearity amongst the predictor constructs was not an issue in this model [29]. Table 6 indicates the squared multiple correlations

Table 8 Bootstrapping results on specific indirect effects

Path	Specific indirect effects	T-statistics	Significance
PS → QP → CA	0.142	3.245	<.01
PS → QP → SAT	0.098	3.793	<.001
PS → Value → CA	0.083	3.449	<.01
PS → Value → SAT	0.165	6.257	<.001
PS → SP → CA	0.123	3.378	<.01
PS → SP → SAT	0.187	5.238	<.001

(R^2) for each endogenous latent variable. A general evaluation of the results suggested that these factors contributed significantly to the cognitive assimilation, satisfaction and perceived value of live streaming and that the variance change could be explained are 40.0%, 60.6% and 54.7%, respectively.

The PLS-SEM method was also used to confirm the hypothesised relationships between constructs in the proposed model. The significance of the paths included in the proposed model was tested using a bootstrap resample procedure with 5000 samples. As can be seen in Fig. 1 and Table 7, the findings demonstrated that perceived value exerted significant positive effects on cognitive assimilation and satisfaction, thus providing support for Hypotheses 1a and 1b. The quality of presentation positively affected the cognitive assimilation (H2b) and satisfaction of viewers (H2c), while it had no significant effect on the perceived value of the livestreaming programme (H2a). Social presence had significant effects on perceived value (H3a), cognitive assimilation (H3b) and the satisfaction of viewers (H3c). The f^2 shows that the most important antecedent of the cognitive assimilation was quality of presentation ($f^2 = 0.099$), while that of the satisfaction was social presence ($f^2 = 0.258$).

Similarly, the perceived serendipity exerted significant effects on quality of presentation ($\beta = 0.441$, $p < 0.001$), social presence ($\beta = 0.434$, $p < 0.001$) and perceived values ($\beta = 0.594$, $p < 0.001$). To analyse the impact of perceived serendipity on cognitive assimilation and satisfaction with livestreaming broadcasts, we further tested whether quality of presentation, social presence and perceived value mediate the effects of perceived serendipity on cognitive assimilation and satisfaction. Following the mediation analysis procedure suggested by Hair et al. (2018), bootstrapping with 5000 samples was used to evaluate the significance of specific indirect effects. The results reveal that the quality of presentation, social presence and perceived value of livestreaming fully mediated the effect of serendipity on cognitive assimilation and satisfaction with livestreaming broadcasts (Table 8).

To further assess the differences between males' and females' livestream watching behaviours, we conducted further multi-group analyses in Smartpls with males and females. The results demonstrated no significant difference between males and females regarding the variables influencing the cognitive assimilation, satisfaction and perceived value in relation to watching livestreaming programmes. In addition, a multi-group analysis was conducted with both frequent and non-frequent users of livestream e-commerce platforms and social media; the results revealed that there

was no significant difference amongst them regarding the variables influencing the cognitive assimilation, satisfaction and perceived value in relation to livestreaming e-commerce.

5 Discussion and conclusion

5.1 Theoretical implications

Because research concerning the effects of livestream e-commerce is limited, the current study constructed a model based on consumer value theory and ELM to explore the determinants of cognitive assimilation and the satisfaction of viewers. The above analysis demonstrated that the perceived serendipity, quality of presentation and social presence of livestreaming all exert a significant positive impact on consumers' perceived value, cognitive assimilation and satisfaction in relation to livestreaming. Consistent with Wongkitrungrueng and Assarut [93]'s findings revealing the effects of perceived value on trust in products and trust in sellers, the results of the current study confirm that the perceived values of live streaming exert positive effects on the cognitive assimilation and satisfaction of viewers. The relationship between perceived serendipity, quality of presentation, social presence and cognitive assimilation and satisfaction is partially mediated by the perceived value of viewers.

This finding confirms the claim that serendipitous information involving unexpected findings can enhance viewers' watching experience and the perceived value of watching livestreaming. The interrelation between the perceived serendipity and perceived value of watching livestreaming is in accordance with the literature regarding recommendation systems [65]. Unexpected information and suggestions may enhance intrinsic values, including hedonic and social values, which can enhance viewers' cognitive assimilation and satisfaction. Serendipitous information and communication are fun, curiosity-evoking and satisfying social activities, which coincide with greater perceptions of hedonic values, social presence and quality of presentation and are more likely to have higher levels of satisfaction.

This echoes scholars who have claimed that the quality of presentation helps to satisfy information-related needs and to answer the queries of e-commerce consumers; the present study demonstrated that the quality of presentation is a strong antecedent of cognitive assimilation in livestream shopping ($f^2 = 0.099$). This finding is consistent with the finding of Gao et al. [25] that information completeness is the strongest determinant of perceived persuasiveness. In livestreaming e-commerce, the direct observation of the product, accurate answers to various questions about the product and clear presentation of the product's features and the usage experiences of the live streamer can significantly enhance customers' acceptance of the product.

Past studies have uncovered different findings regarding the relationship between information quality and customer satisfaction [23, 88]. In line with Tam et al. [88], the quality of presentation in the present study was positively correlated to satisfaction. In the livestream shopping context, quality presentation is important to viewers, as the information may meet their utilitarian needs, which is one of the key

motivations behind livestream shopping [93]. Viewers are more satisfied if they can access useful and relevant information from the livestreaming programme.

The results of this study also emphasise the importance of social presence in livestreaming commerce, which coincides with prior studies [7, 53]. This finding is consistent with previous claims that perceived hedonic values and social values are significantly influenced by social presence in online contexts [100]. Livestreaming commerce viewers are more satisfied if the livestreaming video can provide higher levels of social presence. This result is important for planning livestreaming experiences, which must be designed not to focus only on the outcome but also on the way people will interact with the streamers and other viewers.

5.2 Practical implications

The results have yielded several practical suggestions for livestreaming commerce operators. Live streamers should maximise the advantages of the visual and interactive features of livestreaming broadcasts so that viewers derive utilitarian, hedonic and social value from watching livestreaming, which can influence their decisions and satisfaction. Our results suggest that the perceived serendipity, quality of presentation and social presence of livestreaming e-commerce can indeed positively influence customers' satisfaction and cognitive assimilation through consumer values.

Serendipity is an experiential process that has the property of being 'unexpected' [54]. Some studies suggest that serendipity essentially arises from chance encounters with marketing stimuli [43], while some studies suggest that perceived serendipity is a process of creating unexpected meaning for customers [61]. Live streamers can adopt unique, humorous and interesting appeals to present their products and enhance the serendipitous feelings of viewers.

The manner in which a seller presents their product should help the customer be able to understand how the product will be used in a close-to-real situation. The seller should explain the key features of products clearly, provide immediate responses to customers' questions about product information and discuss their experience with using the product. Live streamers should possess thorough product knowledge before broadcasting. Their own choice of high-quality goods will increase consumer trust and thus enhance persuasiveness to viewers. If they can demonstrate the use of their products and proactively help customers to solve problems, customers are more likely to feel satisfied.

Social presence is important to enhance the satisfaction of viewers. Real-time interactions with live streamers allow the viewers to obtain not only a more customised and thorough understanding of the products but also to develop a para-social relationship with the live streamers [25]. As demonstrated by Hou et al. [36], the current findings indicate that social presence is related to satisfaction and cognitive assimilation. Thus, live streamers should promote interactive communication by responding to viewers' questions and rewarding viewers to encourage them to express their ideas. Live streamers may also use various social networking sites and apps to connect with viewers and enhance communication with them since the

participation of viewers is influenced by both their attachment to the streamer and the group [15].

Livestreaming e-commerce platforms may also benefit from designing their physical environments in a manner that facilitates social interaction and social presence. As with livestreaming e-commerce platforms in China, they provide bullet screens which can enhance the enjoyment of livestreaming and real-time interactions between streamers and viewers [98]. Some livestreaming platforms have different ways to offer social value to viewers. For example, the platforms can provide badges and titles to reward viewers who send high-value gifts and provide them with privileges. Gift senders may feel their self-esteem enhanced when they send virtual gifts to live streamers in front of other viewers [47].

5.3 Limitations and suggestions for future research

This study was subjected to several limitations. First, the research context selection and data collection process might have restricted the generalisability of the results. This study involved conducting an investigation in Hong Kong and collecting data from social media and livestreaming platforms used by local residents. Future researchers are encouraged to investigate whether there are cultural differences in livestream viewing behaviours and our proposed model. Second, this study did not classify the live stream users in terms of their usage of livestreaming and purchase behaviours for further analysis. Recent research has also suggested that livestreaming is not universally successful in selling all types of products and that sellers should consider product attributes and types when using livestreaming [91]. Third, future studies can also examine various contextual factors and moderators in the process of persuasion. For example, the effect of the potential power of live streamers, such as celebrities and key opinion leaders, has received surprisingly limited scholarly attention. Finally, this study focuses on examining the impact of livestreaming on viewers. However, sellers can integrate livestreaming with different platforms and social media sites to augment their influence on customers. As a result, future studies can investigate how marketers can effectively integrate livestreaming with other social media and e-commerce platforms.

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Declarations

Conflict of interests On behalf of all authors, the corresponding author states that there is no conflict of interest. The authors have NO affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials discussed in this manuscript.

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