1   **Title:** Evaluating #VetFinals: can Twitter help students prepare for final examinations?

2   **Short title:** Twitter use as examination preparation

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9

10   **Abstract**

11   Twitter is increasingly used in education. In this paper, Twitter was evaluated for its potential to aid

12   veterinary students in their preparation for final examinations. '#VetFinals' revision sessions were

13   facilitated by experts on a variety of topics. The initiative was evaluated through consideration of

14   potential participants, session content and student experiences. In analysis of nine sessions, 52

15   students participated from eight veterinary schools. During a session, the facilitator tweeted 66 times

16   on average, primarily asking a general question. Students on average tweeted 84 times, mostly in

17   response to facilitators. They also asked novel questions and responded to fellow students. Focus

18   groups and interviews with 11 students suggested that: sessions are useful for preparation/self-testing

19   to succeed in exams; the facilitator and session style impact on learning; the sessions feel like

20   personalised learning; there are elements of safety and exposure leading to some fear of tweeting;

21   peer learning promotes competition; a community of learners was formed; Twitter has become a part

22   of normal professional life. Whilst not all students will take part in this type of social media use, many

23   found it beneficial. The importance of the facilitator suggests the need for faculty development.

24

25

26   **Introduction**

27   Social media are increasingly utilised as teaching tools in a variety of ways. Their readily accessible

28   nature, low cost and relative ease of use makes them appealing to teachers who wish to expand their

29   armoury of delivery methods. However, there are challenges related to the use of any new technology,

30   and the public nature of some social media tools is potentially off putting to users especially in medical

31   education. It is therefore important to assess their effectiveness in a range of contexts, so that

32   teachers can ensure they select the right tool for the right purpose, resulting in an effective learning

33   experience.

34   **Use of Twitter in teaching**

35   The microblogging social media tool Twitter has been used in a range of educational contexts. The

36   platform allows users to post ("tweet") short pieces of text alongside links to pictures or other online

37   resources, and interact with other users posts which can be themed by the use of hashtags. A hashtag

38   is a user generated keyword preceded by the symbol '#' included in a social media post, allowing other

39   users to search via this keyword (Twitter 2016). Twitter has been used real-time within the classroom

40   as an alternative communications channel, for example in accounting (Osgerby & Rush 2015) and

41   pharmacy teaching (Dvorkin Camiel et al. 2014). It has also been utilised outside of the classroom to

42   continue conversations between formally scheduled teaching (Junco et al. 2011) or whilst medical

43   students are on clerkships (Reames et al. 2015). These uses encourage connectivity between learners

44   as and when suits them.

45   Whilst Twitter can be used as a one-way transfer of information between teacher and student, it is

46   the ability to utilise it for collaborative sharing and discussions which makes it a popular tool in medical

47   education (Forgie et al. 2013), potentially encouraging student reflection and self-directed enquiry

48   (Sandars et al. 2015), as well as expanding networks and emphasising precision in writing (Choo et al.

49   2015). Knowledge is created socially between Twitter users, aligning it with theories of social

50   constructivism, and communities of practice develop where experts share their knowledge with

51   novices (Wenger 1999). The learning theory of connectivism is also helpful to consider how Twitter

52   can be utilised (Siemens 2005), with individuals joined to each other and also to content about which

53   they are learning.

54   Gurbani (2014) summarises various medical Twitter initiatives including #FOAMed and #twitfrg, which

55   encourage resource sharing and collaborative learning. Recently, publications have begun to review

56   the effectiveness of Twitter in medical education, and in a systematic review the majority of studies

57   showed a positive effect on learner satisfaction (Cartledge et al. 2013). Student attainment after a

58   Twitter intervention has not been measured extensively, but one study did show an improvement in

59   grades with compulsory participation (Junco et al. 2013).

60   **Negative aspects of Twitter use**

61   As with any social media tool, there are potential negative consequences of using Twitter in teaching

62   and learning. During classes it can be seen as a distraction (Forgie et al. 2013) and students may

63   perceive teaching is being manipulated just to include Twitter (Osgerby & Rush 2015). The 140

64   character limit may be prone to misinterpretation and inaccuracy of complex medical tweets, and the

65   ease of anonymity online is feared to lead to unprofessionalism (Choo et al. 2015). In the clinical

66   context, this potentially has far reaching consequences including damaging reputations and limiting

67   opportunities for employment (Kogan et al. 2015). Despite these fears, no studies have recorded

68   issues of unprofessionalism occurring during academically focused social media initiatives (Cartledge

69   et al. 2013, Mawdsley & Schafheutle 2015).

70   There are mixed views on the ability of social media to engage shy students. Students experiencing

71   Twitter on a management course requested further use, specifically due to its ability to engage shy

72   students (Menkhoff et al. 2015). In lectures with education students, Twitter appeared to enable shy

73   students to tweet, but when the lecturer followed these Tweets up with a verbal question this

74   deterred the students from contributing again (Tiernan 2014). Junco et al. (2011) suggested that

75   Twitter did facilitate individuals to tweet who might not have asked questions in a face-to-face setting,

76   but identified that the tweets could be more rude or demanding than would be appropriate face-to-

77   face.

78   **Further evaluation of social media in clinical education**

79   It is important to continue to evaluate the use of social media in clinical education, because outcomes

80   will vary depending on application and context. The evidence base for the utilisation of different tools

81   must be increased so that teachers can select appropriate tools and relevant guidance, and avoid using

82   the technology for little reason other than novelty (Sandars et al. 2015). This paper aims to assess one

83   such initiative: the #VetFinals exam study club which is hosted on Twitter. This project, run by two UK

84   veterinary schools, aims to assist final year veterinary students in their preparation for their final

85   examinations, as well as encouraging digital professionalism role modelling and the development of a

86   community of veterinary Twitter users.

87   The initiative has been explained in detail elsewhere (Whiting et al. 2016). In summary, experts

88   facilitate one hour sessions on a case or topic of their choice and post a series of questions or prompts.

89   Students answer with tweets of their own. The #VetFinals website (https://VetFinals.wordpress.com/)

90   promotes upcoming sessions and presents summaries of previous sessions via Storify, another social

91   media tool. Sessions commonly involve veterinary students from across the UK. The initiative has been

92   running since 2011 and sessions are conducted between January and June.

93   This study was specifically performed to evaluate this social media intervention, in response to calls

94   to evidence this new and increasingly commonly used teaching method (Sterling 2015). It is hoped

95   that the outcomes of this study will inform others utilising social media in medical education.

96   **Methods**

97   A sequential mixed methods approach (Creswell et al 2003) was utilised whereby "meshing" of data

98   allows the distinctive advantages of each method to be retained (Mason 2006), working within a

99   constructivist epistemology where understanding of students' lived experiences is generated in a

100 social way. Analysis of the participants and content of #VetFinals sessions and resources informed a

101 subsequent in-depth qualitative analysis of participants' perspectives of their learning during these

102 sessions. Evaluation was undertaken during the most recent iteration of #VetFinals sessions, from

103 March to May 2015.

104 **Participant evaluation**

105 The website Twitonomy was utilised to identify followers of @VetFinals, the account used to deliver

106 the sessions, and locate them geographically. This analysis took place on June 30th 2015. From this list

107 of followers, active participants were further identified by identifying accounts from which at least

108 one Tweet with the #VetFinals hashtag had been sent during a revision session within the evaluation

109 period. Information such as location and gender was recorded.

110 **Session content evaluation**

111 Content analysis was performed on Tweets in a similar approach to Tiernan (2014) and Lin et al (2013).

112 All tweets using the #VetFinals hashtag were downloaded for the duration of three early sessions to

113 enable codes to be generated which identified the types of tweets. No new codes were identified by

114 the third session and therefore data saturation of codes was considered to be complete. The

115 generated codes were then used to analyse the final nine sessions delivered during the analysis period.

116 These codes were used to inform the next stage of the study.

117 Storify summaries of the 12 sessions were accessed to record view numbers on October 20th 2016.

118 **Learner experience evaluation**

119   A qualitative approach utilising focus groups explored participants' experiences and perspectives of

120   the use of Twitter in this format. This method was chosen to allow interaction between students in

121   exploring experiences relevant to social media in-depth (Stalmeijer et al 2014). One to one interviews

122   were also utilised due to unavailability of some students who were away from university on

123   placements or study leave.

124   Focus groups were held at the University of Nottingham and the Royal Veterinary College (RVC),

125   London, as the two founding institutions and those with the most active participants (see Results

126   section). Participants were purposively sampled to include students at different stages of study and

127   with various #vetfinals levels of experience to provide a range of opinions for discussion. Experiences

128   were categorised as: those who frequently attended sessions and repeatedly tweeted (range 18-37

129   tweets) and those who had only tweeted a few times (range 4-9 tweets). In total 10 students from

130   one institution and nine from the other were approached via email to take part. No incentive other

131   than refreshments were offered to participants.

132   All focus groups and interviews were conducted by TK, an independent researcher who led the

133   evaluation of the project.

134   The focus groups and interviews were semi-structured with questions founded on previous

135   explorations of learning within ICT-enabled communities (Ala-Mutka 2009; Dale et al. 2011) as well as

136   the results from the session content evaluation. The prompts considered motivation (previous twitter

137   experience, expectations of taking part), activities (what the students do in a session), benefits,

138   barriers & challenges, and support. The focus groups and interviews were audio recorded, and

139   transcribed verbatim.

140   Consent was obtained from all participants. This study was granted ethical approval by the Royal

141   Veterinary College URN 2015 1350.

142 The transcripts were analysed according to Braun and Clarke (2006)'s six phases of thematic analysis

143 for each question. The data were read and re-read to allow familiarisation, initial codes were

144 generated, themes of codes were identified, reviewed, defined and named. Analysis was

145 independently conducted by two researchers (TK and KM) who were not involved in the #VetFinals

146 teaching to avoid bias and aid confirmability. The themes and codes were compared and

147 demonstrated similarity in interpretation of the transcripts. Discussion allowed areas of difference to

148 be resolved and the final themes to be named. Finally, the themes were refined through discussions

149 between one researcher (TK) and a third researcher (LM), who was able to ensure credibility through

150 experience with observing #VetFinals sessions. As the themes demonstrated much similarity between

151 the focus groups, and as all criteria of participants were met, the initial quota of two focus groups and

152 two interviews was not expanded.

153 The transcripts and initial analysis (themes and sub-codes) were emailed to the participants who were

154 invited to provide feedback as part of participant checking. Two students responded and said that the

155 transcripts and interpretations were a 'faithful representation' of their views.

156 **Results**

157 **Participants**

158 At the time of analysis, the #VetFinals account had 719 followers.

159 The locations of 95 recent followers were primarily from the UK and Ireland (76 accounts). Additional

160 locations were identified as: USA (6), Spain (2) and one in each of Algeria, Australia, Brazil, Czech

161 Republic, Egypt, Malaysia, Nepal, New Zealand, Romania, Slovakia and Sri Lanka.

162 In the nine sessions analysed, 52 veterinary students tweeted at least once, averaging 12 students per

163 session (range 6-20). In total, 14 males and 36 females took part (plus one unknown). Participants

164 were from at least eight veterinary schools, most frequently from the University of Nottingham and

165 the RVC (totalling 75% of known locations). All student accounts were public.

Session content

Content analysis of all tweets during three early sessions identified three codes for facilitators (general question/comment, response to students and retweet) and four codes for the participating students (response to facilitator's question, response to fellow student, asking a new question, retweet).

In the remaining nine sessions, the average number of tweets per session was 150 (interval 81 - 238). The facilitator tweeted 66 times per session on average, primarily asking a general question or providing a general comment to all participants (Table 1). They also responded directly to students using the '@' function with praise, a follow up question or correction. Facilitators rarely retweeted a student's post.

INSERT TABLE 1

The student cohort on average tweeted 84 times with most being responses to facilitators. Retweets were rare, but responses to other students slightly more common e.g. agreeing, questioning, or highlighting errors:

"I was thinking we'd already done a PLT count, think you're right!"

"is that high enough to panic about?"

"we aren't talking about fluke"

Students sometimes asked a new question to the facilitator. These new questions were identified as they slightly changed the direction of the topic. E.g.

"how quickly should you see improvement? would you wait the 4wks to decide if it wasn't diet + more tests needed"

Analysis of the Storify records showed an average of 198 views per session summary (range 88-369).

Learner experience

188 Eleven students out of the 19 approached took part in the evaluation. Participants were equally

189 divided between the two lead institutions and demographics, including reported Twitter use, are

190 shown in table 2.

191 INSERT TABLE 2

192 Prior experience of all participants in using Twitter before #VetFinals engagement was variable ranging

193 from none – individuals who joined specifically for #VetFinals (n=4), to those who had an account and

194 used it sporadically for certain topics such as sport (n=5), to those who used it frequently and were

195 big promoters of the technology (n=2).

196 **Thematic analysis produced nine main themes relating to the learner experience.**

197 In the following sections the main themes that formed inductively from the data are outlined with

198 example quotes from student participants to aid credibility. Quotations are coded according to their

199 origin: I=Interview, FG=Focus Group, followed by student identifier.

200 **Driving exam success: revision and self-testing**

201 A strong theme emerged around the sessions motivating revision and examination success. Students

202 liked having a novel way to revise and were keen to participate in something they saw as potentially

203 helping them to pass examinations.

204 *"I was already looking for new ways to revise because I get quite bored quite quickly … being able to*

205 *use Twitter which I consider a fun thing, and then being able to actually revise while I was on it, sounded*

206 *like a really good idea"* (I 1).

207 Whilst most students used the term revision when referring to their activity during the sessions, some

208 students suggested it was a way to test knowledge and not just revise, with topics encouraging

209 identification of weakness:

210 *"I will do some revision in the day. Then I'll have a good six hours where I don't do anything, or I do*

211 *something different, because I want to use #VetFinals to recall it.... I'll use #VetFinals as a recall not a*

212 *revision"* (FG2, S8).

213 *"They prompt you to go, right, hang on this is a big hole in knowledge. Not only will I attend the Twitter*

214 *session and learn it here, I also need to go over the notes in my own time."* (FG1, S3).

215 Session topic choice also impacted on engagement, with assessment relevance strongly driving

216 participation. There was potential for topics to cause stress if they were too in-depth for the level of

217 knowledge required for upcoming examinations.

218 **Facilitator impact on learning**

219 The role of the facilitator was seen as crucial to the usefulness of the sessions and hence student

220 engagement. The sessions were described as most helpful when a case was worked through

221 sequentially, so that students could 'see' the facilitator's and other participants' clinical reasoning as

222 the case developed, and integrate their own knowledge of the topic:

223 *"When the format went: problems, differentials, diagnosis, treatment, that worked quite well … you're*

224 *trying to work through a case … but if they weren't doing that it made it quite tricky to kind of follow"*

225 (FG2, S4).

226 *"It's just really helpful to bring together a lot of the knowledge because if you're just revising lecture*

227 *by lecture you don't always bring the stuff together*." (I2).

228 The style of facilitation, including pace and session management, was viewed as crucial for successful

229 learner engagement. In very small groups, the pace was slow and students felt forced to stay and try

230 to answer for the sake of the facilitator, who they appreciated had put in a significant amount of work.

231 In larger groups, the facilitator's questions were responded to at different speeds by participants. The

232 reasoning process was therefore disrupted for some, as responses occurred out of sync. One student

233 identified the challenges of flow in online sessions as follows:

234 *"You are aware [the facilitator is] waiting for something, but you are getting nothing back either, so*

235 *it's like, I've given you what I'm thinking of, so we need to move on."* FG1, S3).

236 **"Personalised" learning in a large scale context**

237 Students readily identified that whilst the sessions were being delivered to potentially hundreds of

238 participants, they still had the ability to feel personalised because of the potential for timely feedback.

239 A personal response to their interactions was valued by students, including their tweet being 'liked'

240 or 'favourited'.

241 *"It's not a one-on-one session, but it kind of is, at the same time, which is really nice. And I feel, when*

242 *the clinicians do tweet you back and say, "yes, but…", it makes you really think about things."* (FG2,

243 S8).

244 Several students also saw it as an opportunity to ask their own questions:

245 *"You can direct any of your questions; you pretty much have the clinicians' undivided time. And they're*

246 *always very keen and quick to respond."* (I1).

247 However, sometimes this feeling was lost if the session was flowing and students felt they should not

248 interrupt, even if there was something fundamental they had not understood:

249 *"When it's going so fast paced… everyone says that there's no such thing as a stupid question, but*

250 *when you've got a question like that, you don't want to ask it whilst everyone else is like firing away*

251 *with answers and you're a bit confused, but you can't really catch up with what's going on until you've*

252 *kind of asked it"* (FG1, S4).

253 Students suggested that facilitators could create rules around retweeting and 'favouriting' tweets to

254 help with busy sessions, and that they should also include an open questions session at the end, for a

255 limited time, in order to return to a more personalised learning experience.

256 Participating students also identified classmates who did not wish to engage in the "live" format,

257 because of the approach required, but did choose to access the Storify resources of the sessions, and

258 could be described as "lurkers" (Nonnecke & Preece 2000) who still benefitted from the initiative.

259 **Safety and exposure**

260 Social media provides a different learning environment and this appeared to both provide safety and

261 expose students, depending on their perspective. The active users in this research clearly felt able to

262 post, including typically "shy" learners:

263 *"I've never asked or answered a question in lectures because I don't know, it's too scary, but I was*

264 *more than happy to participate."* (FG1, S4).

265 Some students used group-working to create one response to limit exposure. Active students primarily

266 comprised final year students, with fourth year students posting only when confident, and third year

267 students observing their future community, indicating that lurkers also existed during the live sessions.

268 Many students considered the challenge of speaking up online to be the same as that in a face to face

269 teaching session, and that the use of social media does not change this:

270 *"It's exactly the same pressures…. It's the fear of being wrong."* (FG2, S8).

271 The use of a private Facebook group was suggested as an alternative format for the sessions. However,

272 this was refuted by one student suggesting that the veterinary field should overcome the stigma

273 associated with being wrong:

274 *"We should be shattering this perfectionist complex that we have in the veterinary community."* (FG2,

275 S11).

276 The facilitator's, and other students', responses to wrong answers were very shaping to students who

277 did tweet an incorrect answer. In one isolated event, this was also linked to different viewpoints across

278 veterinary schools, which some found challenging.

279 **Peer learning: Competition and Comparison**

280 Whilst it was clear that peer learning was a benefit of this teaching format, there was also unease

281 around this aspect including competition between participants from different universities. Some

282 students viewed the intercollegiate nature of the sessions as primarily negative. They preferred to

283 comment when surrounded by friends, disliked other students correcting their peers and were more

284 likely to attend sessions run by their home institutions' lecturers.

285 *"I've never really felt any competition… some people were taking it as a bit of a competition and sort*

286 *of commenting on each other's quite a lot which it just kind of, got in the way a little bit … there was*

287 *no need for it, … a 'let's show that I'm clever' type of thing."* (FG2, S4)

288 Other students saw the benefit of learning from multiple universities' ways of teaching. They thought

289 they 'bounced off' other student's posts and wanted to encourage inter-student posting (while

290 appreciating this must be done with care). It seemed as if the sessions were as competitive as the

291 individual participants wanted to make them, with many students rushing to get their answer in first.

292 *" […] I like that, bouncing off other people, rather than going, that, that, that, that, that, done, [in*

293 *reference to copying and pasting book answers] because then you're not learning."* FG1, S8).

294 Most students read each other's posts and realised some knew more and some less than them, which

295 was seen as reassuring. The responses of peers, however, were not taken to be the truth and the

296 students wanted the facilitator to sum up each point with the 'right answer'.

297 **A community of learners**

298 A theme emerged around the sessions enabling learners to access and feel a part of a veterinary

299 Twitter community, and all began to follow others including their peers, lecturers and veterinary

300 organisations. As one student described:

301 *"You're seeing who are your allies in the vet world on twitter … discovering, or realising, who's out*

302 *there."* (I1).

303 However, there was some concern about session participant numbers growing too large, and

304 impacting on the community experience.

305 **Part of normal professional life**

306 Inevitably, issues around online professionalism were discussed by participants who demonstrated

307 awareness of the public nature of Twitter. There was consensus that the topics were not controversial

308 and unlikely to be of interest to the general public. The students seemed surprised that their peers

309 were prone to poor online professionalism, due to the frequency with which they are informed about

310 it by faculty. However, they identified times when they themselves had breached professional rules,

311 for example, by tweeting about being inebriated. One student described how social media was now a

312 normal part of many students' lives:

313 *"You should probably already be aware of what you can't do even if you don't use [social media]…*

314 *because social media is such a huge part of our lives … this is common sense to us. You put everything*

315 *on Facebook; it's our version of common sense, but … I think we are aware of [client confidentiality]*

316 *enough now that we shouldn't be making these sorts of mistakes."* (I1).

317 The ability to discuss veterinary matters in an educational situation on social media was appreciated.

318 One student summed this up:

319 *"It was quite nice to be able to use social media in that way because you knew that it was okay to kind*

320 *of use it like that."* (FG1, S4).

321 However, not all students were confident with Twitter and they discussed the challenges of utilising

322 new initiatives like #VetFinals when they weren't familiar with the technology.

323 **Discussion**

324 This analysis of a Twitter initiative for veterinary students adds to the literature with its specific

325 analysis of social media use for group revision sessions, which has not been assessed previously.

326 The #VetFinals sessions aimed to encourage peer learning and self-direction, potentially engaging shy

327 students as well as more confident participants. Facilitators aimed to demonstrate positive role-

328 modelling in the use of social media, and to contribute to an expanding network of veterinary related

329 Twitter users. The analysis aimed to investigate these aspects whilst remaining open to other benefits

330 or challenges of using social media in this way, in order to consider future developments for this

331 initiative and other similar teaching strategies.

332 **"Types" of learners engaging with social media**

333 The participant analysis shows that #VetFinals sessions have successfully engaged over 50 students

334 through active participation in exam preparation sessions, in part due to the novel nature of this type

335 of learning. With over 700 followers of the @VetFinals account, this is perhaps disappointing, although

336 similar to findings in other studies of social media use in teaching (Lin et al. 2013; Reames et al. 2015).

337 The qualitative analysis provides some clues as to why this may occur when using social media in

338 teaching.

339 The theme of protection and exposure suggests that students are very divided on this topic. The

340 number of followers compared to active participants suggests that potentially "shy" students are

341 following but not actively engaging with the sessions, for fear of publicly being incorrect. One potential

342 reason highlighted by the active students was that social media would not be attractive to shy people.

343 In comparison to introverts who usually prefer to learn in isolation, shy individuals tend to desire social

344 connections, but feel anxious about participating due to the potential for humiliation (Cain 2013). This

345 fits with the concept of following #VetFinals, but failing to post, through fears of being wrong, similar

346 to a classroom setting. Root Kustritz (2013) also indicated that being shy was a reason why veterinary

347 students did not post in a Facebook teaching tool. A notable exception in this study was one individual

348 who stated they would never speak up in class, but was happy to do so via Twitter. While several

349 studies have suggested that social media can promote engagement in shy people (Junco et al. 2011;

350 Tiernan 2014; Menkhoff et al. 2015), their participation was related to a formal course. It is possible

351 for #VetFinals to support shy people, especially through responding to wrong answers appropriately.

352 However, it is unlikely that social media will be a revision tool chosen by introverts, although the high

353 view rates of the Storify summaries suggest that this post-event format may suit a broader range of

354 learners. Shy and introverted students' participation in optional social media learning opportunities is

355 a complex issue which requires further study.

356 **Non participants**

357 The low number of active participants on average per session could be viewed as somewhat

358 disappointing, although it is of note that this number represents approximately 2% of UK final year

359 veterinary students. However, the effort of running these sessions is minimal, and the data strongly

360 points to the benefits of the sessions to non-participants, either via observing the sessions or utilising

361 the Storify records which were highly accessed. The focus groups demonstrated that some of the

362 participants previously watched prior to posting, and that non-participant peers accessed the Storify

363 records. These individuals are 'lurkers' (Nonnecke & Preece 2000), who may read and learn from posts

364 passively, but do not actively take part via posting. Reasons emerging in this study via peers include

365 disliking the pressure, lack of time and inconvenient timing, but the current study design did not access

366 lurkers, and it is therefore not possible to make further judgements on their behaviour. It is however

367 also likely that the cognitive load of fast Twitter chats is too much for some learners (Manca et al

368 2004).

369 **Peer learning and dealing with uncertainty**

370 #VetFinals aimed to provide an intercollegiate platform for exam preparation, and the facilitators

371 expected it to rely on peer learning as much as facilitator leadership. However, there were some

372 unexpected challenges associated with both the peer learning expectation and the use of facilitators

373 from different institutions.

374 There was evidence of both direct and indirect peer learning occurring during the sessions.

375 Interestingly, the challenges of peer learning in the context of social media use were remarkably

376 similar to those reported in face to face teaching sessions (Channon et al. 2016). Some students

377 enjoyed bouncing ideas off each other and showing their agreement with their peer's answers. Others

378 relished the competitive nature of Twitter and the recognition achieved from peers, similar to Dvorkin

379 Camiel et al.'s (2014) pharmacy students. However, some disliked the corrections some students

380 offered, and viewed this as "showing off". This is perhaps concerning, because correcting colleague's

381 potential mistakes is frequently a necessary part of being a professional, and fear of speaking up can

382 allow errors and subsequent negative patient outcomes to occur (Kobayashi et al. 2006; Oxtoby et al.

383 2015). In order to achieve accuracy in online discussions, it is suggested that a Twitter community with

384 a culture of correcting each other professionally should be encouraged (Choo et al. 2015), helping to

385 alleviate concerns around the accuracy of social media posts. Even those students who tweeted

386 corrections appreciated that this must be done with care, but this culture requires further facilitator

387 promotion and support (Kind et al 2013).

388 Recognising the high stakes of the examinations these students were preparing for, it perhaps not

389 surprising that some found learning about alternative case approaches from experts from different

390 veterinary schools stressful, and also doubted their peers' contributions. They preferred the expert to

391 sum up the conversation, echoing accounting students' lack of trust in the work of their peers on a

392 Twitter leaning support tool (Osgerby & Rush 2015). Receiving knowledge from (certain) experts and

393 a low tolerance for uncertainty is indicative of early stages of cognitive development (Horii 2007).

394 Veterinary students must however learn to cope with uncertainty and the lack of one right answer, as

395   this is a common occurrence faced by veterinarians in primary care practices (May 2015). Facilitators

396   of these sessions must be instructed to manage "wrong answers" appropriately (which failed to

397   happen in one example given by participants), appreciating that the sessions are about dialogue and

398   discussion. Teaching by humiliation is inappropriate in any setting (Stark 2003).

399   **Self-directed learning**

400   Twitter's promotion of a multi-way dialogue, as opposed to information transfer, fosters the ability

401   for students' self-directed learning. Evidence of this was seen via the 'asking a new question' code

402   which indicated a slight change in the direction of conversation. The sessions appeared to provide a

403   personalised learning experience despite their large group nature, helping students become confident

404   at posing questions, although some were still reluctant to interrupt the flow of the session, suggesting

405   a facilitator-prompted final question section. In contrast to Osgerby and Rush's (2015) findings, these

406   answers were clearly acknowledged as feedback, and importantly, timely feedback. The topics and

407   content identified students' weaknesses and allowed them to self-direct their future learning to assess

408   these areas, similar to medical students who received information tweets while on clerkships (Reames

409   et al. 2015).

410   **A community of professional Twitter users**

411   All focus group and interviewees reported following other participants (friends and those who

412   impressed them during the sessions) as well as the facilitators and veterinary organisations, suggesting

413   development of a community of practice of users allowing a type of situated learning to occur (Lave

414   & Wenger 1991). In the current era, a positive online profile and links to relevant colleagues can

415   provide several benefits including collaborations, acquisition of new skills (Choo et al. 2015) and job

416   opportunities, according to one participant. Following other veterinary users allowed students to role

417   model appropriate use of social media and understand what it could bring to future professional

418   development and there was no evidence of unprofessional Twitter use during the sessions similar to

419 previous studies (Cartledge et al. 2013; Mawdsley & Schafheutle 2015). Depending on the career they

420 choose, veterinarians, and healthcare physicians alike, may work in remote or isolated locations.

421 Isolation has been identified as a potential risk factor in veterinarian's emotional wellbeing and a

422 precursor to stress and suicide (Mellanby 2005). The creation of an online community of practice of

423 peers at similar professional stages may help to combat these negative emotions. Future work aims

424 to consider the growing network of #VetFinals participants through the use of social network analysis,

425 in order to map the emergence of the veterinary Twitter community of practice.

426 **Limitations**

427 Whilst the findings in this analysis are specific to this initiative, there is scope for generalisation across

428 similar uses of social media in the revision and group learning context.

429 The inability to consult "lurkers" restricted understanding of the whole #VetFinals community within

430 this analysis. The positive results of this study cannot therefore be generalised to the silent majority

431 of participants, and further research to clarify how lurkers benefitted through watching the sessions

432 or reading the Storify records would be valuable. Participant perception analysis is also limited; whilst

433 sampling aimed to involve a range of students, inevitably it may be that students with mainly positive

434 perceptions attended the discussions and interviews. It is quite likely that students who disliked or

435 were not active on #VetFinals may be have been reluctant to take part in face-to-face evaluations of

436 the initiative, despite invitations. This may have led to an overemphasis in the report on engaged

437 students' views. However, a range of perceptions (both negative and positive) was gathered and are

438 highlighted in this report.

439 The qualitative part of the study was also limited by student availability post-final examinations and

440 the relatively few active students. Both focus groups had numbers slightly below those recommended

441 (6-10 participants) (Stalmeijer et al 2004). However, through purposive sampling, it was ensured that

442 a range of the desired criteria (#VetFinals experience, year of study and gender) were met.

443   Although participant checking was logistically challenging and also limited, it was encouraging to

444   receive two positive responses, which help demonstrate the validity of the analysis.

445   This study only considers the usefulness of Twitter to UK students from two veterinary schools.

446   However, international users were present, and some generalisation to their perceptions is possible.

447   Further studies of international users would be useful. The authors hope that that findings from this

448   study will encourage teachers from countries where Twitter is not available to investigate other social

449   media tools, enhancing the learning experience for their students.

450   **Conclusion**

451   The use of social media in teaching should be considered in the same way as the adoption of any new

452   educational tool. It will not appeal to all learners, and the type of learning occurring should be closely

453   monitored. It was therefore important to perform this analysis and it provides helpful evidence for

454   the use of social media in the examination revision context.

455   The findings indicate that the use of Twitter and the #VetFinals teaching events have been beneficial

456   to the participating students in their final year examinations. Students engaged with the novelty of

457   the tool and relied heavily on the facilitator to lead the session at the right pace and in the right way,

458   with some evidence of peer learning. Unsurprisingly, motivation was based on upcoming assessments,

459   but the lasting legacy of understanding the professional use of social media for learning is interesting

460   and requires further evaluation. Whilst not all students will take part in this type of social media use,

461   related resources can still be utilised as an additional method of examination preparation, expanding

462   access across different learning approaches.

463   This analysis underlines the importance of the facilitator role in social media use. Faculty development

464   may be necessary to ensure the facilitator engages with individuals as well as the group, sets an

465   appropriate pace, deals with uncertainty appropriately, and role models supportive behaviour with

466   learners. These points will be added to the facilitator guidelines for this initiative, and it is suggested

467   they may be useful for other discussion based Twitter uses.

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471 **References**

472 Ala-Mutka K. 2009. Review of Learning in ICT-enabled Networks and Communities. Seville, Spain:

473 Institute for Profespective Technological Studies.

474 Braun V, Clarke V. 2006. Using thematic analysis in psychology. Qual Res Psychol. 3:77–101.

475 Cain S. 2013. Quiet: The Power of Introverts in a World That Can't Stop Talking. London, UK: Penguin

476 Books Limited.

477 Cartledge P, Miller M, Phillips B. 2013. The use of social-networking sites in medical education. Med

478 Teach. 35:847–857.

479 Channon SB, Davis RC, Goode NT, May SA. 2016. What makes a "good group"? Exploring the

480 characteristics and performance of undergraduate student groups. Adv Heal Sci Educ. Epub:08 April

481 2016.

482 Choo EK, Ranney ML, Chan TM, Trueger NS, Walsh AE, Tegtmeyer K, McNamara SO, Choi RY, Carroll

483 CL. 2015. Twitter as a tool for communication and knowledge exchange in academic medicine: A

484 guide for skeptics and novices. Med Teach. 37:411–6.

485 Creswell JW, Plano Clark V, Gutmann M, Hanson W. 2012. Advanced mides methods designs. In:

486 Tashakkori A, Teddlie C. Handbook of mixed methods research in the social and behavioural

487 sciences. Thousand Oaks California: Sage; p. 209-240.

488 Dale VHM, Kinnison T, Short N, May SA, Baillie S. 2011. Web 2.0 and the veterinary profession:

489 current trends and future implications for lifelong learning. Vet Rec. 169:467–467.

490 Dvorkin Camiel L, Goldman-Levine JD, Kostka-Rokosz MD, McCloskey WW. 2014. Twitter as a

491 medium for pharmacy students' personal learning network development. Curr Pharm Teach Learn.

492 6:463–470.

493   Forgie SE, Duff JP, Ross S. 2013. Twelve tips for using Twitter as a learning tool in medical education.

494   Med Teach. 35:8–14.

495   Gurbani C. 2014. How can Twitter support your studies? Student BMJ 22:g4129

496   Horii CV. 2007. Teaching insights from adult learning theory. J Vet Med Educ. 34:369–376.

497   Junco R, Elavsky CM, Heiberger G. 2013. Putting twitter to the test: Assessing outcomes for student

498   collaboration, engagement and success. Br J Educ Technol. 44:273–287.

499   Junco R, Heiberger G, Loken E. 2011. The effect of Twitter on college student engagement and

500   grades. J Comput Assist Learn. 27:119–132.

501   Kind T, Patel P, Lie D, Chretien K. 2013. Twelve tips for using social media as a medical educator.

502   Med Teach. 36:284-290.

503   Kobayashi H, Pian-Smith M, Sato M, Sawa R, Takeshita T, Raemer D. 2006. A cross-cultural survey of

504   residents' perceived barriers in questioning/challenging authority. Qual Saf Health Care. 15:277–83.

505   Kogan LR, Hellyer PW, Stewart SM, Dowers KL. 2015. Recruitment and Hiring Strategies of Private

506   Practitioners and Implications for Practice Management Training of Veterinary Students. J Vet Med

507   Educ. 42:97–106.

508   Lave J, Wenger E. 1991. Situated Learning. Legitimate peripheral participation. Cambridge, UK:

509   Cambridge University Press.

510   Lin M-FG, Hoffman ES, Borengasser C. 2013. Is Social Media Too Social for Class? A Case Study of

511   Twitter Use. TechTrends. 57:39–45.

512   Mason J. 2006. Mixing methods in a qualitatively driven way. Qual Res. 6:9-25.

513   Mawdsley A, Schafheutle EI. 2015. Using Facebook to support learning and exam preparation in a

514   final-year undergraduate pharmacy clinical therapeutics module. Curr Pharm Teach Learn. 7:869–

515   875.

516   May S. 2015. Towards a scholarship of primary health care. Vet Rec. 176:677–682.

517   Mellanby RJ. 2005. Incidence of suicide in the veterinary profession in England and Wales. Vet Rec.

518   157:415–417.

519   Menkhoff T, Chay YW, Bengtsson ML, Woodard CJ, Gan B. 2015. Incorporating microblogging

520   ("tweeting") in higher education: Lessons learnt in a knowledge management course. Comput

521   Human Behav. 51:1295–1302.

522   Nonnecke B, Preece J. 2000. Lurker demographics: Counting the silent. Proc CHI 2000. 2:73–80.

523   Osgerby J, Rush D. 2015. An exploratory case study examining undergraduate accounting students'

524   perceptions of using Twitter as a learning support tool. Int J Manag Educ. 13:337–348.

525   Oxtoby C, Ferguson E, White K, Mossop L. 2015. We need to talk about error: causes and types of

526   error in veterinary practice. Vet Rec. 177:438–438.

527   Reames BN, Sheetz KH, Englesbe MJ, Waits SA. 2015. Evaluating the Use of Twitter to Enhance the

528   Educational Experience of a Medical School Surgery Clerkship. J Surg Educ. 73:1–6.

529   Root Kustritz M V. 2013. Use of Facebook as a Teaching Tool in a Veterinary Communications

530   Course. J Vet Med Educ. 40:327–332.

531   Sandars J, Patel RS, Goh PS, Kokatailo PK, Lafferty N. 2015. The importance of educational theories

532   for facilitating learning when using technology in medical education. Med Teach. 37:1039–1042.

533   Siemens G. 2005. Connectivism: A learning theory for the digital age. Int J Instr Technol Distance

534   Learn. 2:3–9.

535   Stark P. 2003. Teaching and learning in the clinical setting: A qualitative study of the perceptions of

536   students. Med Educ. 37:975–982.

537   Stalmeijer RE, Mcnaughton N, Van Mook WNK. 2014. Using focus groups in medical education

538   research: AMEE Guide No. 91. Med Teach. 91:1–17.

539   Sterling M. 2015. Twitter in academic medicine. Med Teach. 38:428-428

540   Tiernan P. 2014. A study of the use of Twitter by students for lecture engagement and discussion.

541   Educ Inf Technol. 19:673–690.

542   Twitter: Using hashtags on Twitter [Internet]. 2016. Twitter [cited 2016 Nov 16]. Available from:

543   https://support.twitter.com/articles/49309

544   Wenger E. 1999. Communities of practice: Learning, meaning, and identity. Cambridge, UK:

545   Cambridge University Press.

546   Whiting M, Kinnison T, Mossop L. 2016. Teaching Tip: Developing an Intercollegiate Twitter Forum to

547   Improve Student Exam Study and Digital Professionalism. J Vet Med Educ. Epub n.d.

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550   Table 1. Average tweets per session according to author and content code

Facilitator			Students			
General Question/ Comment	Response to Student	Retweet	Response to Facilitator's Question	Response to Fellow Student	Asking a New Question	Retweet
48	17	1	71	8	5	0

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555   Table 2. Demographics of students participating in the evaluation

	Total participants	Year of study			Gender		Twitter use	
		3	4	5 (final)	M	F	Frequent	Infrequent
Focus group 1	5	-	1	4	2	3	4	1
Focus group 2	4	1	-	3	2	2	3	1
Interview 1	1	-	-	1	-	1	-	1
Interview 2	1	-	1	-	-	1	1	-

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