1      **'Think Aloud' as a facilitator of self-regulation in golfers**

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22                                    **Abstract**

23     Think Aloud (TA) has been used as a tool to promote self-regulation and reflection within

24     coaches, yet it has not been employed within the same context to support athletes. The aim of

25     the present study was to understand golfers' perceptions of using TA at two time points:

26     immediately post performance and after a six-to-eight-week reflection period. Six golfers (5

27     males, 1 female; age: $M = 30.8$ years, $SD = 14.8$; handicap: $M = 6.92$, $SD = 3.9$) used TA

28     during the performance on six holes of golf and listened back to their TA audio. Using semi-

29     structured interviews and subsequent thematic analyses, we generated four themes: increased

30     awareness, awareness of how behaviour influences performance, disruption of thought

31     processes and performance, and application to coaching. Preliminary evidence provides

32     support for TA as a potential tool to promote self-regulation in golfers which could be used to

33     inform coaching interventions.

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35     *Keywords:*  Reflection, perceptions, performance, golf

## Introduction

Learners who self-regulate are defined as "metacognitively, motivationally and behaviourally active participants in their own learning process" (Zimmerman, 1986, p. 308). Self-regulated learners generate their own thoughts, feelings, and actions to attain their learning goals, which in turn, facilitates the problem-solving process and improves effectiveness of learning. Given the demands placed on athletes (e.g., Sarkar & Fletcher, 2014), self-regulation plays an important role in one's development when striving for goal attainment (Jonker et al., 2011). Zimmerman's (1986, 2006) self-regulation model includes three cyclical phases. Firstly, the forethought phase concerns how the individual approaches a task and consists of planning and analysis strategies (e.g., goal setting). Secondly, the performance phase occurs during a task and is concerned with the use of self-control strategies (e.g., self-instruction, imagery, attention focusing). Finally, the self-reflection phase occurs after each performance bout and is concerned with deliberate efforts to adapt one's performance in a systematic manner (e.g., casual attributions). This process of self-evaluation is argued to facilitate causal attributions about one's success and failures.

Reflection is argued to be a sub-facet of metacognition and can be defined as an individual's ability to apply previous experiences to improve future performances in a goal-directed manner (Peltier et al., 2006; Zimmerman, 2000). Metacognition is particularly important as it enables one to evaluate their own thinking and can be defined as "the awareness of, and knowledge about one's own thinking and consists of planning, self-monitoring, evaluation and reflection" (Jonker et al., 2010, p. 902). Zimmerman (2000) posits that learners can direct their reflection to the result (self-judgement) or to an objective (self-reaction). Specifically, self-judgement comprises of sub-processes referred to as self-evaluation and causal attributions (e.g., an athlete's assessment of their own performance),

60    while self-reaction comprises of sub-processes referred to as self-satisfaction and adaptive

61    inferences (e.g., an athlete's emotional and cognitive response to their attributions).

62        Zimmerman (1986, 2006) began developing his theory in education settings and

63    researchers have applied its principles to sport. Athletes who have developed high levels of

64    self-regulation compare self-observed performance against goal attainment, previous

65    performance of themselves and of others or contribution to performance of the team (i.e.,

66    self-evaluation). They calibrate their causes of success and failure to their self-observed

67    performance (i.e., causal attributions) and feel satisfied or dissatisfied during reflection by

68    their performance (i.e., self-satisfaction). Athletes with high self-regulatory skills also modify

69    their decision making and behaviour accordingly to adopt more proficient learning and self-

70    regulation strategies to improve in the future (i.e., adaptive inferences; Zimmerman, 2000).

71        Despite the importance placed on developing self-regulation in athletes, relatively few

72    studies have considered how athletes can develop their own reflection processes. Clearly and

73    Zimmerman (2001) examined differences in self-regulatory forethought and self-reflection in

74    adolescent basketball players. Findings showed that expert basketball players set more

75    specific goals, displayed higher levels of self-efficacy, made more strategy attributions, and

76    selected more technique-oriented strategies than non-experts and novices. Experts were also

77    better able to relate their success and failure experiences meaningfully by using appropriate

78    strategies to modify future performances (i.e., strategy attributions). More recently, Tan et al.

79    (2016) investigated the effects of a guided reflective diary on elite archery accuracy and the

80    factors facilitating and hindering the usage of a guided reflective diary. Elite archers reported

81    that completing a reflective diary enhanced motivation, helped them forward plan, and

82    enabled them to understand their feelings during shooting. Nevertheless, the process of

83    keeping a reflective diary was also perceived as time consuming and repetitive in nature. It is

84    therefore important to ensure that the methods used to promote self-regulatory skills are

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85　efficient and athletes are challenged regularly to limit the negative impacts associated with

86　repetition. Collectively, these findings highlight the importance of self-reflection, the factors

87　that impact reflection efficacy, and ultimately, the processes underpinning the development

88　of self-regulation. Researchers and practitioners should therefore consider the available

89　reflection methods when striving to develop self-regulatory skills within athletes.

90　　One method that has been previously used within practitioner (e.g., coaching and nursing)

91　settings to promote reflection is Think Aloud (TA: Ericsson & Simon, 1993; Whitehead et

92　al., 2016a). TA involves an individual verbalising his/her/their thought process continuously

93　as they are performing. Ericsson and Simon (1993) proposed three levels of verbalisations.

94　Level 1 verbalisation is simply the vocalisation of inner speech where the individual does not

95　need to make any effort to communicate his/her/their thoughts. Level 2 verbalisation involves

96　the verbal encoding and vocalisation of an internal representation that is not originally in

97　verbal code. Level 3 verbalisation requires the individual to explain his/her/their thoughts,

98　ideas, hypotheses, or motives.

99　　Previous research within the sport psychology literature using TA has predominantly

100　adopted the technique to collect in-event cognition (Kaiseler et al., 2012) and decision-

101　making data (Whitehead & Jackman, 2021). For example, TA has been used to collect data of

102　stress appraisals and coping in trap shooting, golf and tennis (e.g., Calmeiro et al., 2010;

103　Kaiseler et al., 2012; Swettenham et al., 2018), expert-novice differences in planning

104　strategies in golf (e.g., Whitehead et al., 2016b), pacing in endurance sports such as running

105　and cycling (e.g., Whitehead et al., 2018) and decision making and anticipation (e.g.,

106　Whitehead & Jackman, 2021).

107　　Despite the appeal of using TA to capture in-event cognitions, it is important to consider

108　the reactivity that TA may elicit within a participant when engaging in the method. Reactivity

109　refers to instances where participants may modify their behaviour as a result of being

110 measured or observed. In the case of TA research, the process of verbalising thoughts

111 throughout the duration of a task may increase positive behaviour or increase negative

112 behaviour (Double & Birney, 2019). Although Fox et al. (2011) found that level 2

113 verbalisations are nonreactive, Double and Birney (2019) highlight this potential issue where

114 participants might attend to internal cognitions in a way that they would not have without

115 thinking aloud. Nevertheless, thinking aloud could facilitate metacognition and possibly

116 reflection during the performance of the task. Within Whitehead et al.'s (2018) study, some

117 cyclists reported becoming more self-aware, and in turn, they felt that it helped their

118 performance. Research is therefore needed to explore whether TA informs the self-regulation

119 cycle.

120    The use of TA has been used as a reflective practice tool in a range of domains. For

121 example, Banning (2008) adopted TA as an educational tool to develop and assess clinical

122 reasoning in undergraduate nursing students. It is proposed that the process of thinking aloud

123 facilitated the nurses to ''verbalise their thought processes and rationale for the types of

124 questions that they ask during a history or physical examination and for the diagnostic

125 examination and for the diagnostic hypotheses that they consider'' (Lee & Ryan-Wenger,

126 1997, p. 102). Conversely, Whitehead et al. (2016a) asked sports coaches to verbalise their

127 thoughts during their live coaching sessions and partake in reflection by listening back to

128 these verbalisations and by reflecting with their peers. Findings revealed an increased

129 perceived self-awareness in coaching practice and a perceived improvement in

130 communication and pedagogical practice. The evidence appears to suggest that practitioners

131 developed self-regulatory skills and developed a sense of self-awareness of their own

132 knowledge and thinking in relation to their context of practice. The facilitation of the meta-

133 cognitive process (Banning, 2008) may aid self-reflection and discovery of ineffective

134 thought processes.

135     A growing body of literature supports the importance of self-reflection in developing self-

136 regulatory skills (e.g., Zimmerman, 1986; Jonker at al., 2010; Brick et al., 2015). Previous

137 research has predominantly examined how coaches learn to reflect and how coaches stimulate

138 reflection in athletes. Subsequently, there is potential to examine how TA may facilitate the

139 process of self-regulation in golfers. Given the inherent limitations in using retrospective

140 methods to facilitate self-reflection (Bernard et al., 1984), we sought to advance the

141 knowledge base by examining the use of TA as a tool to promote self-regulation. Although

142 TA was originally intended to capture naturalistic thought processes for research purposes, it

143 is important to note that we employed TA to facilitate reflection. Therefore, the aim of the

144 present study was to understand golfers' perceptions of using TA at two time points:

145 immediately post performance and after a six-to-eight-week reflection period.

146                                 **Method**

147 **Philosophical position**

148     This study was underpinned by a realist ontology and constructivist epistemology.

149 Ontological realism assumes that a reality exists, but that it is independent of the conceptions

150 researchers have of it (Sayer, 2000), while epistemological constructivism posits that

151 knowledge is theory-laden and fallible (Wiltshire, 2018). In accordance with to our

152 philosophical stance, we recognise that knowledge can be refined, revised, or refuted

153 (epistemological constructivism) and that the views reported by participants reflect real

154 properties and events experienced by the participants, independent of the research

155 (ontological realism). We adopted a qualitative approach to understand the subjective

156 behaviours and beliefs of participants in terms of their use of TA as a reflective practice tool

157 (Samdahl, 1999). We believe that our findings can be applied with reference to naturalistic

158 generalisability, where readers may be able to take their own meaning from the findings

159 (Tracy, 2010; Smith, 2018).

**Participants**

Using personal contacts of the second author, we approached participants via email. The second author had existing rapport with the participants due to her professional involvement at the golf club where the data was collected and participants regularly attended (Smith & Sparkes, 2016). Purposeful sampling was used to capture a broad skill level of golfers (Braun & Clarke, 2013; Sparkes & Smith, 2014). Similar to sample sizes used in previous research that have captured perceptions of TA to facilitate reflection (e.g., Whitehead et al., 2016a; Swettenham & Whitehead, 2021), participants were six golfers from a golf club in the South of England (5 males, 1 female; age: $M = 30.8$ years, $SD = 14.8$; handicap: $M = 6.92$, $SD = 3.9$). We recruited two high skilled golfers (handicap $\leq 5.4$), two intermediate skilled golfers (handicap $5.5 - 12.4$) and two low skilled golfers (handicap $\geq 12.5$). Participants had an average of 11.2 ($SD = 4.9$) years competitive playing experience, played at least once per week and had played an average of 12.2 ($SD = 10.5$) competitions in the 12 months prior to participation. All participants identified as white British. Institutional ethical approval and informed consent were obtained prior to participation.

**Materials**

*TA training video*

Participants were instructed on how to TA using a training video developed by Birch and Whitehead (2019). The video consisted of visual and verbal instructions and provided participants with an understanding of how TA works so that participants could competently perform the technique. In line with Ericsson and Simon's (1993) guidelines, example instructions included "think aloud involves you saying out loud everything that you are thinking as you are performing the task." Given that we aimed to examine level 2 verbalisation, we used instructions to promote level 2 verbalisation and deterred level 3 verbalisation (e.g., "I don't want you to try to plan out what you say or try to explain to me

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what you are saying"). It is important to note that we instructed participants to refrain from

thinking aloud during skill execution to reduce possible interference with motor movement

(Schmidt & Wrisberg, 2000). The remainder of the video comprised of three different

hypothetical golf scenarios (tee shot, fairway shot, green side shot) that required participants

to think aloud their planning strategies. The TA training video was 4:14 minutes in duration

(see Birch & Whitehead, 2019).

**Procedure**

We conducted a pilot study using one intermediate skilled male golfer (handicap of 7,

13 years competitive playing experience) who completed the full procedure. The participant

was confident that the TA training enabled him to understand how to competently TA and

that three practice holes enabled him to apply the technique on the golf course. The

participant also stated that the equipment (e.g., microphone) did not hinder his performance.

Interviews were conducted as a method to explore participants perspectives,

experiences, emotions, and personal meanings of experiences of TA (Smith & Sparkes,

2016). Data collection was completed by the second author, who had a high level of golf

knowledge and experience. It may be inferred that the quality of information gained from the

interviews was enhanced by the researcher's involvement in data collection. Additionally, the

existing rapport between the researcher and participants during the on-course TA may have

allowed for more honest and authentic verbalisations from the participant. Finally, the second

author was familiar with TA in that they had previously completed traditional TA training

(Ericsson & Simon, 1993), golf specific TA training (Birch & Whitehead, 2019), and

completed six holes of golf using TA as part of their familiarisation to the procedure adopted.

Participants viewed the TA training video using an Apple iPad and Sony MDR

ZX660AP headphones. During the training exercises, the researcher ensured the participant

was competently thinking aloud in accordance with Ericsson and Simon's (1993) guidelines.

210 Participants then completed three holes of golf while thinking aloud to apply the learned

211 principles of TA. Feedback was given in instances where the participant deviated from the

212 previously outlined instructions (e.g., 'you are not required to explain your thoughts while

213 thinking aloud'). Data collection did not take place until the researcher was satisfied with the

214 quality of verbalisation which was classified as when the participant no longer needed

215 prompting to verbalise all their thoughts, the participant's thoughts were characteristic of

216 level 2 verbalisation, no level 3 was evident (although impossible to fully determine), and the

217 participant did not verbalise their thoughts during shot execution.

218 Participants then individually completed six holes of golf on their home course whilst

219 thinking aloud. The researcher walked behind the participant and there was no

220 communication beyond reinforcing the need to TA (Nicholls & Polman, 2008). If the

221 participant did not verbalise their thoughts for 20 seconds, the researcher would state the

222 phrase "please think aloud." In an effort to facilitate authentic performance cognitions,

223 participants were told they were competing against each other with the lowest nett score (total

224 shots taken minus handicap) winning a £30 pro shop voucher. Research by Baumeister and

225 Showers (1986) has used similar means to facilitate competitive state emotions and research

226 by Nicholls and Polman (2008) deemed six holes to be sufficient to gather authentic in-

227 performance cognitions in golf. To manage this competitive element, the researcher recorded

228 the participants' scores on each hole, calculated the participants' nett scores and updated a

229 leaderboard of the nett scores. To maintain a consistent level of pressure experienced between

230 participants, the researcher did not reveal the participants' competitors scores until after they

231 had completed the six holes. To ensure confidentiality, names and handicaps of competitors

232 were not shared to the participants when scores were conveyed.

233 ***Immediate and follow-up interviews***

234    Immediately following the completion of the six holes of golf, participants completed

235    the immediate interview in the clubhouse. Participants were then sent an audio file with their

236    TA from the six holes of golf and were required to listen to their verbalisations. Follow-up

237    interviews took place at the golf course clubhouse six-to-eight-weeks after the six holes of

238    golf. During this six-to-eight-week period, participants were not instructed to continue to use

239    TA, but were not restricted to do so if they desired. During this period, participants listened to

240    their on-course TA recording and reflected on their experience.

241    To examine participant experiences of using TA and listening back to their audio

242    verbalisations, we conducted semi-structured follow-up interviews. The follow-up interviews

243    were conducted with the aim to increase the richness and depth of data captured by offering a

244    personal insight into participant experiences (Newton & Burgess, 2008). Using Page and

245    Thelwell's (2013) guidelines, an interview guide was developed based on the aims of the

246    study and previous research that has used TA as a reflective tool (e.g., Whitehead et al.,

247    2016a) to help facilitate the gathering of rich, in-depth data (Smith & Sparkes, 2016).

248    Example interview questions for the immediate interview included 'what aspects of TA have

249    been specifically useful/not useful for you?' Example follow-up interview questions included

250    'can you tell me about your experiences of reflecting upon your use of TA?' Probing

251    questions (e.g., can you provide me an example?) were used to glean more in-depth

252    understandings of participant experiences in both interviews. Immediate and follow-up

253    interviews ranged from 11 mins 15 secs to 19 mins 33 secs and 13 mins 48 secs to 20 mins 36

254    secs in duration, respectively.

255    **Data analysis and research credibility**

256    All audio interview files were transcribed verbatim. Interviews ranged from five to

257    eight pages of A4 1.5 spaced text and between 2465 - 3409 words. We conducted a thematic

258    analysis to explore participant perceptions and beliefs regarding TA (Braun & Clarke, 2019).

259  To ensure credibility and trustworthiness a team approach to analysis was employed with the

260  aim of promoting critical reflexivity rather than consensual agreement (Braun & Clarke,

261  2019; Smith & McGannon, 2018). We engaged in a reflective thematic analysis process

262  (Braun & Clarke, 2021) and began by reading all transcripts of interviews (immersion in the

263  data) in Nvivo 10 (step 1). Once complete, we developed a list of codes from the first two sets

264  of interviews. To further emphasise credibility, the initial codes were reviewed as a team and

265  considered (step 2). Collaborative coding is supported by Saldana (2013) as it allows a

266  "dialogic exchange of ideas" (p. 34) that support interrogation and discussion from multiple

267  perspectives. Following this critical review, codes were amended and definitions of codes

268  were established. At this stage, all authors engaged in peer debriefing through formal

269  meetings (Creswell & Miller, 2000) and discussed the aim of the study and how interpreting

270  the data related to both our own biases as researchers and our interpretations of the

271  interviews. One discussion concerned the third author's biases towards using TA as a self-

272  reflection tool and this discussion enabled the remaining authors to challenge some of these

273  initial codes. At this stage, we generated 25 codes. We agreed that these codes would be

274  condensed into four main themes, however, a discussion on the agreement of these themes

275  included changes of theme names. Specifically, 'becoming aware of lack of focus' was

276  changed to 'increased awareness,' 'reinforcing positive behavior' was changed to 'awareness

277  of how behavior influences performance,' and 'recognizing negative behavior' was changed

278  to 'disruption of thought process and performance.' The theme 'application to coaching'

279  remained the same. We felt these updated theme names better represented the data and the

280  aims of the study.

281      The codes were then adopted as a starting point to analyse the remaining transcripts.

282  Once all interviews were coded, the second author searched for themes across all codes (step

283  3). Once more, these themes were reviewed by the third author (step 4). In light of the

284 potential limitations of inter-rater reliability, an external and independent researcher acted as

285 a critical friend to ensure data collection and analysis was plausible and defendable (step 5;

286 Smith & McGannon, 2017). This step was continued during the peer review phase. During

287 this stage themes were reviewed and through a team discussion, the main theme names were

288 modified, and sub-themes were identified. Therefore, we developed the results via an

289 iterative process of theme generation. These additional sub-themes provide the reader with

290 more detail and insight into the findings of the interviews conducted. Following this final

291 stage of refining and naming of themes, we generated our findings (step 6) which are

292 presented in the following section.

## Results

294 We present the themes and sub-themes that were generated from the data. An

295 increased awareness of golfer's thought processes relative to their performance was present

296 throughout all interviews. Within this increased awareness emerged many more specific

297 themes, such as being aware of drifting and losing focus and an awareness of overthinking. In

298 addition, participants were able to articulate how they became aware of their thoughts

299 impacting their performance. More specifically, golfers recognised the presence of positive

300 routines and how their emotions or negative reactions may have influenced their

301 performance. Although TA was reported to have positive benefits, we generated a theme

302 relating to the disruptions of thought processes and performance. This theme linked to how

303 some participants found it difficult to verbalise thoughts following less successful shots and

304 how TA disrupted putting performance. Finally, participants reported the potential benefits of

305 TA within a coaching context and recommended specific suggestions for a coach using TA to

306 gain an understanding into a golfers/client thought processes.

307 **Increased awareness**

308    Increased awareness refers to how participants became aware of different elements of

309    their thought processes. Specifically, within this theme, being aware of drifting through the

310    use of TA and being able to prevent this was evident. In addition, participants reported being

311    aware of their overthinking and how TA had helped them to understand their own thought

312    processes.

313    *Drifting*

314    The term drifting refers to when a participant recalled thoughts relating to past

315    experiences, projected thoughts into the future and/or thought about irrelevant cues. The

316    participants in this study reported that they became aware of this drifting and as a result were

317    able to reverse this process. Participant four explains below:

318        When I hit the pitch left, I was pretty pissed off about it, but by the time I had got to

319        the next chip I had verbalised that I was pissed off about it, but I can do a little chip

320        up and putt her in and it will still be a par … I think it helped me see that something

321        that I do struggle with is how I often drift off and find myself not thinking about shots

322        at all and that's when I can cock up (P4, immediate interview).

323    Again, this idea of not being focused on the present performance was also reported by

324    participant six who explained how he realised that he was not fully focused on his

325    performance. Nevertheless, he recognised this within the interview and explained how he was

326    able to reflect as a result of using TA:

327        This (TA) has actually made me realise that there's a process that I need to go through

328        every time and to keep that focus really. I've realised that I need to work on my

329        concentration and every ball you go to hit you have to approach in the same manner

330        and just try and make sure you get that process of talking through what you're

331        planning on doing and don't get distracted like I do when I'm playing in a

332      competition … I think that is something that I need to do when I'm playing in a

333      competition, it's worth focusing in on it (P6, follow-up interview).

334 This theme was also evident in participant one, who reported how her mind wandered.

335 Nevertheless, using TA enabled the participant to be more focused on her game:

336      I find that my mind wanders and that is kind of the same with golf. When it is in your

337      sub-conscious your mind wanders and does other things, but when you're having to

338      actually say it out loud your mind is focused on the words you are saying so I can see

339      that would be useful. (P1, immediate interview).

340 *Awareness of overthinking*

341      This theme represents participants experiences of having too many thoughts during

342 performances, which was perceived to have a detrimental impact on performance. Participant

343 one articulated how using TA raised awareness of the number of thoughts present during

344 performance:

345      The most interesting bit (about TA) is that I think I need to improve on the most is the

346      preshot. …You know I think there's a couple times where I say 'make a full turn' and

347      talking about the backswing. In my own head that means about five things … There's

348      way too much stuff going on in my head. Rather than doing all the analytical bit, pick

349      the shot and then go right 'commit to hitting the shot' (P1, immediate interview).

350 Participant one reinforced this idea of overthinking in her follow-up interview, where she

351 recognised how TA could help herself understand how much she should be thinking during

352 her performance. In the following quote, participant one is referring to how TA could help

353 understand this: "Sometimes not having too many thoughts can be a good thing, but I think

354 there's a balance to be had and actually knowing where you've got too many thoughts or not

355 enough thoughts could be quite helpful."

356 Participant two echoed the notion of having an optimal number of thoughts in that he

357 reported how he sometimes get into a loop of overthinking. Although participant two did not

358 report any immediate change or improvement in performance, they became aware of the

359 effect or danger of overthinking:

360    I realised (through using TA) the dangers of how sometimes I'm overthinking. I have

361    this tendency to think about my own thinking and it can be a dangerous loop for me to

362    get into. I think that it (TA) highlighted this for me even more (P2, follow-up

363    interview).

364 **Awareness of how behaviour influences performance**

365    This theme refers to how participants not only became aware of their thought

366 processes, but also how being able to articulate their thoughts impacted their performance. A

367 range of sub-themes were identified, namely, following a set thought process, reflecting on

368 emotional instability, and learning from TA.

369 *Following a set thought process*

370    Participants reported that using TA enabled them to be more aware of some of the

371 more positive processes that they followed. The theme of following a set thought process

372 refers to how some participants became aware of the pre-performance routines or thought

373 processes that they perceived as being positive to their performance. Participant one reported

374 how TA allowed them to illuminate their methodical thought process:

375    It (TA) made me aware of the processes I go through. For example, before the shot I

376    would go through the same thing of; 'ok what's the wind doing?' 'Where's good to go

377    on this hole?' 'Where's a good miss?' 'What kind of shot shape do I want?' 'What

378    club am I hitting?' 'Is it the right club?' Going through it quite methodically definitely

379    helped me see how I'm quite methodical (P1, immediate interview).

380    The perceived benefit of being aware of one's thought processes was also evident in the

381    follow-up interviews:

382         Yes, I think it (TA) reinforced what I think I do; 'what's my yardage?' 'What club am

383         I going to use?' 'Where am I going to aim the shot?' 'Am I going to have to take

384         more club or less club because it's uphill or downhill?' I think it reinforces that I

385         actually do that even though I'm not sure in my normal process that that's a conscious

386         thought but it was quite reassuring that I do go through that process (P1, follow-up

387         interview).

388    Participant four echoed this perceived benefit in that TA reinforced the process or routine that

389    he followed: "So that's the good bit in confirming that I think I've got a fairly good routine

390    and reinforcing that has helped me understand and confirm my own process" (P4, immediate

391    interview).

392    ***Reflecting on emotional response***

393         The theme of reflecting on emotional response refers to how using TA enabled

394    participants to identify negative emotions during performance. Participant three explains how

395    listening back to his TA audio file reinforced some of his original thoughts about his

396    behaviour on the course and allowed him to see how he could improve his performance as a

397    result:

398         Listening back to it (TA) was really useful as well. I can learn what makes me angry

399         and … eliminate that from my game and don't let it bother me too much. Hearing on a

400         scale of how angry I get and I will be able to remember the shot I am sure. So yeah,

401         measuring my temperament and what my limits are (P3, follow-up interview).

402    Furthermore, participant five reflected on how he is hard on himself and he acknowledged

403    how he needed to be more positive and focused on his good performances:

404    Generally, when you're playing on your own or whenever it may be, you do focus on

405    the bad because that's what needs improving … Being a bit kinder to myself when I

406    do hit a good shot can be really useful and maintain a positive mind-set. That is

407    something that I need to do more as I am very hard on myself as I found throughout

408    the TA (P5, follow-up interview).

409 In his follow-up interview, participant three explained how he felt embarrassed after listening

410 back to his audio file, due to his language and swearing. Nevertheless, he was able to reflect

411 on this and consider how he has become calmer as a result:

412    I used to be quite well contained but it sort of built up and built up and built up so if I

413    ever did have a bad hole it ruined the rest of my game and I'd swear a lot. Whereas

414    now I try and be a lot calmer and when I walk off the green I can go onto the next tee

415    with no worries because I have got it out. So, yeah quite embarrassing (listening back

416    to TA) would be the best way to describe it (P3, follow-up interview).

417 Furthermore, participant four reinforces how he developed awareness of their emotional

418 responses to performance and how they might be able to rationalise this in future

419 performance:

420    As I was speaking aloud it made me more aware of the situation, almost aware of the

421    emotional response I was giving to it. The main thing was making me aware of the

422    current situation rather than losing my head over a shot (P4, immediate interview).

423 **Disruption of thought process and performance**

424    The use of TA itself was reported to cause some disruption to thought processes, and

425 in some participants, to performance. Specifically, it was reported that verbalising

426 unsuccessful shots and performances was sometimes difficult and some participants may

427 employ an avoidance focused coping strategy of ignoring this perceived negative

428    performance.  In addition, putting performance seemed to be most affected, especially when

429    participants first started to use TA during this skill.

430    *Difficulty verbalizing and evaluating negative performance*

431         It is important to note that participants acknowledged the process of TA to be

432    challenging at times. For example, participant six reported the potential difficulties of

433    verbalising his thoughts after a bad shot. Although this highlights how TA has potentially

434    changed the focus of his natural attention, the following quote provides evidence of how this

435    illumination of negative behaviour has been used to improve his thoughts process:

436         Something that I found particularly difficult when thinking aloud was verbalising

437         everything even when I'm hitting a bad shot. If it is something that is an unforced

438         error and it's not necessarily the fact that my swing was bad, I just didn't hit the shot

439         that I wanted to and it was just a one off maybe. I would maybe overlook it but where

440         I'm verbalising everything I'm kind of focusing more on the bad shots which actually

441         turned out to be really positive because I'm really focusing on those shots and making

442         sure that I don't do them again and making the same mistakes again (P6, follow-up

443         interview).

444    Participant four also explained the potential difficulties of verbalising less successful

445    performance. This links to the emotions that are elicited following both positive and negative

446    outcomes. Participant four, perceived the negative emotions following an unsuccessful

447    performance to be a potential issue when using TA:

448         If someone was playing bad I think it would be harder for them to say their true

449         thoughts. I would probably struggle with it a bit more because you know you get

450         emotional when you play badly or you miss a putt. (P3, follow-up interview).

451    *Potential distraction to performance*

452   This theme refers to some participants reporting how TA could possibly act as a

453   distraction to their performance, especially when verbalising thought processes while putting.

454   For example, participant two reported how he initially thought more about TA and less about

455   his putt, which resulted in a negative outcome: "especially with the putts at the start, it

456   affected me quite badly, because I was focusing more on speaking aloud at times rather than

457   my actual shot" (P2, immediate interview).

458   One participant reported being distracted during putting performance due to his putting

459   routine being visual and how having to verbalise his thoughts directed his attention away

460   from the visual cues he would usually use when putting:

461       I am visual with putting. I'm like 'that is the spot I want to hit it on', and if I'm

462       talking to myself I'll almost forget where that spot is and if I don't look at it again, I

463       have to keep looking at the spot until I'm like that is exactly where I want to hit I

464       now. If I keep talking I put myself off where I'm trying to aim. Even though I'm

465       saying where I want to aim it, I've lost that visual connection with my reference point.

466       So as a result, on putts, I found it a lot more difficult (P4, follow-up interview).

467   The potential issue of TA being a distraction during putting is an important consideration for

468   how TA is employed and in what environment. For example, the evidence may suggest that

469   TA is best used in practice conditions only, given that it might be detrimental to competitive

470   performance.

471   **Application to coaching**

472       All participants recommended the use of TA as a useful coaching tool. Although this

473   is only from the perspective of the golfer and not the coach, participants reported how the

474   coach could use TA to understand, monitor, and challenge the golfers thought processes.

475   Participants stated that coaches could use TA to better understand their player's thoughts, and

476   in turn, be able to implement appropriate coaching interventions as a result. Specifically, the

477   sub-themes of gaining an insight into a golfer's thought process and coach intervention were

478   identified.

*Gaining an insight into a golfer's thought process*

480   Our participants reported how TA could help the coach to gain an insight into what the golfer

481   is thinking:

482        I could see how actually articulating (TA) is actually quite useful from a coaching

483        perspective, because if you're actually articulating what you're thinking your coach

484        knows whether you're actually going through a routine to your thinking which is

485        actually quite important and whether you're actually thinking in the correct way (P2,

486        follow-up interview).

487   Participant four also provides support for the use of TA in coaching, specifically when

488   making the coach aware of the golfer's thoughts relating to course management and focus:

489        If you've got an athlete that you feel has poor course management, is thinking the

490        wrong thoughts or is losing their head at some point in the round then you can use

491        think aloud to assess what they are thinking and see where you might be able to

492        change it (P4, follow-up interview).

*Coach intervention*

494        Through providing an awareness of thought processes, it was suggested that this could

495   lead to a range of possible coaching interventions. Participant two explains the potential

496   benefits of using TA as a remote coaching tool, where a coach could gain insights into their

497   golfer's thought process and then suggest relevant coaching points:

498        I think it (TA) gives a coach … an idea of the routine that you're going through and it

499        would enable them to help you by making suggestions by saying you're doing this,

500        how about if you try and do x, y and z. I can see that it would have benefits. Good

501        things that you're doing, bad things that you're doing, things that my help. Also, if

21

502        you've got too much going on in your head or perhaps not enough going on in your

503                head (P2, immediate interview).

504    Participant five explains how using TA could enable the coach to identify when an athlete's

505    thoughts may disrupt their performance and allow the coach to challenge the player and

506    interrogate their thought processes at certain points of their game:

507                For coaching it is a positive thing because the coach can pick up on 'why were you

508                thinking that there?' 'Why were you thinking this here?' When you hit a bad shot and

509                you let it get to you. … I think from a coaching perspective the coach can turn around

510                and say 'why do you think that way?' 'Why are you so harsh on yourself?' (P5,

511                follow-up interview).

512                                              **Discussion**

513                The aim of the present study was to understand golfers' perceptions of using TA at

514    two time points: immediately post performance and after a six-to-eight-week reflection

515    period. Using Zimmerman's (1986, 2000) self-regulated learning theory as a guiding

516    framework, we were able to provide an original contribution to the literature by elucidating

517    how using TA might promote self-reflection, and ultimately, self-regulation in golfers.

518                One major finding from the present study is that TA appears to have developed an

519    increased level of self-awareness in golfers. This finding is represented by both the increased

520    awareness and awareness of how behaviour influences performance theme. According to

521    Zimmerman (2000), reflection is a sub-component of metacognition that relates to awareness

522    of and knowledge about one's thinking and learning. The golfers in the present study appear

523    to have developed their ability to evaluate their own thinking by a process of self-reflection.

524    In line with Zimmerman's (1986, 2000) self-regulated learning theory, it appears that using

525    TA facilitated self-judgment as reflected by participants being aware of the consequences of

526    their thoughts and behaviours. The process of self-evaluation was facilitated as golfers

527 appeared to compare their self-observed performance against goal attainment, and in turn,

528 calibrate the causes of success and errors to their self-observed performance (causal

529 attributions). For example, close inspection of participant four's quotes suggest that he

530 attributed performance errors to controllable processes that may sustain motivation as he

531 implies that developing a strategy to manage drifting may lead to future success

532 (Zimmerman, 2002).

533      Despite the findings of the present study suggesting that TA developed self-awareness

534 through reflection, participants did not report using TA as a reflective tool between the

535 immediate and follow-up interviews. Subsequently, participants did not engage in the sub-

536 process of adaptive reactions as there was an absence of effort to adjust one's method of

537 learning. Individuals who judge their success and failure as opportunities to learn may

538 develop a more adaptive attribution style, which in turn, may enhance emotional control

539 (Zimmerman, 2000). Given the absence of adaptive reactions, caution should be taken when

540 interpreting the findings regarding the extent to which an improvement in self-regulation was

541 identified. Notwithstanding, these collective findings illustrate the reported benefits of TA

542 and its capability to facilitate increased self-awareness through the process of self-reflection.

543      Golfers reported that TA could be used by the coach to better understand their golfers

544 thought processes, and in turn, implement coaching interventions. These interventions could

545 cover a variety of areas such as pre-performance routines (e.g., monitoring pre-event anxiety

546 symptoms), performance strategy (e.g., pacing strategy), and psychological strategies aimed

547 at responding to stressful situations (e.g., monitoring attentional control strategies).

548 Researchers (e.g., Swettenham et al., 2018; Kaisler et al., 2012; Whitehead et al., 2016a) have

549 supported the notion that TA could be used as a performance enhancement tool by coaches

550 and sport psychologists. To date, only one study has explored a sport psychologist's use of

551 TA to improve emotional control in a tennis player (Moffat et al., 2021). Therefore, more

552 research is needed to develop a better understanding of how practitioners may employ TA

553 within their practice.

554     One suggestion could be to focus on how coaches challenge athlete learning. Hansen

555 and Anderson (2014) suggest that challenging an athlete's reflection may enhance more

556 reliable learning experiences. Hansen and Anderson (2014) present the concepts of the coach

557 being the sense-giver and the athlete being the sense-maker, where the coach's role is to

558 stimulate athlete reflection through intervening in the sense-making process. This process of

559 sense-giving is where the coach challenges the way the athlete perceives and interprets

560 training advice (Jones et al., 2012). Sense-giving interventions involve giving direction to

561 athletes via training plans, observing and interacting with the athlete, encouraging the athlete

562 to reflect on their training, and asking challenging questions (Hansen & Anderson, 2014).

563 Using TA may provide an additional method of sense-making for the athlete where they are

564 able to not only self-reflect, but also have their TA challenged by the sense-giver (coach).

565 Given that self-regulated learners are eager to challenge established behavioural patterns

566 (Zimmerman, 1986, 2000), using TA alongside the sense-giving process may provide a

567 fruitful means of developing highly valuable self-regulatory skills in athletes. Further

568 research is therefore warranted to examine the collaborative use of TA in developing self-

569 reflection, and possibly self-regulation, in athletes.

570     As can be seen from the themes, golfers reported both positive and negative

571 perceptions of using TA. Participants reported that thinking aloud helped identify problem

572 areas (e.g., drifting) in their game. Being able to identify drifting of focus and concentration

573 is a key component of successful performance in that drifting into the past or the future may

574 inhibit performance (Wilson et al., 2006). Therefore, being able to identify this drift through

575 the use of TA is an important finding for the present study. Despite participants not reporting

576 using TA between the immediate and follow-up interviews, they did, however, consider

577   applying what they had learned to competitive environments. For example, participants

578   reflected on how they could apply the use of TA to competitive environments, where this

579   drifting could be identified to improve their focus. The six-to-eight-week reflection period

580   and the process of listening back to one's TA were also perceived positively by participants.

581   Participants reported the benefits of listening back to their TA and the collective findings

582   encompassed by the increased awareness and awareness of how behaviour influences

583   performance themes highlight the value and positive perceptions of golfers using TA.

584        Despite the reported benefits of using TA, some golfers revealed concerns about using

585   TA in that it caused disruption in thought processes and performance, especially after

586   executing poor putts. The theme of disruption of thought process and performance highlights

587   the prevalence of reactivity from thinking aloud during performance. This evidences how

588   metacognition occurs where participants are potentially becoming more aware of their

589   thoughts and decision-making by virtue of TA directing attention towards the conscious

590   process. Indeed, a recent review of reactivity to measures of metacognition argued that TA

591   may cause reactivity whereby participants may attend to internal cognitions in a way they

592   would not have ordinarily done and may be compounded by the nature of their verbalisations

593   being recorded (Double & Birney, 2019). Although metacognition has been associated with

594   positive developmental (e.g., Lior, 2004; Theodosiou & Papaioannou, 2006) and performance

595   benefits (e.g., Jonker et al., 2011; Nietfeld, 2003), it may also promote conscious control of

596   movement that is argued to potentially hinder skill execution. According to Masters' (1992)

597   theory of reinvestment, automated motor processes can be disrupted if the performer tries to

598   consciously control skill execution. Research (e.g., Pijpers et al., 2005; Wan & Huon, 2005)

599   has generally supported the contention that consciously controlling movement hinders

600   performance in conditions of high anxiety. Given that participants in the present study used

601 TA under simulated competition conditions, reinvestment theory could explain the

602 discomfort experienced.

603       Nevertheless, this element of reactivity and leading participants to attend to internal

604 cognitions becomes somewhat of a double-edged sword. By becoming aware of these thought

605 processes, golfers may increase his or her understanding of how their cognitions impact their

606 practice, and in turn, potentially develop self-regulatory skills to facilitate more effective

607 learning (Zimmerman, 1986, 2000). Conversely, directing one's attention towards cognitions

608 that underpin skill execution can potentially hinder performance. Stephenson et al. (2020)

609 found that coach's use of TA during practice enabled them to become more aware of their

610 own cognitions and coaching behaviours, yet TA also became a distraction from the task of

611 coaching and thus negatively impacted overall coaching performance. Despite the

612 overwhelming body of literature supporting the use of TA as a valid and reliable means to

613 capture in-event cognitions (for a review, see Fox, Ericsson, & Best, 2011), the present study

614 highlights the need for researchers and practitioners to acknowledge the potential for

615 reactivity when using TA as self-regulation tool. This also leads to considerations about the

616 learning of TA and that it is a skill. Initially, participants may become distracted as they are

617 in the cognitive phase of learning (Fitts & Posner, 1967). Consequently, researchers should

618 consider the length of TA training to overcome such impacts.

619       Although this is the first study to consider the use of TA as a tool to facilitate self-

620 regulation within athletes (golfers), it is important to acknowledge the limitations of the study

621 and consider how future research may develop this area further. We understand that reflection

622 is more than just listening back to your thoughts. Future research may consider how the wider

623 social environment and development of the individual athlete plays a role in how they reflect

624 and engage in the TA process. Using TA in isolation also means that participants are only

625 able to self-correct, which may result in an individual only knowing what they know or not

626    knowing what they don't know. Howell (1982) termed this phenomenon unconscious

627    incompetence. This may explain why participants acknowledged the importance of using TA

628    collaboratively with their coach. Research within coaching has emphasised the role of

629    guidance or a critical friend in enhancing reflections (Szedlak et al., 2019). Furthermore,

630    using TA through a collaborative process with other coaches has also been suggested in

631    previous research (Stephenson et al., 2020). Future research should therefore consider

632    triangulating methods (e.g., performance measures) and gaining perceptions of others (e.g.,

633    the coach).

634        Due to the exploratory nature of the present study, participants were instructed to

635    listen to and reflect upon TA audio using an open and unstructured process. We acknowledge

636    the benefits of structured reflection approaches and encourage researchers to harness

637    frameworks (e.g., Gibbs' reflective cycle; Gibbs, 1988) to facilitate deeper reflections. We

638    also acknowledge that caution should be taken when interpreting the findings regarding the

639    extent to which an improvement in self-regulation was identified. We encourage researchers

640    to analyse TA content and/or harness follow-up interviews more explicitly to assess changes

641    in self-regulation to further shed light about the use of TA as a tool to promote self-regulation

642    in athletes.

643        Furthermore, it is important to consider and acknowledge how reactivity,

644    metacognition, and reflection are also very individualised processes, where some individuals

645    may benefit from reporting on their metacogntition, while others may be impaired and some

646    do not react at all. This was evidenced by Whitehead et al. (2018) where some cyclists

647    reported perceived benefits of using TA "it helped me pace myself better" (p.106), whereas

648    others reported negative reactivity "it slowed me down" (p.106) and others reported no

649    reactivity "I was probably as per normal" (p.106). The absence of any long-term follow-up

650    interviews and the lack of questioning surrounding participant's effort to adjust one's method

651    of learning limit the scope of the study to reveal the wider implications of using TA to

652    develop the broader self-regulation process. Therefore, we encourage researchers and

653    practitioners to examine how TA could be used longitudinally and how the content of TA

654    may change with the potential development of self-regulation skills.

655    **Conclusion**

656    The aim of the present study was to glean golfers' perceptions of using TA, and

657    ultimately, to advance understanding of its use as a tool to promote self-reflection and self-

658    regulation in golfers. Talented athletes are more likely to self-reflect during athletic

659    performance in comparison to lower-level peers (Jonker et al., 2011). Therefore, it is

660    important that research and practice considers how best to facilitate this process within the

661    athlete population. More specifically, using TA may help athletes to better understand how

662    they think and feel within real-time performance in comparison to retrospective reflections

663    such as diary methods (Tan et al., 2016). Although the present study does pose

664    methodological questions for research using TA as a data collection tool for capturing

665    naturalistic cognition, TA offers a potential tool to promote self-regulation for golfers and

666    other athletes who wish to self-evaluate their in-situ thought processes. Researchers are

667    encouraged to examine the use of TA as a self-regulation tool to further support or challenge

668    these preliminary findings.

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