Contribution ID: **148** Type: **Poster**

A study on factors bullet screen commenting behaviours of e-sports fans during live watching from the perspective of social cognitive theory

Thursday, October 2, 2025 5:15 PM (15 minutes)

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Abstract
This study explores the factors influencing bullet screen commenting behaviour among e-sports fans during live watching, based on social cognitive theory. Using survey data from 1,457 respondents, the analysis shows that viewing motivation, self-efficacy, and immersion significantly promote commenting, with self-efficacy and immersion exerting stronger mediating and chain effects. The findings reveal the psychological and behavioural mechanisms driving interactive participation in e-sports live streams. Practically, they suggest that enriching content, enhancing immersion, and optimizing the commenting environment can effectively boost audience engagement, providing valuable guidance for improving e-sports broadcasting quality and tournament service strategies.
Keywords: e-sports；viewing motivation；self-efficacy；sense of presence；bullet screen commenting behaviours

1. Introduction

Bullet screen comments, an emerging form of online commentary, allow viewers to express attitudes through text, images, emojis, and symbols during live e-sports broadcasts, providing a real-time platform for fan interaction (Ma et al., 2024). As e-sports live watching grows, bullet screen comments have become a key channel to understand audience psychology and behavioural intentions, underscoring their research value (Hsieh & Zeng, 2022). Yet, existing studies rarely explore the mechanisms underlying such behaviours in the e-sports context, nor do they comprehensively examine influencing factors from motivational, psychological, environmental, and behavioural perspectives. Accordingly, this study addresses two questions:
(1) What factors influence bullet screen commenting among e-sports fans during live events?
(2) How can fans be better motivated to engage in commenting for enhanced viewing experiences?
To answer these, a conceptual model of the formation mechanism of bullet screen commenting behaviour was developed (see Fig. 1).

Fig.1 Conceptual model of the mechanism for generating viewer bullet screen commenting behaviour for e-sport online live streaming events

2. Methods

The study employed a two-stage survey of e-sports enthusiasts, comprising a preliminary survey and a formal survey, using snowball sampling to distribute questionnaires. A total of 1,692 responses were collected, of which 235 were excluded as invalid, resulting in 1,457 valid questionnaires and an effective response rate of 86.11%. The questionnaire consisted of two sections: the first collected respondents'demographic information, and the second measured four constructs—viewing motivation, self-efficacy, immersion, and bullet screen commenting—using a 21-item, five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Data analysis was conducted with SPSS 26.0 and AMOS 26.0. Reliability testing and exploratory factor analysis were performed on the pilot data, while confirmatory factor analysis on the formal dataset examined discriminant

and convergent validity. In addition, the PROCESS macro (Model 6) in SPSS 26.0 was used to test mediating effects via the bias-corrected non-parametric percentile bootstrap method with 5,000 resamples and a 95% confidence interval.

3. Results and Discussion

The study first tested for common method bias using Harman's single-factor test, and the results showed no serious bias. Correlation analysis indicated that bullet screen commenting behaviour was significantly and positively associated with viewing motivation, self-efficacy, and sense of presence, while the three antecedent variables were also significantly correlated with each other. Regression and bootstrap analyses further confirmed the hypothesized relationships. Viewing motivation significantly predicted bullet screen commenting behaviour both directly and indirectly (see Table 1). Specifically, self-efficacy and sense of presence served as mediators, with three significant mediating paths identified: (1) viewing motivatio→self-efficacy→commenting behaviour (effect value=0.242, 95% CIs=[0.191, 0.294]) , (2) viewing motivation→sense of presence→commenting behaviour (effect value=0.103, 95% CIs =[0.072, 0.136]) , and (3) viewing motivation→self-efficacy→sense of presence→commenting behaviour (effect value=0.098, 95% CIs=[0.075, 0.125]) (see Table 2). The mediating effect accounted for 63.74% of the total effect, indicating that bullet screen commenting behaviour is shaped not only by direct motivational drivers but also by psychological mechanisms of efficacy and immersion, which substantially enhance the predictive power of the model (see Fig. 2).

This study highlights that bullet screen commenting is not only a direct outcome of viewing motivation but is also shaped by psychological and experiential mechanisms. While motivation encourages fans to share opinions, emotional expression, and knowledge with others (Zhang & Wang, 2020; Zhou et al., 2019; Lin et al., 2018), the findings show that self-efficacy significantly enhances this process. Drawing on self-determination theory and social cognitive theory, higher self-efficacy increases viewers'confidence in expressing themselves, thereby fostering interactive commenting as a way of communication and self-presentation (Schunk & DiBenedetto, 2020; Deci & Ryan, 1985;Qin & Li, 2020). Similarly, the sense of presence acts as a crucial mediator: immersive experiences created by interactivity, entertainment, and visibility stimulate satisfaction and strengthen the bridge between motivation and commenting behaviour (Yu & Xu, 2017). Importantly, the study validates a sequential pathway, whereby motivation enhances self-efficacy, which in turn heightens the sense of presence, ultimately driving commenting engagement. This indicates that viewers who feel more capable and immersed are more likely to actively participate in bullet screen interactions. Overall, the results suggest that beyond motivational drivers, psychological confidence and immersive experiences play a pivotal role in shaping interactive behaviours, offering new insights for understanding audience participation in e-sports broadcasting.

Table 1 Test results of hypotheses H1-H6

Table 2 Results of the mediation effect test

Fig. 2 Mediated model of viewer bullet screen commenting behaviour in e-sport online live events

4. Conclusions

(1) Stronger live-watching motivation directly promotes e-sports enthusiasts'bullet screen commenting, while a higher sense of presence further encourages interactive communication.

(2) Viewing motivation also indirectly drives commenting behaviour by enhancing self-efficacy and sense of presence, which increase willingness and frequency of engagement.

(3) Motivation fosters self-efficacy, which strengthens the sense of presence, jointly forming a chain effect that ultimately leads to bullet screen commenting.

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Session Classification: POSTER PRESENTATION

Track Classification: Digital Sports, E-Sports, and Physical Activity