Flow state as a performance measure in Esports

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Abstract

Esports (i.e. electronic sports) are a kind of sport characterized mainly by being facilitated by an electronic system. Currently, Esports is a growing discipline that is getting popularity year after year. The most played games in Latin America are Counter-Strike: Global Offensive (CSGO) and League of Legends (LoL). However, there is yet little research on Esports and the psychological factors involved during games that may affect player performance. In sports, the Flow State (sometimes simply called “flow”) is a sensation in which one's own skills are adequate to face the challenges that are presented to us. Literature suggests that entering Flow State may improve performance. This work seeks, on the one hand, to determine whether Counter-Strike: Global Offensive (CSGO) and League of Legends (LoL) players manage to experience a Flow State during such activity. On the other hand, improvement of player performance due to entering into Flow State was tested. Finally, the study assessed whether a more satisfying subjective experience was obtained in players who managed to enter the Flow State. For this purpose, an online survey (n = 323) was conducted using a Flow State Scale and an Optimal Experience Questionnaire after the participants had played their last game. Results show that most of the surveyed players entered in Flow State, and that this would have generated both a more satisfying experience and a better performance. These results deepen knowledge about Esports and may help in improving players' experience in video games and their performance.

Keywords: optimal experience, videogames, amateur, self-consciousness, engagement

Introduction

Esports (i.e. electronic sports) are a kind of sport characterized mainly by being facilitated by an electronic system (Wagner, 2006). In practical terms, Esport commonly refers to the fact of playing video games in a competitive way (professional or amateur) that are coordinated under different leagues, leaderboards and championships, where players belong to teams or other sports organizations that are sponsored by different commercial organizations (Wagner, 2006). Interestingly, team disciplines seem to be preferred by western Esports culture, while individual disciplines are more popular in eastern culture (Hamari & Sjöblom, 2017).

Currently the most played games in Latin America are Counter-Strike: Global Offensive (CSGO) and League of Legends (LoL) (Hamari & Sjöblom, 2017). This kind of video games are based on two teams competing against each other in a sequence of rounds in which players have either to kill or to destroy the other team structures. In order to achieve optimal performance in competition, players must be able to fully concentrate on the activity and to adapt to their opponents, entirely relying on their own abilities (Fernández-Macías, 2015; Nakamura & Csikszentmihalyi, 2014).

Counter Strike: Global Ofensive (CSGO) is a First-Person shooter videogame created by Valve and Hidden Path Entertainment in 2012. It is a Competitive E-Sport in which two teams conformed by 5 players face each other in multiple rounds. The players can choose between two teams: terrorist and antiterrorist. The terrorist team's mission is "plant a bomb" in a specific part of the map; and the antiterrorist team's mission is to deactivate that bomb. The winner of the game is the team that wins more rounds. This videogame is set in a war scene. There are several game modes: Competitive; Partner; Casual; DeathMatch; Armament Race; Demolition; Duck Hunter. The classic mode to play is Competitive.

League of Legens (LoL) is a multiplayer online battle arena video game developed by Riot Games in 2009. In this competitive esport, 2 teams of 5 players face each other. It is characterized as a strategy game, tower defense and computer role-playing game with a medieval setting. To win you have to destroy the other team's nexus. The Nexus it is like the core of the teams and gives the players the control over his characters. There are 140 champions to choose from and 3 game modes, the most played is "summoner's rift".

The flow state

The flow state (sometimes simply called “flow”) is a sensation in which one's own skills are adequate to face the challenges encountered (Jackson & Csikszentmihalyi, 2002). This sensation emerges during activities that are goal-directed and governed by rules providing clear feedback on performance (Nakamura & Csikszentmihalyi, 2014). This state of concentration happens to be so intense that it would decrease attention to irrelevant aspects of the environment as well as inducing a temporal distortion during the experience; that is, the feeling that time goes by faster than normal (Jackson & Csikszentmihalyi, 2002; Nakamura & Csikszentmihalyi, 2014).

Nakamura and Csikszentmihalyi (2014) proposed the existence of two conditions in order to enter Flow State. The first refers to the perception of a challenge, or opportunities for action, that require (without exceeding or underusing) existing skills. It is the feeling that one is facing challenges that have a level of difficulty appropriate to one's abilities. Thus, one has the feeling that he can control his own actions; that is, you can deal with the situation because you know how to respond to whatever comes next (Nakamura & Csikszentmihalyi, 2014).

The second condition is to have clear goals and to have immediate feedback on the progress that is being made. The Flow State is about a subjective experience of facing

manageable challenges by addressing a series of goals, processing feedback about progress, and adjusting actions based on that feedback (Nakamura & Csikszentmihalyi, 2014).

Under these conditions, the experience unfolds seamlessly from moment to moment, and one gets in a subjective state that presents intense concentration and focus on what is being done, developing a fusion between action and consciousness (Nakamura & Csikszentmihalyi, 2014). This characteristic focuses on performing tasks automatically, allowing performing the activity in a more fluid way, thus avoiding the occurrence of intrusive thoughts (Calvo et al., 2008; Jackson, 1996).

According to Nakamura and Csikszentmihalyi (2014), during the flow state, the experience of the activity becomes intrinsically rewarding. The autotelic experience refers to the intrinsic satisfaction produced by the task. This is related to self-determination theory (Deci & Ryan, 2002), which postulates that a task is easier to perform when one feels satisfaction simply by doing it, without the need for any external reward (Calvo et al., 2008).

The flow state and performance in Esports

In a recent study (Himmelstein & Shapiro, 2017), it was stated that to achieve optimal performance, players should be able to adapt to their opponents, communicate adequately with their teammates (in cases where the game is not individual), and fully trust their abilities (Bányai et al., 2019). In addition, they must be able to develop themselves and their team (i.e., engage in individual skill practice and analyze team and self-performance) and set a varied set of goals (short-term and long-term). On the other hand, barriers or difficulties in execution are related to trust problems, inadequate coping strategies, past achievements and mistakes, lack of personal and team development (Himmelstein & Shapiro, 2017).

López-Torres et al. (2007) discovered that the flow state occurs in a situation of optimal performance in elite athletes. Particularly, they discovered that flow values are higher in better sports performance experiences, while worse sports performance experiences present lower values (López-Torres et al., 2007). However, there is still debate about whether research results in other sports could be generalized to Esports. In addition, this is reinforced by the lack of research related to Esports and the performance of its players.

Objective of this study

The purpose of this study is to determine whether CSGO and LoL players are able to reach flow state while playing these games, and whether their performance improves or not depending on it. Finally, to assess if players manage to experience a more satisfying subjective experience when they are in flow state.

Hypothesis

Hypothesis 1a [H1a]: The Esport CSGO video game allows its players to enter in flow state.

Hypothesis 1b [H1b]: The Esport LoL video game allows its players to enter in flow state.

Hypothesis 2a [H2a]: The performance of CSGO participants who enter the flow state is higher compared to those who do not enter the flow state.

Hypothesis 2b [H2b]: The performance of LoL participants who enter the flow state is higher compared to those who do not enter the flow state.

Hypothesis 3a [H3a]: CSGO participants who enter the flow state report having more satisfying subjective experiences than participants who cannot access this state.

Hypothesis 3b [H3b]: LoL participants who enter the Flow State report having more satisfying subjective experiences than participants who cannot access that state.

Methods

An online flyer was posted in Spanish-speaking player forums on different social networks such as Facebook, Instagram and Discord. The purpose of the survey was to reach the general public. 283 subjects (CSGO) and 40 subjects (LoL) were surveyed after finishing a game through an online survey using Google Forms. The differences between the sample sizes were due to the number of players participating in the Latin American community forums, being much higher for CSGO than for LoL.

The survey involved assessing flow state, cognitive activation level and the emotional tone of the experience, in addition to demographic data. At the beginning of the questionnaire, participants were asked to complete an informed consent.

Subjects

The surveyed players for both Esports were all general public over 18 years of age, with an average age of 20.4 years (*SD* = 6.4) for CSGO and an average age of 22.5 years (*SD* = 3.5) for LoL. The majority of both samples were men (94.2 % for CSGO and 77.5 % for LoL) and the nationality of the participants was mostly Argentine (93.9 % for CSGO and 82.5 % for LoL), while the rest of the sample were from other Latin American.

It was observed that participants slept an average of 7.5 hours (*SD* = 2) for CSGO and 7.35 hours (*SD* = 0.7) for LoL the night before the survey was carried out. On the other hand, these participants reported playing daily an average of 4.8 hours a day (*SD* = 2.1) for CSGO and 3.3 hours (*SD* = 1.4) for LoL.

In-game performance

In order to measure the performance of each participant within the video game, the statistics thrown at the end of each game were used. A screenshot of the results of their last game was requested when completing the survey[1]. In case the images were

[1]Particularly for CSGO, only 56 participants from the original sample provided a screenshot of the results of their last game.

unreadable results were consulted by mail. This allowed to record the number of kills (i.e., the number of times the participant killed another player within a game), deaths (i.e., the number of times the participant died within the game) and assists (i.e., the number of times the participant collaborated in a kill by damaging the health of another player during a game). The performance of each player was determined based on the K / D ratio, which implies dividing the number of kills divided by the number of deaths that each participant had.

Additionally, for LoL, if the player used a support character in the team, his performance would be calculated by dividing the number of assists by the number of deaths. (A / D). In any other role, his performance was calculated by dividing the number of kills by the number of deaths (K / D) he had in the game.

Instruments

In order to measure the Flow State, the Spanish adaptation (Calvo et al., 2008) of the Flow State Scale (Jackson & Eklund, 2002; Jackson & Marsh, 1996) was used. Its construction was based on the nine dimensions of flow: Balance between ability level and challenge, Merging of action and awareness, Clear goals, Clear direct feedback, Concentration on task, Sense of control, Loss of self-consciousness, Distorted sense of time, Autotelic experience (Jackson & Csikszentmihalyi, 2002; Jackson & Marsh, 1996). Each dimension was assessed by four questions. In other words, the scale is made up of 36 items in total. The format for responding consisted of a 10-point Likert-type scale, going from “1” (strongly disagree) to “10” (strongly agree). According to literature consulted, the selected cut-off score was 6.8 (Jackman et al., 2017; Kawabata & Evans, 2016). Jackson and Marsh (1996) reported that the internal consistency in the nine subscales was $\alpha = .83$ (ranging from .80 to .86) after having administered it to 394 athletes. Also, the Spanish adaptation (Calvo et al., 2008) showed

an adequate internal consistency with an average Cronbach's alpha coefficient higher than .70 for all factors. Regarding goodness-of-fit indexes, both the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) had values higher than .90, and the root mean square error of approximation (RMSEA) had values lower than .08. These values showed to be acceptable according to literature (Hu & Bentler, 1999).

In addition, with the purpose of evaluating the emotional tone and cognitive activation of the participants, a section of the Optimal Experience Questionnaire (Mesurado, 2008) was used, which allows evaluating the emotion caused by carrying out the task (emotional tone), and the alert sense of competence that one has during the task (cognitive activation). Emotional tone and cognitive activation were evaluated with the 7-point semantic differential method through 14 items.

Data analysis

The data of this study was analyzed using the programming language R. To obtain the value of the flow state in each participant, and in order to test the authors first hypothesis, responses of the 9 subscales that make up the Flow State Scale were averaged. In the first instance, it was necessary to define a cut-off score on said scale, which was set at 6.8, following the criteria used by Kawabata and Evans (2016).

For subsequent analyses of mean comparisons, Student's t-tests were used as long as the assumptions of the t-test were fulfilled. These are: a) the normal distribution of the variable (measurable with the Shapiro-Wilk test); b) the homogeneity of variances (Levene's test).

A one-sample Wilcoxon signed rank test was performed to assess whether the Esports evaluated allowed their players to enter a Flow State ($\mu = 6.8$), considering that this variable was not normally distributed for either CSGO ($V = 25215$; $p < .001$) or LoL ($V = 581$; $p = .011$) players.

Regarding the analysis of performance based on the flow state for CSGO, no evidence was found that the variable related to the performance of the participants does not satisfy the assumption of distributional normality for those who passed the cut-off score of the Flow State ($W = .94$; $p = .06$) nor for those who did not enter a Flow State ($W = .92$; $p = .26$). Likewise, no significant differences were found between the variances of the subjective experiences of the participants in both conditions ($p = .13$). Therefore, a two-sample t-test was carried out to compare performance means according to the condition of the Flow State of the participants to respond to the hypothesis (H2a). On the other hand, in the case of LoL it could not be proved that the variable relative to the performance of the participants satisfies the assumption of distributional normality for those who passed the cut-off score of the Flow State ($W = .85$; $p = .001$) or for those who did not enter a Flow State ($W = .57$; $p < .001$). As it was not possible to apply a t-test for comparison of means, a Wilcoxon test was performed to answer the research question (H2b).

For the analysis of the results about optimal experience, it was necessary to perform a comparison means test in order to respond to the hypothesis raised (H3a and H3b). First, it was analysed whether the variable related to the subjective experience of the participants fulfilled the assumptions of normality and homoscedasticity of the variances. Thus, after performing a Shapiro-Wilk test for CSGO participants, it was observed that data was not normally distributed, both for the participants who entered the flow state ($W = .96$, $p < .001$), and for those who did not enter the Flow State ($W = .95$, $p < .001$). Finally, significant differences were found between the variances of the subjective experiences of the participants in both conditions ($p < .05$). Therefore, it was decided to perform a non-parametric test of medians to answer this research question.

On the other hand, in order to answer the last hypothesis (H3b), it was necessary to perform a means comparison test. Thus, whether the data related to the subjective experience of the participants fulfilled the assumptions of normality and homoscedasticity of the variances was tested. After performing a Shapiro-Wilk test, it was observed that the distribution of the variable was normal, for both the participants who entered a flow state ($W = .97$, $p = .56$), and for those who did not ($W = .91$, $p = .19$). Since no significant differences were found between the variances of the subjective experiences of the participants in both conditions ($p > .20$), a *t*-test was carried out to compare the means of subjective experience according to the flow state condition of the participants.

Results

Flow state

As Table 1 evidence, the descriptive statistical analysis showed that 63.6 % (n = 180) for CSGO and 70 % (n = 28) for LoL of the players entered into flow state in the CSGO game prior to completing the questionnaire. Participants for CSGO who surpassed the cut-off score in the flow scale had a mean score of 7.05 ($SD = 1.5$), and those for LoL had a mean score of 7.19 ($SD = 1.43$). According to the one-sample t-test, there is evidence that players enter in flow state both while playing CSGO [$t\ (310) = 3.44$; $p < .001$] and LoL [$t\ (39) = 1.72$; $p = .047$].

Table 1.

Data of the participants who passed the state of flow and those who did not

	n	**% of participants**
Flow state (CSGO)	180	63.6
Flow state (LoL)	28	70
No flow state (CSGO)	103	36.4

No flow state (LoL)	12	30

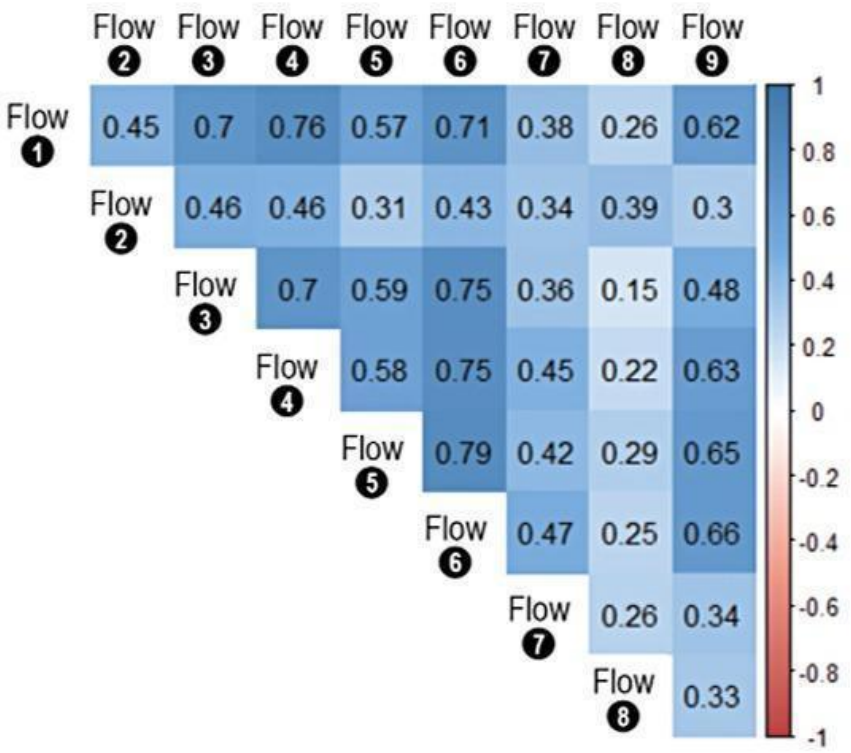
Results show that players who surpassed the cut-off flow score in any of the subscales did not necessarily manage to do it in all of them. It is observed that the majority of the players scored high on subscales such as clear goals (75.5 %; 76.2 %)[2], concentration on the task (74.4 %; 73.2 %), autotelic experience (74.1 %; 73.5 %), sense of control (73.9 %; 72.4 %) and balance between ability level and challenge (73.6 %; 74.2 %). However, a low percentage of players managed to reach the cut-off score in subscales such as distorted sense of time (25.2 %; 19.2 %).

A correlation analysis was performed (see Figure 1 and 2) to test the correlation between the different subscales. Although all flow subscales correlated positively with each other.

Figure 1.

[2]The first percentages correspond to CSGO analyses and the second ones to LoL.

Correlogram of the scores of the different flow subscales for CSGO



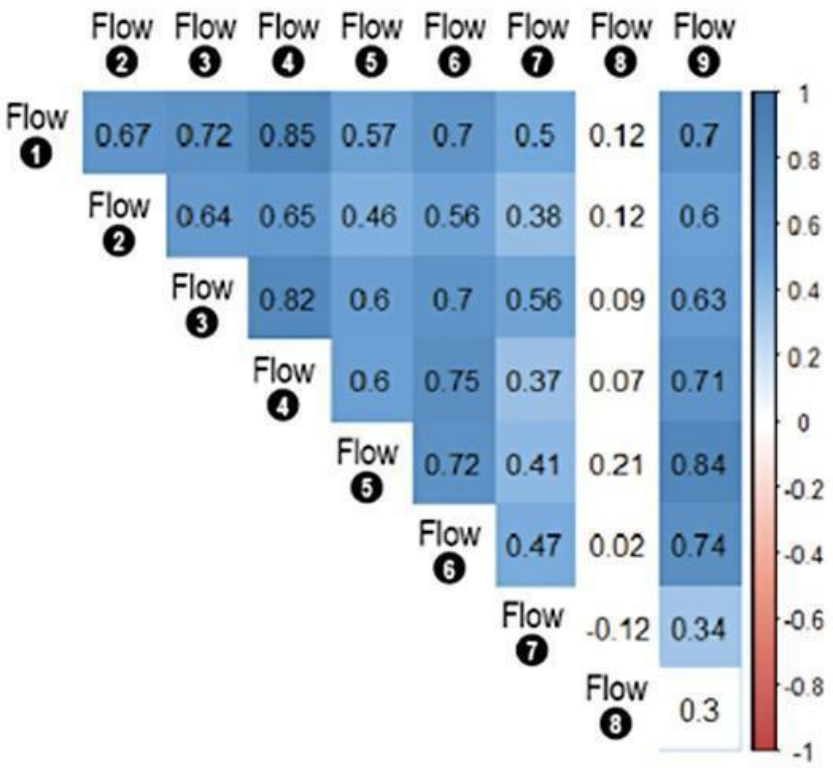
Notes:

All comparisons between flow subscales were significant after applying a Bonferroni *p* value adjustment ($p < .001$), except for comparison between flow 3 and 8 ($p = .01$).

Flow 1: Balance between ability level and challenge, Flow 2: Merging of action and awareness, Flow 3: Clear goals, Flow 4: Clear direct feedback, Flow 5: Concentration on task, Flow 6: Sense of control, Flow 7: Loss of self-consciousness, Flow 8: Distorted sense of time, Flow 9: Autotelic experience.

Figure 2.

Correlogram of the scores of the different flow subscales for LoL.



Notes:

All comparisons between flow subscales were significant after applying a Bonferroni *p* value adjustment, except for comparison between flow 3 and 8 ($p = .01$).

Flow 1: Balance between ability level and challenge, Flow 2: Merging of action and awareness, Flow 3: Clear goals, Flow 4: Clear direct feedback, Flow 5: Concentration on task, Flow 6: Sense of control, Flow 7: Loss of self-consciousness, Flow 8: Distorted sense of time, Flow 9: Autotelic experience.

For CSGO analyses, the strongest correlations were found between the subscales "Concentration on task" and "Sense of control" ($r = .79$; $p < .001$), "Balance between ability level and challenge" and "Clear direct feedback" ($r = .76$; $p < .001$), "Balance between ability level and challenge" and "Clear goals" ($r = .7$; $p < .001$), "Balance between ability level and challenge" and "Sense of control" ($r = .71$; $p < .001$), "Clear goals" and "Sense of control" ($r = .75$; $p < .001$), "Clear direct feedback" and "Sense of

control" (r = .75; p < .001), and, finally, "Clear goals" and "Clear direct feedback" (r = .7; p < .001).

Also, for LoL the strongest correlations were found between the subscales "Balance between ability level and challenge" and "Clear direct feedback" (r = .85; p < .001), "Autotelic experience" and "Concentration on task" (r = .84 ; p < .001), "Clear goals" and "Clear direct feedback" (r = .82; p < .001), "Clear direct feedback" and "Sense of control" (r = .75; p <.001), "Autotelic experience" and "Sense of control" (r = .74; p < .001) and, finally, "Concentration on task" and "Sense of control" (r = .72; p < .001). On the other hand, it was observed that the subscale "Distorted sense of time" presented non-significant correlations with the rest of the scales for both games.

Cronbach's alpha coefficient was calculated for the total scale and for each subscale, in order to assess the internal consistency of the instrument for both CSGO and LoL players. The values obtained for CSGO players were: α = .94, 95%IC [.93, .95] for the total Flow State Scale, α = .82, 95%IC [.78, .85] for Balance between ability level and challenge, α = .84, 95%IC [.81, .87] for Merging of action and awareness, α = .80, 95%IC [76, .84] for Clear goals, α = .87, 95%IC [.84, .89] for Clear Direct feedback, α = .88, 95%IC [.86, .90] for Concentration on task, α = .85, 95%IC [.81, .87] for Sense of control, α = .79, 95%IC [.75, .83] for Loss of self-consciousness, α = .78, 95%IC [.73, .82] for Distorted sense of time, and α = .88, 95%IC [.85, .90] for Autotelic experience. On the other hand, the values obtained for LoL players were: α = .95, 95%IC [.92, .97] for the total Flow State Scale, α = .86, 95%IC [.77, .92] for Balance between ability level and challenge, α = .84, 95%IC [.74, .91] for Merging of action and awareness, α = .89, 95%IC [83, .94] for Clear goals, α = .92, 95%IC [.87, .95] for Clear Direct feedback, α = .91, 95%IC [.85, .95] for Concentration on task, α = .76, 95%IC [.61, .86] for Sense of control, α = .77, 95%IC [.63, .87] for Loss of self-consciousness, α = .81,

95%IC [.69, .89] for Distorted sense of time, and α = .88, 95%IC [.81, .93] for Autotelic experience.

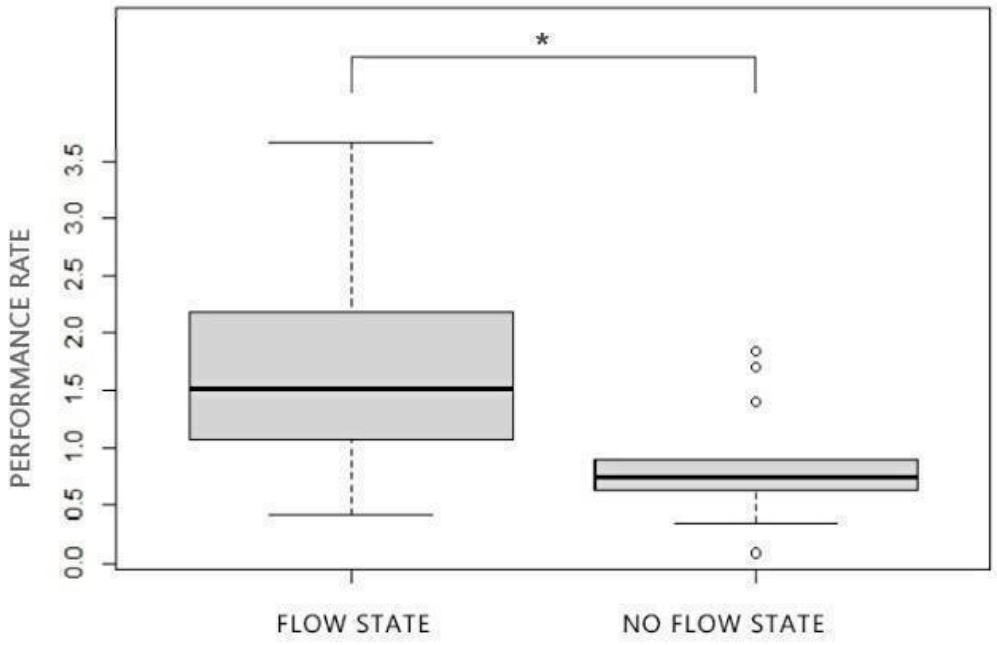
A confirmatory factor analysis (CFA) was performed with the 36 items to test whether the factor structure of the Flow State Scale in CSGO and LoL playes is equivalent to the original structure. The nine latent variables corresponding to those suggested by the original authors were introduced into the model. The model for fit was determined by the Comparative Fit Index (CSGO CFI = .89; LoL CFI = .5), the Tucker-Lewis Index (TLI = .88; LoL TLI = .43) and the root mean square error of approximation (CSGO RMSEA = .07; LoL RMSEA = .23).

Flow state and performance

Significant differences were found, showing a significantly better performance [t (43) = 3.57; p <.001; Cohen's d = 1.17] for those who entered a flow state (M = 1.69; SD = .77) compared to those who did not in CSGO (M = .87; SD = .51) (Figures 3 and 4). Similarly, in LoL players, the performance of those who entered flow state was higher (Mdn = 3) than in those who did not enter into flow state (Mdn = .82; W = 233, p = .001). The Glass rank biserial correlation coefficient rg = .63 indicated a large effect size.

Figure 3.

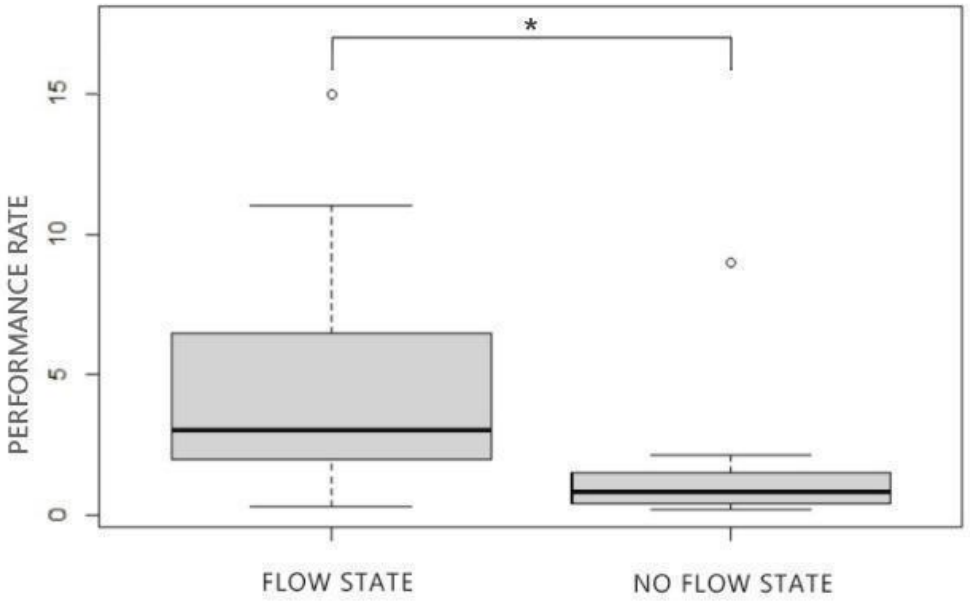
Comparative boxplot of performance in participants who entered or did not enter the flow state for CSGO.



Note. *Significant differences were found ($p < .001$) between performance in players who entered in flow state (M = 1.69; SD = .77) and those who did not (M = .87; SD = .51).

Figure 4.

Comparative boxplot of performance in participants who entered or did not enter the flow state for LoL.



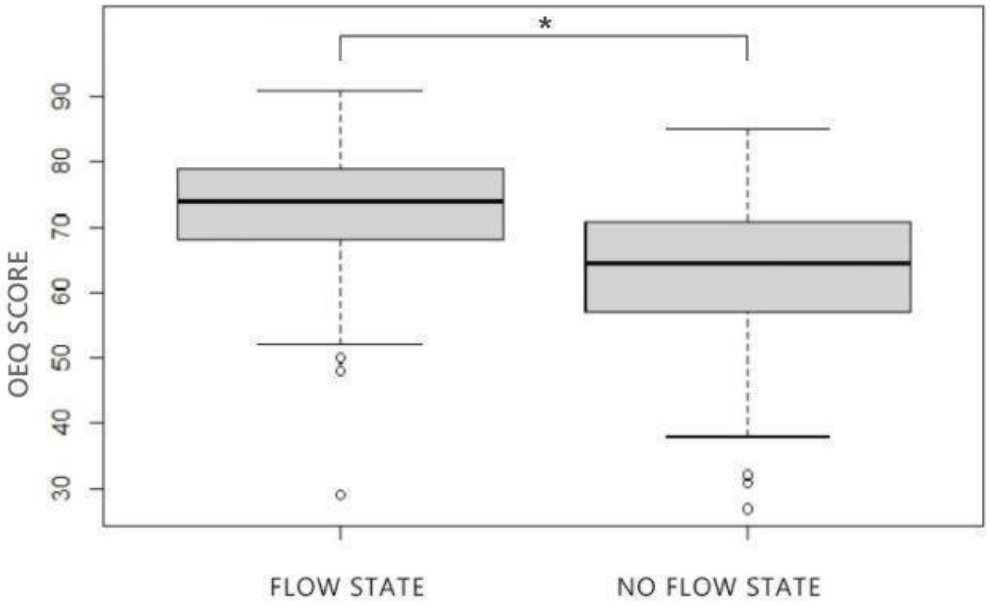
Note. *Significant differences were found ($p < .001$) in performance of players that entered flow state ($Mdn = 3$) compared to those who did not ($Mdn = .82$).

Flow state and optimal experience

As shown in Figure 5, it was observed that the CSGO players' subjective experience was significantly more satisfying [t (253) = 7.5; $p < .001$; Cohen's $d = .97$] for those who enter into flow state ($M = 73.09$; $SD = 9.67$) compared to those who did not enter into flow state ($M = 62.72$; $SD = 12.155$). This could be observed in LoL players too (Figure 6), in whom their subjective experience was significantly more satisfying [t (38) = 6.69; $p < .001$; Cohen's $d = 2.31$] for those who enter into flow state ($M = 75.79$; $SD = 6.88$) compared to those who did not enter into flow state ($M = 56.83$; $SD = 10.79$).

Figure 5.

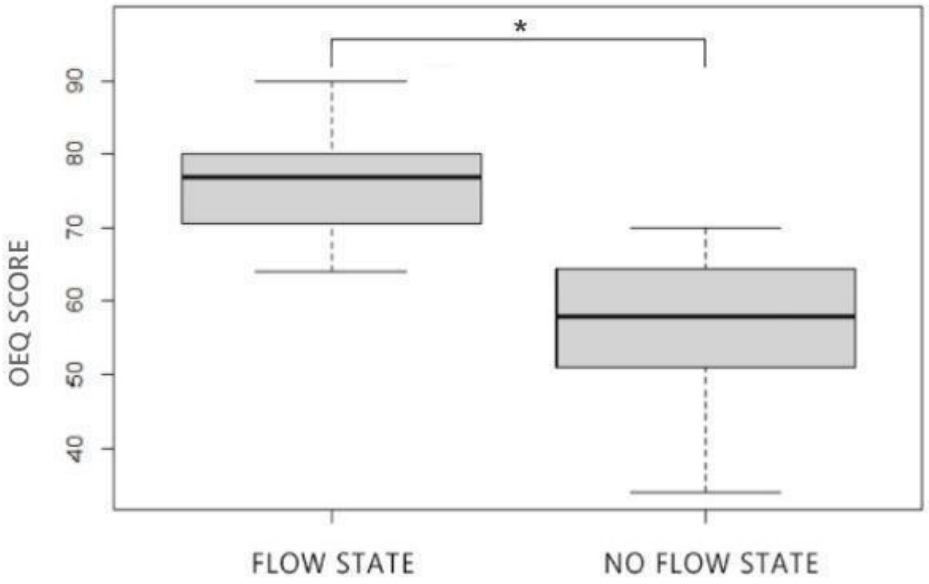
Subjective experience score for participants who had or had not passed the flow state cut off score for CSGO



Note. More satisfying subjective experiences (higher raw scores) in participants who entered a flow state were observed. *Significant differences were found ($p < .001$).

Figure 6.

Subjective experience score for participants who had or had not passed the flow state cut-off score for LoL



More satisfying subjective experiences (higher raw scores) were observed in participants who entered in a flow state. *Significant differences were found ($p < .001$).

Discussion

The aim of this study was to determine if Esports players could experience the flow state while playing, if their performance improved depending on whether they entered this state and if their experience became subjectively more satisfying when they were in flow. With this goal in mind, two online surveys were conducted (n = 283; n = 40) where participants had to complete once they finished playing their last game. In order to be able to guarantee with greater certainty that the players had entered a flow state, not only was the Flow State Scale (FSS) used, but also a Questionnaire of Optimal Experience was added to the survey that allows to inquire about other characteristics of the experience.

The results indicate that 63.6 % of players managed to exceed the flow status threshold in CSGO and 70 % for LoL. However, not all players who managed to reach the threshold in some of the flow dimensions did so in all of them. This phenomenon may be what some authors have proposed as “microflow” states (Jackson, 1995). This would imply that they experience flow episodes with a certain frequency or depth, but they do not experience the different flow dimensions in the same way or reach the same subjective state (Fernández Macías et al., 2015).

One of the dimensions that most frequently appeared in the participants was the autotelic experience, in line with Jackson and Csikszentmihalyi (2002), who consider this dimension as one of the most associated with best performances. Results obtained in the LoL study show that the autotelic experience positively correlates with the rest of the dimensions (mainly with the concentration on task) with the exception of the distorted sense of time. Another of the most frequently experienced dimensions was clear goals, which seems to mean that players set realistic goals that made it easier for them to focus on the game. The third most experienced dimension was concentration on

task, which may imply that focused attention helps the player to experience positive states (Fernández Macías et al., 2015). Finally, the fourth dimension that was most experienced was balance between ability level and challenge; this would mean that the ranking systems in these Esports actually allow the player to find challenges that are suitable for his abilities.

On the other hand, it was found that the least experienced dimension, both in CSGO and LoL, was the distorted sense of time. This could be explained by the fact that players are constantly aware of time passing, since this allows them to organize their actions and teamwork during the match. Unlike other sports, in Esports the situational conditions or the map in which it is played usually change at certain moments of the game, so having a clock or "game time" becomes a tool that allows to improve performance. It should be noted that, although this dimension has been the least experienced, this did not interfere with the development of the rest of the flow dimensions or with achieving better performance. As evidenced, the dimension of distorted sense of time was the one that least correlated with the rest of the dimensions. These results are congruent with those obtained by Fernández Macías (2015), who found that marathon athletes experienced at a lower level the flow dimensions that correspond to the distortion of the sense of time, the loss of self-awareness and the merging of action and awareness. Similar results were previously obtained in other research on the performance of elite athletes in the flow state (López-Torres et al., 2007). In the mentioned study, researchers made recordings and self-reports of the athletes in order to identify phrases that were linked to the subscales that make up the flow state. The subscales of loss of self-awareness and distortion of the sense of time were the ones with the fewest reports. All this could suggest that the distortion of the

sense of time is not directly linked to the experience of the flow state or that, at least, it is not absolutely necessary to experience this state.

The model fit values obtained (i.e. CFI, TLI and RMSEA) for CSGO players can be interpreted as acceptable, considering the parameters proposed by Brown (2015). However, these metrics for LoL players were below the threshold of acceptability. Nevertheless, this makes sense considering that the the confirmatory factor analysis for LoL players was computed is 40 participants, while a reasonable sample size to conduct such type of analysis would be n = 150 (Muthén and Muthén, 2002).

Regarding the performance of the participants, it was found that those who managed to enter the flow state in their last game performed better than those who did not manage to enter that state. The dimensions that best correlated with good performance were "Balance between ability level and challenge" and "Clear goals". These results are consistent with what Fernández-Macías (2015) states that flow is associated with sporting success and the ideal state to compete (Jackson, 1996; Jackson & Csikszentmihalyi, 2002; Jackson et al., 1998; Jackson & Marsh, 1996). When they are in flow state, athletes manage to completely abstract themselves in their execution, to the point of experiencing their own sensations, perceptions and actions in an extraordinarily positive way, performing their best possible performance in an apparently automatic way (Jackson, 2000). Consequently, the flow characteristics favor high performance, and therefore directly predict the quality of execution (Fernández-Macías et al., 2015).

The results obtained in the present research regarding the optimal experience of the participants are consistent with the development of the flow state and support the results obtained by the FSS scale. According to some authors, it may be questionable to assure that the flow state has been reached simply by achieving a certain score in a survey

without directly evaluating the participants through interviews and other techniques (Jackman et al., 2017). However, in this study it was found that the players who entered into flow during their last game did indeed experience a more satisfying subjective experience. These findings are consistent with that described by Mesurado (2010), who states that perception of achievement would affect the positive emotional experience, developing an emotional state of gratification, which in turn, would affect cognitive activation. Finally, cognitive activation (characterized by a high concentration on the task and focused and sustained attention), would affect the achievement experience, thus forming a feedback between the variables that explain the optimal experience or flow (Mesurado, 2010). Consequently, both this feeling of gratification during the performance of the task and the adequate cognitive activation would imply an ideal performance. However, it would be worth raising the possibility that the results referring to the optimal experience are a consequence of the good performance in the game and not its cause, since it would be expected that those players who did well would have been more inclined to score higher in the indicators of a subjectively more satisfying experience but that would not be strictly involved with the development of flow.

Many recent studies have investigated psychological factors such as flow state (Chen et al., 2019) and competitive anxiety in high-performance sports (Caicedo et al., 2017; Correia & Rosado, 2018; Pluhar et al., 2019; Zhang et al., 2018). However, this is the first study that works with a population that is exclusively dedicated to electronic sports. The present study is one of the first to provide evidence that it is possible to experience the flow state when playing electronic sports. In this regard, video games currently have the ability to offer the player useful and accurate information about their performance in the game, and the objectives to win the game are also well defined. This is consistent

with what Nakamura and Csikszentmihalyi (2014) say that clarity of objectives and accurate and immediate feedback are essential conditions to enter in flow state. In the same way, Esports today have developed a great control configuration for the player. This means that players have certain facilities that allow them to improve their mastery of the game. For example, players are allowed to assign keyboard keys to their liking, or even, when you have the necessary peripheral accessories (mouse, keyboard, etc.) it is possible to assign some specific actions to other keys in order to accelerate certain movements within the game. This is closely related to what Jackson (1995) mentions, that one of the facilitators of the flow state is the optimal environment and situational conditions. In this sense, it could be thought that the characteristics of soundtrack, in game graphics, and the convenience of the controls are linked to these facilitators for the development of flow in Esports players.

Regarding the practical applicability of the results obtained, it can be said that, in order to improve player's experience and their performance in the game, game developers should pay special attention to the in-game communication with the player, informing in a simple and direct way the evaluation of the player's performance, and establishing clear and realistic goals that facilitate focusing on their task. Likewise, it is important that video games have classifications by ranking or different leagues (as CS: GO and LoL do) that allow players to place themselves at an adequate difficulty level for their abilities, allowing them to avoid boredom by winning too easily or the frustration of losing repeatedly.

Limitations

Currently, there are indicators in CSGO such as the ADR (i.e. average damage per round) and the HVTL index, which can be observed in external web pages. Similarly, in LoL, there are indicators of damage to champions, structure damage, gold earned and

objectives achieved (the latter essential for players in the role of "jungle"). In future research, it would be relevant to have these performance indices to ensure that players actually performed better within the game.

Also, some of the variables that can affect the performance of players in Esports are the internet connection quality and speed, and the computer or device in which the game is played. In this study, data collection was limited to remote methods, leading to variables that remained uncontrolled. Although robust results were found as predicted, future research should ensure that all players have the same connectivity and device.

Conclusions

The main conclusions that can be drawn from this research are that Esports players experience flow episodes in the same way as in other sports modalities. The dimensions most experienced by players are autotelic experience, clear goals, balance between ability level and challenge, and concentration on the task; while there is a marked contrast with the dimension referred to the distortion of the sense of time. The results obtained allow us to report that the fact of entering in a flow state not only implies performing in the best possible way, but also that the experience becomes subjectively more satisfying accompanied by positive emotions and an optimal level of cognitive activation for the development of the task. In this way, players do not get bored or fatigued in their activity, achieving an ideal performance at every moment of the competition.

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