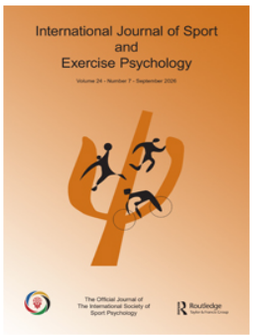

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Exploring self-regulatory processes in League of Legends using think-aloud

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ABSTRACT

Although self-regulation is widely recognised as central to performance in traditional sport, esports research often relies on retrospective or self-report measures, offering limited insight into how players regulate cognition, emotion, and behaviour in real time. This novel study examined self-regulatory processes in League of Legends using a think-aloud protocol to capture cognition as it occurred during play. Four semi-professional players verbalised their thoughts while competing in solo queue, and data were analysed using reflexive thematic analysis, guided by Zimmerman's cyclical model of self-regulated learning. Findings demonstrated evidence of forethought, performance, and self-reflection phases, while also highlighting the rapid and recursive nature of self-regulation in esports. Players engaged in ongoing goal setting, strategic planning, attentional control, emotional regulation, and post-game evaluation. Regulation was influenced by social and contextual demands, and the draft phase was identified as a unique context within League of Legends that impacted players' anticipatory planning, emotional responses, and early regulatory efforts before gameplay began. Our study provides insight into how regulatory processes function in fast-paced, information-dense environments, offering applied insights for esports players, coaches, and practitioners seeking to support sustainable high performance in esports contexts.

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Regulation; esports; cognition; video gaming; coping

Esports have witnessed exponential growth in recent years, emerging as a highly competitive domain that involves players competing in certain video games (e.g., Himmelstein et al., 2017). Esports are often characterised by displays of fine motor coordination and perceptual-cognitive skills (Pedraza-Ramirez et al., 2020), self-regulation and stress appraisal (Trotter et al., 2023), suggesting the importance of further exploring the cognitive processes of esports players to support the fast-growing field of high

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performance. Cognition can be understood as "all the activities and processes concerned with the acquisition, storage, retrieval and processing of information regardless of whether these processes are explicit or conscious" (Bayne et al., 2019, p. 609). Similarly to Quick and Lyle (2024), this study considers cognition to be the "thinking" that happens in a specific context.

Self-regulation is one cognitive process which can be defined as the "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2000, p. 14). With Zimmerman (2000) suggesting our human ability to self-regulate may be one of our most important qualities, providing us with an "adaptive edge" (p. 13) for survival and flourishing. Our current study will draw on Zimmerman's (2000, 2006) phases of self-regulation: the forethought phase, the performance phase, and the self-reflection phase. Zimmerman's model was used due to its explicit recognition of self-regulatory processes before and after task engagement, expanding traditional views which solely focus on self-regulation during task execution (Schunk & Usher, 2013). The forethought phase precedes performance and encompasses the motivational beliefs and strategic planning that influence how an individual approaches a task. This includes skills, such as goal setting and planning, which influence the degree and quality of subsequent self-regulation (Zimmerman, 2000). This is followed by a performance phase, which involves the processes that take place during task engagement; for example, individuals might engage in self-instruction, attention focusing, self-monitoring, and regulate effort and emotion in real time. The self-reflection phase occurs after performance, and involves evaluating performance, making attributions about outcomes, and using these reflections to inform future regulation cycles. The self-regulation phase feeds back into subsequent forethought, meaning the model is cyclical.

Importantly, Zimmerman's model situates self-regulation within a social cognitive framework, recognising that regulatory processes are shaped by their social and physical environment (Zimmerman, 2006). Our paper, therefore, views regulation as happening in relation to teammates, opponents, and task demands within a specific performance context. This highlights the importance of examining self-regulation within the environments in which performance occurs, such as the socially and cognitively demanding context of League of Legends (LoL).

LoL is one of the most popular esports worldwide and a flagship competitive title in contemporary research and practice. For example, recent peer-reviewed work highlights LoL's position within elite competitive environments (e.g., Poulus et al., 2026), and its World Championship finals have drawn peak audiences in the millions, with the 2024 final reaching nearly 6.9 million peak viewers globally (Šimić, 2024). LoL is a Multiplayer Online Battle Arena (MOBA), which is a subgenre of real-time strategy games where two teams compete against each other with each player controlling a single character (Mora-Cantallops & Sicilia, 2018). In LoL specifically, there are two teams of five players battling against one another until one team destroys the opposition's "Nexus" by completing objectives across the map and battling their opponents. Within LoL, there are over 172 unique champions[1] for players to utilise, each with a unique play style and abilities. As a result, a vast amount of game-specific knowledge is required for LoL players to effectively strategise, make split-second decisions, and solve complex problems during gameplay (Pedraza-Ramirez et al., 2020).

Cognitive research in LoL has explored skills, such as spatial awareness (e.g., Horbiński & Zagata, 2023), executive control (e.g., Li et al., 2020), and decision-making (e.g., Valls-Serrano et al., 2022). Valls-Serrano et al. (2022) found that LoL players with better decision-making skills produced higher performance outcomes in terms of minions killed per minute. Self-regulation has also received growing attention in esports research. Several quantitative studies have explored self-regulation using self-report measures, often conceptualising it as a relatively stable aptitude associated with performance level (Trotter et al., 2021). This is supported by Kleinman et al. (2021), who compared self-regulated learning between expert, non-expert, and novice LoL players and found significant differences in the forethought phase (specifically in the execution of goal setting and planning). However, self-regulation may remain underdeveloped even among high-performing players; for example, Trotter et al. (2023) found that some student and national-level Counter-Strike: Global Offensive (CS: GO) players showed borderline low (i.e., a mean score only two points above the impaired classification cutoff) or compromised self-regulation scores. Though the data from Kleinman et al. (2021) were collected retrospectively, limiting insight into how self-regulatory processes unfold in real time, a recent study by Trotter et al. (2025) explored self-regulation in real time through analysing gameplay voice communication, finding that LoL teams do not regulate behaviour in a linear fashion, but in multiple overlapping regulation cycles. Overall, this research suggests work suggests that self-regulation in esports is complex, context-dependent, and closely intertwined with players' emotional experiences during competition.

Self-regulation and emotional regulation are closely linked, and it can be hard to identify where one begins and one ends (Koole et al., 2011). Emotion-related self-regulation can be defined as "processes used to manage and change if, when, and how (e.g., how intensely) one experiences emotions and emotion-related motivational and psychological states, as well as how emotions are expressed behaviourally" (Eisenberg et al., 2007, p. 288). This is vital within esports contexts, where experiences of emotional dysregulation (i.e., tilt) are frequently reported (e.g., Cregan et al., 2024). Individuals can regulate their emotions through self-regulatory processes (Gagne et al., 2021), and in competitive contexts, the capacity to self-regulate behaviour is considered vital to athletic success (Jonker et al., 2010). Similarly, in esports, players who have strong self-regulation skills have been suggested to be more successful in performance. This is supported by Trotter et al. (2023), who found that the use of self-regulatory skills meant CS: GO players were able to cope more effectively with stress, using effective problem-focused strategies.

To further the self-regulation research in esports, we need to consider different methodologies outside of retrospective reports, which are prone to memory decay and retrospective bias (e.g., Ericsson & Simon, 1980; Whitehead et al., 2015). While Trotter et al. (2025) analysed real-time communication in LoL, they did not capture underlying cognitions beyond what is normally verbalised. To overcome these limitations, researchers have used the Think Aloud (TA) protocol (Ericsson & Simon, 1993a) in sport to capture cognitive processes as they occur. TA involves a participant verbalising their thoughts as they occur during a task. According to Ericsson and Simon (1993a), TA includes three levels of verbalisation. Level 1 involves the direct vocalisation of inner speech, where participants simply say what they are already thinking. Level 2 requires participants to verbalise thoughts that are not in a spoken form (e.g., describing images or sensations) but does not require

explanation. Level 3 involves participants explaining or justifying their thoughts and decisions, which introduces additional cognitive processing beyond the task itself. To date, the TA sporting literature has provided rich in-depth cognitions of self-paced and endurance sports including cycling (Whitehead et al., 2022), golf (Arsal et al., 2016), running (Samson et al., 2017), and tennis (Swettenham et al., 2020), to investigate phenomena, such as stress and coping (e.g., Nicholls & Polman, 2008), decision-making (e.g., Whitehead et al., 2015), and pacing strategies (e.g., Robinson et al., 2021). Of particular relevance to the current study, TA has been used to explore self-regulation in football goalkeeping (Mcgreary et al., 2024) and golf (Birch et al., 2022), both of which used Zimmerman's model as the theoretical framework and found TA to be a viable tool for understanding self-regulatory processes in sport.

To the best of our knowledge, no previous studies have adopted TA in esports, and this is the first study to explore in-action cognitions in solo queue. Many TA studies in traditional sports (e.g., golf, tennis) use deductive analytical frameworks and focus on the frequency of cognitions by quantifying qualitative TA data and undertaking statistical analyses (e.g., Arsal et al., 2016; Oliver et al., 2021; Swettenham et al., 2020). In response to calls for further development of qualitative methods in sport psychology research (Smith & McGannon, 2018), our exploratory qualitative investigation hopes to provide a novel understanding of cognitive processes in LoL using an abductive analytical approach. Therefore, the current study aims to (1) explore the feasibility of using TA to explore cognitions of LoL players and (2) to understand self-regulatory processes through the cognitive content of LoL players' verbalisations. This will be done by analysing the "thinking" that occurs in action for LoL players in a specific context (i.e., solo queue).

Method

Philosophical orientation

The present study was underpinned by a realist ontology and a fallibilist epistemology consistent with critical realism. Ontological realism assumes that reality exists independently of the researcher's conceptions (Sayer, 2000). Epistemological fallibilism posits that knowledge of this reality is always partial, theory-laden, and open to revision (Wiltshire, 2018). From this position, we acknowledge that our interpretations can be refined or refuted, while also assuming that participants' reported cognitions reflect real psychological processes experienced independently of the research context. For this study in particular, this stance allows us to assume that self-regulatory processes exist but are not directly observable. TA verbalisations provide situated and partial access to these processes. While participants' accounts are mediated through language and awareness, they offer meaningful insight into self-regulation during performance.

Participants

Participants were four men who were European semi-professional League of Legends players (M age = 19.5 years, SD = 2.38, range = 18–23 years) from the same European esports team in the Benelux region. A fifth player in the team (bot laner) attended the

initial workshop, but following checks on Think Aloud competence, they did not contribute to data collection. While we acknowledge the small sample size, given the limited literature in this area, the exploratory nature of the study, and our philosophical stance, we encourage the reader to take naturalistic generalisability from this work (Smith, 2018). The participants competed in the highest national League of Legends competition in Belgium, suggesting an elite standard according to Poulus et al. (2026). At the time of the study, participants had competed semi-professionally for an average of 2.25 years (SD = 2.22, range = first year–5 years), based on the year of their first recorded semi-professional competitive activity. During the season in which the study took place, the team reached the playoff stage and won approximately 40% of its regular season matches. Individual players also received formal league-level recognition during the season, indicating that the sample represented active semi-professional competitors with relevant experience at this level.

Participants' in-game roles included one top laner, one mid laner, one support, and one jungler. These roles represent functional positions within a five-player LoL team, each associated with distinct tactical responsibilities, particularly during the early laning phase, while responsibilities may become more flexible in mid – and late-game team-based phases. The top laner occupies the upper lane and is typically involved in 1v1 situations, often transitioning into frontline combat or split-pushing in later game phases. The mid laner operates in the central lane and has high map mobility, frequently contributing as a primary damage source and engaging in cross-map rotations. The bot lane support accompanies the (non-included) AD carry role, which is typically the primary damage dealer in this lane. The support provides utility, protection, and vision control, particularly during the early game. The jungler does not occupy a fixed lane but moves through neutral areas of the map to secure objectives, apply pressure across lanes, and assist teammates through interventions in ongoing engagements across the map.

Procedure

After institutional ethical approval, the team's manager was contacted via X (formerly Twitter), using purposeful sampling, to discuss participation in the study. With gatekeeper permission from the team manager, potential participants (i.e., the players) were informed of the study's procedures before providing consent prior to data collection. The procedure involved a four-stage process including TA training via a workshop and three stages of TA data collection (See Table 1).

Think-Aloud workshop & training

Following informed consent, all participants attended the workshop via Zoom, introducing the TA protocol. This workshop was developed and delivered by two experts in TA

Table 1. Stages of think-aloud training and data collection.

Stage	Participant no.	Total Duration (minutes)
Stage 1: TA Workshop	5	120.0
Stage 2: Time one TA	4	269.2
Stage 3: Time two TAs	4	279.7
Stage 4: Time three TAs	4	247.5

(authors one and six). In line with recommendations from Birch and Whitehead (2020), participants were provided with traditional training, following guidelines by Ericsson and Simon (1993a), which involved a series of TA exercises, comprising: (i) counting the number of dots on a page; (ii) an arithmetic exercise; and (iii) an anagram problem-solving task. In the workshop, participants were then asked to practise level 2 TA, whilst simultaneously watching a video clip of a competitive LoL match and verbalising their thoughts out loud whilst muted. This allowed participants to practise TA before they asked clarifying questions and reflected with authors one and seven about the process of using TA. During this reflection period, authors one and six monitored the participants' competency to use TA using Birch and Whitehead's (2020) TA checklist. For example, we asked participants to reflect on whether all thoughts were spoken, they refrained from explaining thoughts, and they verbalised and thought aloud consistently. During this check for learning, one participant shared that they did not feel comfortable thinking aloud and they did not proceed to the data collection phase.

Think-Aloud data collection

Collecting the TA data involved the participants playing two solo queue games on three separate occasions within two weeks of the initial workshop (time one = 269.2 min; time two = 279.7 min; time three 3 = 247.5 min). Collection of the TA data occurred online, where the researchers and participants met via Discord, a software where communities can communicate over voice, video, and text. The nature of LoL is that players usually wear a headset and microphone to communicate with their teammates. As such, level 2 TA verbalisations (Eccles, 2012) were recorded with the participants' personal microphones during gameplay. In addition to their headsets, all participants played LoL with their own computers and equipment from their homes. As previously recommended by Ericsson and Simon (1993a) and explained in TA studies (e.g., Swettenham et al., 2020; Whitehead et al., 2018), one researcher (authors four or five) was present within a Discord channel with the participant to prompt and record the participant's TA during the solo queue games. Players were not engaged in communication with their solo queue team. During the game, the researcher asked participants to: "please think aloud and try to say out loud anything that comes into your mind throughout the game". This statement sought to acquire level 2 verbalisations; however, it is important to note that we can never be fully confident that level 2 verbalisations are strictly adhered to (Eccles & Arsal, 2017), and some participants did engage in level 3 verbalisations naturally. The researcher was also present to prompt the participant to "remember to think aloud" if they were silent for longer than 10 s (e.g., Whitehead et al., 2015, 2016). Since the participants were immersed in a ranked match, the researchers did not interfere more frequently with participants to prevent performance decline.

Data analysis

Following data collection, author two transcribed all audio files verbatim, with checks for relevance and consistency being made. In total, 793.4 min of TA audio were transcribed and analysed using reflexive thematic analysis (Braun et al., 2023). Participant transcripts ranged from 1681 words to 10498 words (M = 5781.75 words). Following Braun and Clarke's (2021) six-step guide to reflexive thematic analysis, the data were analysed

inductively initially, allowing for content to be grouped into raw themes. To familiarise ourselves with the data, each transcript was read and re-read through a process of "indwelling" (Maykut & Morehouse, 2002) by authors one and three. Next, the data were examined to generate initial codes, which reflected the most basic unit of analysis (e.g., the quote "I think she's going for that bot Scuttle[2]" was included in the code *predictions*). The codes were subsequently reviewed between authors one, two, and six, with similar codes combined to form the initial themes (e.g., the codes *negative emotions* and *positive emotions* were grouped within the theme of *affective responses*). In this process, we initially developed three themes and eight subthemes. The initial themes included *teamplay*, *emotional regulation*, and *adapting and planning*. However, through further iterative discussions about the inductively developed themes, we noted that some lacked sufficient depth. For instance, the *teamplay* theme was supported by relatively few meaningful quotes.

Author six acted as a critical friend during the analysis process, and through iterative discussions, authors one and six noticed an overlap with self-regulated learning theory, particularly the phases of forethought, performance, and self-reflection. Zimmerman's (2000) self-regulated learning framework was, therefore, used to further refine the themes deductively. For example, some subthemes from *adapting and planning* aligned with the *forethought phase*, whilst other subthemes such as *reflecting on performance* fit in the *self-reflection phase*. The initially underdeveloped *teamplay* theme was repositioned as a subtheme within the *performance phase* and renamed *non-verbal communication during gameplay*, highlighting key social aspects at play. Following a final round of reflection and refinement between authors one, two, and six, we were satisfied that the final themes offered a coherent and theoretically informed representation of the dataset (see Figure 1).

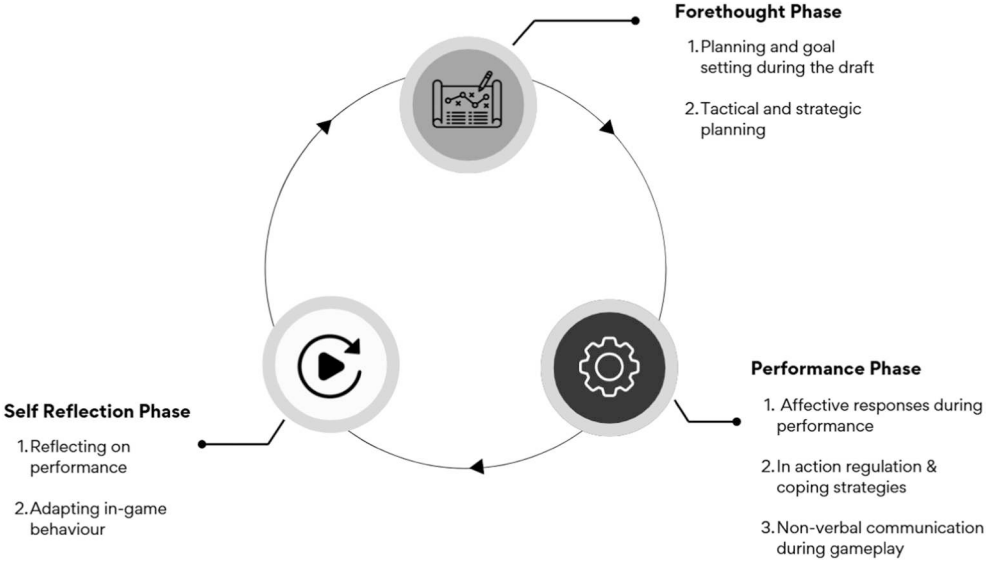

Figure 1. A representation of the cyclical process of self-regulation and developed themes.

Reflexivity and Rigour

Reflexive thematic analysis supports transparency through its iterative and researcher-led process (Braun & Clarke, 2021). We engaged with this in a number of ways. Firstly, verbal data were transcribed verbatim, and a clear audit was kept of the different stages of analysis. This was important due to the iterative discussions leading to conceptual changes in the themes and subthemes. Secondly, our iterative process meant that we frequently discussed the current themes in relation to existing research and our own experiences. Our author team is made up of LoL players, non-LoL players, practitioners (sport psychologists and coaches) who have worked in LoL, and a researcher with no experience playing or working in esports. The researcher with no experience in esports (author six) acted as a critical friend throughout the data analysis process. This diversity of experience has allowed for a rich yet novel perspective upon the current dataset.

Results

Our study analysed "thinking" in action using TA to understand self-regulatory processes of LoL players. Following reflexive thematic analysis of the TA audio, three themes and seven subthemes were developed (see Figure 1). Themes included *Forethought Phase*, *Performance Phase*, and *Self-Reflection Phase*.

Forethought phase

Participants verbalised in the forethought phase about their motivations, goals, and assessed their strengths and weaknesses when in game. For example, participants would note their strengths and weaknesses and set subsequent goals based on their current level.

Planning and goal setting during the draft

Participants began to plan as the game loaded into the draft phase (i.e., the pre-game stage where teams select and ban champions to shape team composition and strategy). These decisions were informed by the amount of information readily available. For instance, when players had relatively little information regarding their opponents, risk-averse assessments regarding champion selections were often made, such as blind picking (i.e., selecting a champion without prior knowledge of the opponent's choice or matchup). For example, "Volibear is very blindable. He doesn't have too many hard counters" (Obi). Similarly, blind picking often resulted in players choosing good early game champions, as illustrated by the quote: "I like to play champions with good early game, and in solo queue, it's especially important because most of the games are decided in 15-20 minutes" (Obi). If participants were picking late in the draft, more information regarding the enemy champions became available, and more detailed assessments were conducted. For example, some players selected champions based on efficiency rather than trying something new: "Is there anything else I would like to try right now? Kled? I'd like to try but that's just not a counter anymore. I'll just pick Graves" (Luke).

Furthermore, the more information about team compositions that became available during the draft phase, the better informed players were in their planning for the game. For example, players considered team compositions to formulate strategies and inform their champion selection. Obi verbalised, "they took Evelynn that means that I need to punish her early game in order in order to play the game because if I just let her farm safely to a simple outscale". Whereas Finn stated:

> Okay, so basically, uhm, playing against LeBlanc as Lee Sin isn't the best so I'm probably gonna look to just err path slowly match her rotations, if possible, if not err just try to alert my teammates as much as possible for her actions so they know how to play the game err when I'm not able to be there to match her.

These quotes highlight that the participants were aware of how specific champion match-ups perform and thus plan accordingly. Participants would also consider countering and how this informed which champions they banned: "Banning Zin Xhao again simply because he is just too powerful for me in the early game" (Obi)

Overall, information obtained via cognitive evaluations allowed players to formulate a strategy for the game. However, whether the participant's assessment of the final draft was in their favour could either provide them with confidence in their team or doubt in their team before gameplay had even begun. For example, Luke verbalised, "Our bot lane matchup is so doomed that we need to play for top so if I don't get the counter matchup then the draft is instantly lost." In comparison to Ben, who may have gained confidence due to the easy team composition on the opposing team: "Well that's a very easy comp to play against so far". This highlights how the draft phase can have an implication on the psychological and emotional state of the player.

In-Game tactical and strategic planning

Following the draft phase, participants were actively planning throughout gameplay. This included jungle pathing[3](e.g., "I'm looking to do Raptors invade and then go toplane", Obi), wave management [4](e.g., "the best I can do is, err, push the wave in so that she either has to do something really fast on Toplane or she has to base to take Mid trade", Obi), and planning invades (e.g., "can we invade?", Finn), rune and summoner spell choice (e.g., "I'm taking conqueror mainly because of during the early-game I feel like the attack is better for mid to late but prefer during my early game skirmishes", Obi, "I can't really peel for Nocturne if I don't play exhaust", Ben), vision (e.g., "I will check for vision here, see if she's just coming from lane." Obi, "I will drop a ward here", Obi "And then I ward defensively so they don't late invade with fucking Xin Zhao" Ben, "I will clear the vision" Luke) and itemisation (e.g., "Umm, I should go for magic resist. They like only have one physical damage dealer, all the other champions are doing magic damage. I will go for thornmail to deal with the healing of Viego." Obi). Some players verbalised that they were unsure what to buy for itemisation, for example "But I don't really know what else to buy. I don't know the champion well enough" (Luke), suggesting the importance of champion-specific knowledge.

Participants would also descriptively state their current actions "I'm basing in prep for the Drake; it's a nice time to base" (Finn) and verbalised their awareness of objectives: "we have 10 seconds till Drake … yeah just play for drake, play for drake, play for drake. Just get the Drake and we win the game." (Obi); "Herald is up in 2 minutes" (Finn).

During gameplay, participants would inform their strategy by observing and predicting their opponent's behaviour. For example, participants would observe what advantages they had over their opponents: "I feel much stronger than her" (Luke), "I feel like we're much stronger 2v2 than them" (Ben). These positive comparisons may improve participants' feelings of confidence and experience of positive emotions. Participants would also try to predict opponent movements: "I think she's going for that bot Scuttle" (Luke), "I think he could be here" (Finn). This appeared to be useful information to inform their next move, as Luke indicated: "I can look for something bot if she stays and doesn't reset". This also allows them to analyse the potential threat of their opponent, for example "Shyvana is here, but it should be fine" (Ben).

Performance phase

Affective responses during performance

Due to LoL's chaotic and unpredictable nature, the participants were required to utilise regulation and coping strategies. The need for such strategies can be seen in the participants' verbalisations, which highlight negative affective responses. Such emotions were prominent after players failed to execute a play as desired or when let down by teammates, which often led to frustration and anger. For example, Luke expressed aggression towards a teammate's inability to protect him: "I just got hit by a huge fucking spear in the face. Why are you standing here and not behind [shouting]? Holy shit!". And Ben expresses frustration with a teammate's behaviour: "Shouldn't be allowed to throw like that by the way it's like whatever I don't want to win" (Ben).

Some participants would explicitly verbalise their poor performance, which may have a knock-on effect on their confidence: "Yeah, I might int[5] it. Ahhh, this fight was pretty bad from me." (Obi). Other participants appeared frustrated when one thing did not go as intended, and this consequently has a knock-on impact on their in-game planning: "Okay, what? There is no way this happens! So, I lost vision [in] the fucking bush! That was disgusting. I cannot answer the botlane now because I don't have wards and their entire vision is on boatside" (Finn). Some participants experienced negative emotions if they felt they lost the game for their team: "I feel so bad, the time I int ended up losing us the game I think" (Ben).

In-Action regulation and coping strategies

In response to negative emotions, the participants attempted to manage internal events through coping strategies. Players reported coping strategies to help them to regulate emotions. These strategies included problem-focused, emotion-focused, and avoidance-focused coping.

Firstly, players utilised emotion-focused strategies such as acceptance, after experiencing setbacks during the competition: "I want to play for those Scuttles so it's kinda bad I was forced to walk botlane, but that's okay" (Obi). Another strategy used by the players was rationalising, where players would regulate negative affect by putting the situation in perspective. For example, "Ah, he got this kill, unlucky, but it's whatever, we get so much out of this". Further, Ben rationalised their poor performance by comparing themselves to others "everyone is bad, I'm bad as well I mean I'm playing bad but it's first game so it's fine".

Avoidance strategies were also used, which are used to ignore or downplay the situation. Players verbalised the use of external attribution, where players would blame external factors, such as their equipment: "My mouse sucks" (Ben). Towards the end of the game, when players were losing, some of them used humour to regulate their emotions. For example, "I'm dead. Fizz Fizz Fizz, fish fish fish, lol lol lol. I'm inting there?" (Ben). Problem-focused strategies were utilised by some players through planning and strategy following a setback. Whilst problem-focused strategies were successful at times, Finn shows us an example of when creating a plan following a setback did not appear to help the situation:

> Like, the game for me is really really over as well, really sad. The only thing I can be viable for now is to find a decent peel onto Ziggs, or I don't even think an engage is going to work, I think just peeling for Ziggs is the way to go because if I do try to find some kind of engage onto them, it's going to end horribly.

Non-verbal communication

Participants verbalised how they communicated non-verbally with their teammates, highlighting the in-action intention of non-verbal communication. This mostly involved using pings, which are in-game non-verbal communication tools that allow players to quickly signal information such as danger, intentions, or locations to teammates without using voice or text chat. As such, pings may support or hinder attention focusing during performance.

Participants used pings for various reasons, such as warning teammates about opponent moves "I think Shen could TP, I will ping" (Obi) and "I will just ping the blue buff because I think Shyvana is there" (Obi), whilst also using pings to alert teammates about other aspects of the game such as wards "I'll just ping quickly that this is warded" (Luke). Participants also verbalised when their teammates would ping for help "Actually pings for help but I cannot do anything" (Finn), and when they thought their teammates pinging them would have helped their gameplay "Maybe if he has pinged me, I would have fought that" (Finn). Some participants verbalised the impact of unhelpful communication from teammates, suggesting that such communication (or lack of it) can lead to frustration in game. For example, Ben found his teammates were pinging too much: "Yeah, I mean ping a little bit less guys. We chillin for now at least", and Finn notes how unhelpful communication led him to withdraw from communication completely:

> I'm getting a ping because I'm missing a Q that I can never hit this is nice in these situations so I just mute all because there's no point in typing to someone that do not simply understand that we cannot fight there in corner but they're just forcing because they are. I'm getting frustrated with the fact that we're not started Drake five minutes ago.

Self-reflection phase

Reflecting on performance

Self-reflection was evident through players' ongoing appraisal of their own decisions, execution, and perceived impact, consistent with Zimmerman's (2020) self-reflection

phase. Across transcripts, players evaluated performance both in-the-moment and retrospectively, often using explicit self-judgement to mark errors or suboptimal play. For example, Obi directly assessed their contribution and outcomes "Okay, I didn't make a difference here" and acknowledged mistakes as they occurred "I'm kind of, oh, I messed up a bit". These appraisals extended to technical execution and timing, such as recognising missed or mistimed actions "Oh, I missed my dash. Oh, well. I'm actually killed" (Ben) and judging the quality of play relative to an internal standard "I kinda played it back them because I didn't get a stall on my W. It for sure could have been much better" (Finn). In this way, self-reflection functioned as part of the repeated cycle of self-regulation in game, capturing how players monitored their effectiveness and identified moments where their play deviated from intended outcomes.

Participants were able to constructively reflect on the outcome of their goal or performance, for example "I could have maybe TP'd [teleported] to change up the fight there" (Luke), and "Maybe I overstayed a bit too much here. I felt too powerful" (Obi). However, the reflections the players engaged in could be emotionally fuelled at times, leading to self-criticism. "I feel like we just over-extended on the topsides for too much. Playing some mind games here. I feel like I can't get out." (Obi).

Self-reflection also occurred at the end of a match rather than continuously in-game. Here, players reviewed causal factors underpinning outcomes and located responsibility within their own choices. In several instances, players explicitly framed performance errors as learnable moments, evaluating both what happened and why it happened (e.g., "If I was better at the game, I probably would have seen that coming" Finn). They revisited earlier decisions with clear self-critique, including macro-level judgements "Probably in a normal situation I would have dodged that game" (Luke) and micro-level attentional or skill-related appraisals "I'm CS'ing [last-hitting minions] like shit" (Obi). These reflections were frequently accompanied by attributional language that linked outcomes to specific misjudgements (e.g., "I think that was the time when I should have reset … " Luke), illustrating how players interpreted performance setbacks through self-judgement and causal explanation. These verbalisations show how players engaged in evaluative monitoring, attribution, and performance accounting in ways that align with Zimmerman's (2000) emphasis on self-judgement processes within the self-reflection phase.

Adaptability

Adaptability was shown through players' regulation of strategy and decision-making in response to changing task demands, highlighting how self-reflection informed subsequent adjustments within Zimmerman's (2000) cyclical model. Players frequently shifted to safer or more conservative play when the game state changed, signalling a deliberate recalibration of approach. For example, one player moved from trading to risk management ("I'm just gonna start playing it safe now (Finn) and explicitly described reorienting their lane plan in response to opponent pressure" "I need to look to shove like right fucking now yeah I can't do anything against the easy free cue combos so I need to avoid leaning right now" (Ben). These adaptations were not limited to mechanics; players also made tactical decisions to manage time, vision, and positioning, such as recalling to stabilise the lane "I can solve it just by recalling and TP back to lane … but you know I don't really have a choice right now" (Obi) or using map and wave logic to reduce

vulnerability "I tp [teleported] on cannon to make sure the wave is coming into me again" (Ben). In this sense, adaptability appeared as a pattern of continuous recalibration, where players modified behaviour to fit emerging constraints and opportunities rather than rigidly adhering to an initial plan.

Adaptability was also seen through adjusting to change future action, including changes to itemisation, champion select decisions, and broader game planning. Players often articulated alternative choices, for example, players reconsidered purchasing decisions "Maybe I should have not bought Zhonyas here" (Obi) and made explicit plans to alter builds based on team composition and opponent itemisation "so I think Rabadons might be the play just go full damage" (Ben). Adaptation also extended into pre-game and between-game regulation, such as champion bans motivated by prior experience "I will ban Camille simply because I don't want to see it again" (Luke) and reliance on external information to optimise decisions "we should always look up pro builds before the game" (Finn). These examples show that players' adaptability spanned in-game tactical changes, strategic resource management, and transitioning back into forethought at the beginning of the cycle.

Discussion

Our study aimed to qualitatively explore the use of TA to capture in-action cognitions of LoL players and to understand self-regulatory processes during solo queue play. In doing so, our study sought to explore how regulation happens in real time within a complex, fast-moving performance environment. Our findings demonstrate that TA is feasible in esports and can capture players' regulatory processes. Our data showed that self-regulation in LoL is not a linear sequence of events but an ongoing, cyclical process where planning, monitoring, emotion management, and reflection continually inform one another. For example, reflections on mistakes immediately informed new plans, and affective reactions shaped subsequent decision-making. The findings, therefore, support Zimmerman's cyclical model and reinforce the idea that self-regulation in high-performance environments is recursive and situational rather than linear (Trotter et al., 2025). The following sections discuss each phase in relation to existing literature and highlight how these findings extend current understanding of esports players.

Forethought phase

Consistent with Zimmerman's model, the forethought phase was evident in players' verbalisations of planning, particularly during the draft and early game stages. Players engaged in anticipatory thinking, opponent modelling/predictions, and contingency planning. This aligns with research in traditional sport showing that skilled performers use advance planning to guide action (McPherson, 2000). In LoL, planning is continuously revisited and recalibrated in response to new information rather than being fixed at the start of performance. Such strategic planning supports arguments that esports expertise involves high levels of game intelligence and pattern recognition (Bediou et al., 2018).

Players articulated reasoning around matchups, taking into consideration their own strengths and weaknesses, accounting for potential risk and win conditions during the draft phase. This is an example of players self-evaluating their potential for success

based on their experience and past performance levels in comparison to others (Zimmerman, 2000). Whilst also showing similarities to research in traditional sport, which found that athletes with higher levels of self-regulation engage in self-evaluation processes (Toering et al., 2009).

Participants' expectations were shaped during the draft phase; an important and challenging part of the game, where making the right decisions when selecting and banning champions influences team composition and strategy (Horst et al., 2024). Some participants entered the game already with the sense that they had an advantage or disadvantage based on champion selection. This echoes research in sport psychology showing that pre-performance appraisals influence emotional states and attentional focus (e.g., Jones et al., 2009). The need to make good matchups at this stage could increase cognitive and emotional demands, requiring greater self-regulatory skills. More specifically, Leis et al. (2024) found that LoL players displayed a higher heart rate during champion selection in competition than in training. Our study advances current understanding by identifying self-regulation within pre-game strategic environments unique to esports; however, more research is needed to explore this phase in depth.

Performance phase

During the performance phase, players frequently monitored their own state, reassessed risk, and adapted behaviour in response to unfolding events. This aligns with self-regulation literature in sport psychology showing that self-monitoring and attentional control are central to high-level performance (e.g., Zimmerman, 2006). However, the density and speed of these processes in LoL are particularly high, reflecting the informational complexity of the game (Trotter et al., 2025), suggesting that regulation cycles may be more frequent and occur at a faster pace than in slower or self-paced sports, given the continuous, time-pressured demands for monitoring and adjustment in dynamic performance environments (Zimmerman, 2000).

Emotional regulation was salient in participants' verbalisations resembling tilt, which is a term often used in gaming, associated with frustration, rage, and reduced performance (Wu et al., 2021). This links to prior esports research linking frustration and emotional dysregulation to performance decline (Himmelstein et al., 2017), suggesting that inability to regulate emotions at the performance phase may lead to performance decline. Zimmerman (2000) notes that inability to regulate may be due to a reliance on reactive methods to self-regulation (e.g., emotion-driven adjustment), rather than proactive ones (e.g., planning, self-monitoring). Our current findings show how players attempt to regulate to prevent or reverse occurrences of tilt. For example, rather than simply losing control, players often reframed setbacks, normalised mistakes, or changed attentional focus to controllable elements. Trotter et al. (2025) found that self-regulation was a mediator between stress appraisal and performance, suggesting that greater self-regulatory skills may mean having more personal resources to cope with stressors that arise during performance.

Communication was also seen as a key to regulation, as it could either support or hinder a player's self-regulatory process, perhaps through attention focusing. Pings were used to manage team awareness and reduce uncertainty, but when communication was perceived as distracting or negative, players muted teammates and became clearly

frustrated. Existing esports literature has emphasised teamwork and coordination, but less attention has been paid to how players regulate their social environment. Our findings suggest that regulation in esports is socially embedded, even in solo queue, and that players are having to be responsive to stressors from teammates as well as gameplay itself (Leis et al., 2026).

Communication reflects the more social dimensions of self-regulation outlined in Zimmerman's (2000) cyclical model, whereby self-regulation is influenced by social cues, feedback, and interactions with others in the environment. In LoL, pings could function as a form of socially mediated regulation, providing information that supports players' focus and regulation. However, we found that when communication aligned with players' goals, it appeared to support regulation, but when it felt excessive or poorly timed, it could have a negative implication for self-regulation and prompt avoidant coping strategies such as muting teammates. It, therefore, seems key to support LoL players in understanding how to effectively regulate following frustrating social interactions; for example, a review from Leis et al. (2024) shows how players use internal regulation to manage communication stressors with teammates. However, it is important to remember that our current study was conducted in solo queue without access to verbal communication, whereas esports teams who can use verbal communication may have a different experience. Even so, there are implications for esports teams in considering how their communication practices can either support or strain teammates' regulatory processes.

Self-Reflection phase

Self-reflection was evident both during and after gameplay. Players evaluated decisions, timing, and execution, often being self-critical. This aligns with Zimmerman's notion of self-judgement and with sport literature showing that expert performers engage in frequent performance evaluation (Zimmerman, 2000). However, the immediacy of reflection in LoL is important to note, with evaluations often occurring seconds after an event, feeding directly into new decisions (Trotter et al., 2025). Furthermore, during the self-reflection phase, players identified specific moments where alternative actions might have changed outcomes. This supports research suggesting that skilled performers engage in deliberate reflection to refine future performance (Ericsson et al., 1993b).

Players often linked outcomes to their own decisions rather than external factors, linking again to self-judgement and causal attribution specifically. This attribution style is typically associated with stronger self-regulated learning (e.g., Zimmerman, 2000). However, repeated self-critique may also contribute to emotional strain and tilt in esports. While self-awareness can support performance, if engaged in a task requiring fast-paced decisions, self-focused performers can experience a higher frequency of mistakes (Silvia & Phillips, 2013). This highlights the importance of balanced reflective practices in performance settings.

Practical implications

There are several context-specific practice implications that may benefit esports players and teams looking to develop self-regulation, though we urge the reader to consider these implications in context, given the study was conducted during ranked solo-

queue rather than tournament conditions. First, while the present study used TA as a methodology for data collection, it has been shown that using TA can also facilitate self-regulation in athletes. Birch et al. (2022) found that TA supported reflection on emotional responses and aided self-regulatory processes in golfers, suggesting TA may itself act as a tool for training self-regulation in esports players. TA may, therefore, be a useful intervention to increase self-regulatory skills in LoL players, potentially supporting players to rely more on proactive methods of self-regulation (e.g., identification of stressors and coping strategies, awareness of thoughts and emotions in-action).

Second, our findings show that self-regulatory skills are important at the draft phase. Trotter et al. (2023) found that self-regulation can mediate the relationship between stress appraisal and performance in CS: GO players, suggesting that self-regulatory skills can improve performance. Therefore, there may be potential for skills such as pre-performance routines to help player self-regulation prior to the draft phase (Cotterill, 2010). In turn, greater self-regulatory skills may impact potential picks, matchups, and counters, influencing the trajectory of the game; however, further research is needed to explore this phenomenon more fully.

Finally, our findings suggest non-verbal communication can impact players' self-regulatory cycles and attention focusing. This is in line with previous research on pings in LoL, who find pings to be important for team activities including planning and articulating tactics, monitoring team and individual progress against goals, and managing conflicts (Leavitt et al., 2016). Therefore, learning how to use pings effectively, or how to manage them in action (such as learning when to mute or filter information), may be important alongside mechanical skill.

As players continuously perceive in-game cues, evaluate optimal actions, and anticipate potential outcomes, it is important that communication between teammates is done so effectively. Developing effective communication can enhance team synergy and cohesion, particularly when players understand what information to share and when to share it (e.g., Eldadi et al., 2025). Coaches can facilitate this through team-based analyses of game recordings, prompting players to reflect on their non-verbal and verbal communication: *Which information was critical at each moment? What could have been communicated differently? How can the phrasing or timing of messages or pings be improved?* Coach support can be complemented by support from sport psychology professionals or other practitioners, helping players refine both the content and delivery of in-game communication.

Limitations & future research

Despite strengths in the novelty of this study, there remain several limitations. First, the study sampled participants at a similar performance level, so it was not possible to compare cognitions between ability levels. Second, participant numbers were small, and each player played a different role on the team. Although we acknowledge the small sample size, based on the limited literature in this area, we hope the readers can take naturalistic generalisability from this work (Smith, 2018). Further research on self-regulation strategies within specific roles is needed in future research. Third, it is acknowledged that some self-regulatory processes can occur outside of conscious awareness and that there are limits to the amount of information that can be obtained using TA (e.g.,

Eccles, 2012). As such, while participants were asked to verbalise any thoughts that came to mind, there is a possibility that relevant information was unreported. This may be particularly salient as none of the participants were native English speakers. Finally, although it was assumed that participants were playing in a competitive, ranked environment, no perceived pressure level was obtained (Vine et al., 2011). Cognitions may have differed if the players were performing in an official match; however, the ability to collect TA data during an official match would not be possible because of the need for constant communication between players. For future research using TA in esports, based on findings from Stodter and Whitehead (2024), stimulated recall could be employed where players would watch a match play VOD and verbalise their retrospective thoughts.

Conclusion

To our knowledge, this is the first study to capture in-action cognitions of LoL players using think-aloud to explore self-regulatory processes during live play. The use of the TA protocol has allowed us to show how regulation processes occur within solo queue in LoL, an information-dense esports environment. Our findings support Zimmerman's (2000) cyclical model while demonstrating that self-regulation in practice is rapid, recursive, and shaped by contextual demands. A key finding was that the draft phase acted as a psychologically important stage of the game, where expectations, self-efficacy, and self-evaluation were influenced either positively or negatively before gameplay began. This extends current understanding by showing that regulation in esports starts prior to in-game action. Regulation was also socially influenced, with players responding to teammates' communication (pings) in ways that could support or disrupt their attentional focus and ability to regulate.

By capturing cognition in action, we have shown TA to be viable in LoL and demonstrated that self-regulation is continually influenced by in-game events, social interactions, and unique contexts specific to LoL (i.e., draft). Additionally, TA shows value for capturing these processes and may offer a useful reflective tool for players and practitioners seeking to support sustainable high performance in esports. Our findings highlight the need to recognise esports as a context with its own psychological and contextual demands, and while Zimmerman's existing model is a useful framework, we call for researchers to continue taking a context-sensitive perspective of self-regulation within esports and its different genres.

Notes

1. A playable, player-controlled character in the game. Players select one champion at the start of a match.
2. A neutral creature that lives on the bottom side of the map
3. Jungle pathing refers to the strategic, planned route a jungler takes through their jungle camps, buffs, and the river.
4. The strategic manipulation of minion waves to control their position and size, ensuring a favourable state to maximise gold/XP, deny opponents, or create safety.
5. Short for intentional feeding. It describes a player deliberately dying to the enemy team, usually to sabotage their own team, either out of frustration, trolling, or grieving.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

Data are not available. The participants of this study did not give written consent for their data to be shared publicly, so supporting data are not available.

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