
Title	Preservice physical education teachers' perceptions of a flipped basketball course: Benefits, challenges, and recommendations
Author(s)	Koon Teck Koh, Chunxiao Li and Swarup Mukherjee
Source	<i>Journal of Teaching in Physical Education</i> , (2020)

Accepted author manuscript version reprinted, by permission, from *Journal of Teaching in Physical Education*. <https://doi.org/10.1123/jtpe.2019-0195> © 2020 Human Kinetics, Inc.

1 **Pre-service Physical Education Teachers' Perceptions of a Flipped Basketball Course:**
2 **Benefits, Challenges, and Recommendations**

3

4

5 Accepted on 12/09/2020 to be published at Journal of Teaching in Physical Education

6

7

8

9

Abstract

10 **Purpose:** Information and communication technologies can enable educators in the
11 development of innovative and contextually relevant approaches for the provision of
12 enhanced learning experiences. This study examined pre-service physical education teachers'
13 perceptions of a flipped learning basketball course in a physical education teacher education
14 (PETE) program. **Method:** Semi-structured interviews were conducted with eight pre-service
15 PE teachers (Female = 3; $M_{age} = 23.5$ years) who had completed the course. Interview data
16 were coded using inductive and deductive thematic analysis. **Results:** Six main themes were
17 identified **reflecting benefits, challenges, and recommendations of flipped learning:** (a)
18 facilitate student-centered learning, (b) promote self-directed learning, (c) encourage real-
19 world application, (d) insufficient avenues to assess understanding, (e) pre-class preparation
20 too time-consuming, and (f) modification of materials and structure. **Discussion/Conclusion:**
21 **Flipped learning can potentially enhance** pre-service PE teachers' motivation in learning and
22 increase active learning time in the sport-based courses in PETE. The identified challenges
23 and recommendations are valuable for PETE educators to effectively prepare and execute
24 flipped learning-based courses.

25 **Keywords:** physical education teacher education, pedagogy, inverted learning, instructional
26 method, basketball

27 **Pre-service Physical Education Teachers' Perceptions of a Flipped Basketball Course:**
28 **Benefits, Challenges, and Recommendations**

29 Physical education teacher education (PETE) programs aim to equip pre-service
30 teachers with the necessary skills and knowledge through enhancing their aptitudes and
31 experiences as 21st century learners (Krause, O'Neil, & Jones, 2019). Yet, in recent years,
32 PETE programs have been challenged to keep pace with the growing demands related to
33 technological innovations in schools (Gawrisch, Richards, & Killian, 2019). The integration
34 of technology as a pedagogical strategy to enhance students' learning is an important skill for
35 pre-service teachers (Gawrisch et al., 2019), and PETE faculties are increasingly working to
36 stream technology as a pedagogical tool into discipline-specific courses for physical
37 education (PE) pre-service teachers (Casey, Goodyear, & Armour, 2017; Krause et al., 2019).

38 The inverted or flipped learning (FL) approach was designed to empower students to
39 be accountable for their own learning. A common structure for FL involves students
40 acquiring content knowledge through technology-based platforms (e.g., watching online
41 videos) prior to in-class activities such as group discussions and debates (O'Flaherty &
42 Phillips, 2015). Such methods aim to leverage on students' pre-existing knowledge and
43 comprehension skills, thereby allowing teachers more time to focus on deeper discussions
44 and higher-order critical thinking during class time (Liu, McBride, Xiang, & Scarmardo-
45 Rhodes, 2018).

46 The use of FL in higher education can lead to enhanced learning outcomes,
47 pedagogical effectiveness, better time efficacy, enhanced engagement, and positive teacher-
48 student interactions (Akçayır & Akçayır, 2018). Several challenges are however associated
49 with the use of FL. For example, Wanner and Palmer (2015) found that some student
50 participants were unable to complete the pre-class assignment and there was a lack of
51 preparation guidelines out of class, which led to learning outcomes being compromised.

52 Furthermore, issues such as low-quality videos and inadequate technology competency may
53 add to the challenges of using FL (Moraros, Islam, Yu, Banow, & Schindelka, 2015). Lastly,
54 students may be concerned with the increased workload and feel anxious about the new
55 teaching approach (Porcaro, Jackson, McLaughlin, & O'Malley, 2016).

56 While FL is generating considerable interest in higher education (Akçayır & Akçayır,
57 2018), there is a relative dearth of evidence on use of FL in PETE (Kretschmann, 2015).
58 Authors suggest that studies on FL have mainly focused on investigating the development of
59 a learner's cognitive skills. However, this has limitations in meeting some of the unique
60 desired learning outcomes of PE. FL can be an effective pedagogical approach in support of
61 teachers in the teaching of PE, increase student physical activity time during lessons (Sargent
62 & Casey, 2020), and enhance students' motivation for learning in PE (Østerlie, 2018).

63 According to self-determination theory (SDT) (Deci & Ryan, 2000), students'
64 motivation for learning is enhanced within a social context that satisfies three basic
65 psychological needs: autonomy (the need to feel independent and be in personal control),
66 competence (the need to feel competent in completing an optimally challenging task), and
67 relatedness (the need to have a sense of belonging to a social group). The learning contexts
68 created by the FL approach (e.g., ownership of knowledge creation, active participation, and
69 peer interactions) tend to enhance students' autonomy, competence, and relatedness
70 (Abeysekara & Dawson, 2015). The need to examine the benefits of using FL approach with
71 empirical research is imperative (Abeysekera & Dawson, 2015) and SDT has the potential to
72 provide the theoretical bases for elucidation of the outcomes of using this approach.

73 As technology in education becomes more pervasive, teachers need to be equipped
74 with the relevant skills and knowledge to stay effective in their practice. According to Krause
75 and Lynch (2018), the PETE curriculum plays an important role in equipping future PE
76 teachers with the necessary ICT knowledge and competencies to better engage their students.

77 In fact, pre-service PE teachers preferred to learn more ICT-related topics in their training
78 curriculum (Tearle & Golder, 2008). Furthermore, introduction of ICT-based FL within
79 PETE programs may significantly influence pre-service PE teachers' attitudes and
80 competencies towards the use of ICT in their teaching practice (Koekoek, van der Mars, van
81 der Kamp, Walinga, & van Hilvoorde, 2018; Tou, Kee, Koh, Camiré, & Chow, 2020).
82 Indeed, Krause et al. (2019) argued that pre-service PE teachers should be exposed to
83 technology-related mastery experiences and social persuasion to develop competencies in
84 integrating ICT in the teaching of PE. However, a lack of exposure and education has been
85 identified as a barrier to integrate ICT into teaching practices (Tou et al., 2020).

86 A dearth of evidence on PE teachers' perceptions on FL-based courses presents a
87 strong rationale to investigate the practical realities of implementing FL (Sargent & Casey,
88 2020), and to understand the experiences of pre-service PE teachers undergoing FL during
89 PETE programs (Krause & Lynch, 2018). Hence, this study examined pre-service PE
90 teachers' perceptions of a FL basketball course in a PETE program. Specifically, this
91 qualitative research was guided by the following research questions: (a) what benefits are
92 perceived by pre-service PE teachers concerning their participation in FL lessons?, (b) what
93 challenges are perceived by pre-service PE teachers concerning their participation in FL
94 lessons?, and (c) what recommendations do pre-service PE teachers have to enhance
95 experiences in FL lessons?

96 **Method**

97 **Participants and Setting**

98 Twenty-one first year pre-service PE teachers attended the 12-week (24 hours)
99 basketball course within a two-year PETE diploma program. The course aimed to develop
100 pre-service PE teachers' skills, specialized content knowledge, and teaching strategies in
101 basketball. All the lessons were designed and delivered by the first author who has more than

102 15 years of basketball teaching experience at college-level and had prior experience using
103 ICT in teaching PE. The course lecturer and participants could access university-wide ICT
104 devices/platforms such as high-speed wireless internet connectivity, the Blackboard®
105 platform (i.e., the university’s online platform that comprises learning resources and a
106 discussion forum), tablets, and an interactive smart screen. At the end of the course, 11 out of
107 21 course participants were randomly selected for face-to-face interviews to generate
108 “insights and in-depth understanding of the topic of interest and information-rich data
109 (Patton, 2002, p. 230)”. Eight of them (female = 3; age: $M = 23.5$ years, $SD = 2.07$, range =
110 21 to 28 years) gave their consent to be interviewed.

111 **Course Design and Instruction**

112 For the purpose of this study, a formerly face-to-face basketball course (two credit
113 points, 24 contact hours) was redesigned to incorporate FL strategies before, during, and after
114 classes (see Table 1). The course was reconfigured for an equal duration of in-class and FL
115 time (10 contact hours each), with remaining four contact hours reserved for a summative
116 assessment.

117 _____

118 Insert Table 1 here

119 _____

120 **Pre-lesson.** Pre-lesson tasks of a FL lesson included watching instructional videos
121 and reading PowerPoint slides. Instructional videos were intentionally designed to be short
122 (i.e., less than one minute per clip), with concise task organization instructions and teaching
123 cues for skill learning. The FL lessons and instructional videos focused on both closed and
124 open skills such as passing and receiving, dribbling, and attacking concepts for 10 hours.
125 Another 10 hours were focused on complex skills and tactics during face-to-face lessons. The
126 PowerPoint slides contained information on lesson structure and learning materials (e.g.,

127 grouping arrangements, setting-up of practice area, and instructional video links for specific
128 skill practice). The learning materials were accessed via the university's online portal and
129 course participants were given the autonomy to learn at their own pace and convenience
130 (Abeysekera & Dawson, 2015). The estimated duration to complete the pre-lesson task was
131 between 15-20 minutes.

132 **During lesson.** A modified version of the Personalized System of Instruction (PSI)
133 model (Metzler, 2000) was used to enact the FL-based lessons to provide course participants
134 the opportunity to progress through a series of learning tasks at their own pace. This included
135 information on task presentation and structure, performance criteria, and error analyses
136 provided by the instructor. A typical FL-based lesson started with briefing course participants
137 on lesson objectives and related learning outcomes. Electronic tablets (one per four pre-
138 service teachers) were provided to course participants should they require access to learning
139 resources via the university's online portal. Subsequently, the participants were expected to
140 complete the tasks outlined in the PowerPoint slides. Learning activities were planned and
141 organized in a sequential and progressive manner. Course participants were given the
142 autonomy to progress at their own pace once they had accomplished the goal of the task. For
143 example, in a stationary chest pass activity, once the course participants achieved 20
144 successful passes with correct form (i.e. making reference to the teaching cues embedded in
145 the instructional videos), they independently progressed to a more complex task (e.g., lateral
146 movement using chest pass). The instructor acted as a facilitator (Goodyear & Dudley, 2015)
147 during the lesson and provided immediate feedback to the course participants by clarifying
148 misconceptions and encouraging higher-order thinking.

149 **Post-lesson.** Course participants were encouraged to use ICT tools such as
150 Blackboard and WhatsApp (a mobile messenger application), for learning engagement
151 beyond face-to-face lessons. The aim was to stimulate learning interest and enhance

152 pedagogical content knowledge through deeper discussions and reflections based on the
153 instructional content shared. For example, course participants were asked to reflect on their
154 learning experience in a FL environment and provide ideas to enhance their lessons if they
155 were to conduct these lessons for their students.

156 **Data Collection Procedures**

157 Prior to data collection, approval was granted by the university's Institutional Review
158 Board. The one-to-one interviews were conducted by the research associate in a quiet
159 environment and at a time convenient to the participants. A semi-structured interview guide
160 was created to gather information on the participants' perceptions of the flipped-based
161 basketball course. The participants were asked about: (a) their perceptions of the flipped-
162 based lessons on their learning (e.g., "In what ways do you think flipped-based lessons help
163 in your learning? "), (b) challenges faced (e.g., "Did you experience any difficulties or
164 challenges during the flipped-based lessons? "), and (c) recommendations on how the
165 flipped-based lessons could be improved (e.g., "In your opinion, what could be done to
166 reduce the challenges faced? "). All the interviews were conducted in English and audio
167 recorded. Each interview lasted for about 52 minutes. Interview recordings were transcribed
168 verbatim resulting in a 65-page document (A4 size, font 12, single spaced) for data analysis.

169 **Data Analysis**

170 The transcripts were analyzed using a reflexive thematic analysis approach, requiring
171 the researchers to be reflective and thoughtful in engaging with the data and making well-
172 reasoned decisions during the data analysis process (Braun & Clarke, 2019). **Data were**
173 **deductively (in reference to the research questions), and inductively (in reference to meanings**
174 **and codes organized to create the sub-themes) analyzed.** Specifically, the analytical approach
175 consisted of four steps. First, the research associate familiarized herself with the data and
176 made sense of it by scrutinizing the content of the transcripts several times. Second, the

177 research associate identified meaning of units (i.e., sentences or paragraphs) throughout the
178 text and labelled them according to what was expressed (e.g., “students take on more
179 responsibility for learning”). Third, codes with similar meanings were gathered to form sub-
180 themes using predominantly inductive analysis. For example, “peers’ help to clarify doubts”
181 was grouped under the subtheme of “promote cooperative learning that facilitates knowledge
182 consolidation”. Finally, the sub-themes were revisited and checked by the research associate
183 and the first author if they were coherently related to form a logical structure in relation to the
184 three research questions. This process reflects considerable analytic work created by the
185 researchers to ensure that the data were analyzed and interpreted appropriately (Braun &
186 Clarke, 2019).

187 **Validity and Quality Assurance**

188 A relativist approach was used to inform validity and determine quality of the present
189 study (Smith & McGannon, 2018). This approach uses an ongoing list of criteria that aligns
190 with the context and circumstances of a study. Among the key criteria applied in the present
191 study are the worthiness of the topic; the significant contribution of the study and rich rigor
192 (e.g., interviewing a sample of the FL group to generate data that was appropriate for the
193 purpose of the study). Other criteria also proved important such as the credibility through the
194 first author's familiarity with the FL group, as well as the rigorous analytical process
195 involving deliberation between the first author and the independent research associate.
196 Finally, coherence through ensuring that the purpose, methods, results, and discussion were
197 clearly presented, and underpinned by a strong theory (i.e., SDT) constitute the main criteria
198 for determining the quality of the present study. Evidence of validity and quality in the
199 present study are therefore in line with the contextual circumstances of the research.

200 **Results**

201 A total of 172 codes were categorized into six themes to answer the three research

202 questions. Relevant quotes from the transcripts were selected, interpreted, and presented to
203 support the identified themes. To ensure confidentiality and anonymity, pseudonyms were
204 used to distinguish the participants.

205 **Benefits of Using Flipped Learning Lessons**

206 Three themes were generated that reflected the benefits of using FL-based basketball
207 lessons in the PETE program: (a) facilitate student-centered learning, (b) promote self-
208 directed learning, and (c) encourage real-world application of ICT in teaching PE.

209 **Facilitate student-centered learning.** Under this theme, three sub-themes were
210 identified: (i) free up time during class for student-centered activities, (ii) cater to differential
211 learning needs of students, and (iii) promote cooperative learning that facilitates knowledge
212 consolidation.

213 *Free up time during class for student-centered activities.* Commonly beginning of
214 class activities focused on orienting students to the day's lesson; however, the FL reduced the
215 need for such an orientation and increased the time available for other learning
216 experiences. Charlotte shared that watching the instructional videos prior to the lessons
217 prepared them on what to expect from the lesson and this allowed more time for actual
218 practice compared to the traditional face-to-face lessons. The pre-class task familiarity
219 minimized the learning curve and maximized the active learning time during lessons.

220 The method [flipped approach] saves us a lot of time. During the lesson, all he [instructor]
221 needs to do is to tell us what we're going to do, and all we have to do is execute it. We
222 already have an idea [before the lesson] of what we're going to do, so, we are able to get on
223 the tasks quickly...we actually have more time to practice and play...(Charlotte)

224 Lucas agreed with this view and added that such a method would provide learners
225 additional time to practice and further explore the skill:

226 I think the videos allowed room for more student-initiated activities in class. For example,
227 when we are learning specific skill like a chest pass. If the learner has already understood how

228 to do it from watching the video before class, they only need to organize into groups and start
229 practicing during class. As a result, they are able to not only try out but also experiment with
230 it at their own pace in their respective groups.

231 *Cater to differential learning needs of students.* The multi-media and self-paced
232 tasks accommodated the varying needs of learners. Participants found the instructional videos
233 helpful in their learning through multiple modes of information delivery (e.g. visual, audio,
234 and verbal). In addition, the teaching cues in the videos broke down the basketball
235 movements into smaller components, allowing participants to pay attention to the key
236 elements of the technical skills. This led to a systematic and structured approach to develop
237 the required movement skills and competencies to accomplish the tasks successfully. This
238 was constructive and beneficial for both novice and experienced basketball participants.

239 Aiden said:

240 Some of us are visual learners, while others are more hands-on. So, prior to lessons we could
241 have a look at the motion of the basic skills [in the videos] and we can gather our collected
242 understanding to prepare for the lesson, especially for those who don't have prior experience.
243 So we know that how should our hands be, what should our legs do and we can see the full
244 motion [of the drills].

245 The instructional videos also provided freedom to progress at a pace that suited their learning
246 needs. Aiden said:

247 Some of us have a lot of experience [with basketball] while some of us have very little. If,
248 prior to lesson, we know what's going to happen and we know what we need to do for the
249 lesson, we can speed up the pace [of doing the drills] ourselves. For example, we may find
250 that we don't need much time for this segment [of the tasks] so we can have a shorter practice.

251 The flipped-based lessons allowed participants to review the instructional videos multiple
252 times. This led to a better awareness of the sequence and structure of the required movement

253 skills thus facilitating their learning experiences and promoting deeper appreciation for the
254 learned content. Ethan said:

255 I think it helps. If you don't get it, you can just replay it [the video] as compared to the
256 traditional method where you have to ask someone to demonstrate [the skills]. So, if you
257 don't get it, the person would have to keep demonstrating. I think ICT makes the skills more
258 accessible to us.

259 ***Promote cooperative learning that facilitates knowledge consolidation.*** The FL
260 approach led to a greater extent of cooperative and collaborative elements in learning. It
261 increased opportunities for purposeful social interaction among peers and facilitated
262 clarification of doubts. This consolidated their understanding of the learning materials they
263 had to internalize prior to the class. Accessibility to the videos prior to lessons also facilitated
264 the element of peer teaching outside the classroom environment. This was particularly helpful
265 to those with relatively low skill levels and game experience to expedite task progression and
266 enhance learning during lessons. Lucas provided an example to illustrate this point:

267 Before the lesson, some of us would watch the video together. So for example, my classmate
268 who has no basketball experience would watch it together with some of us that already know
269 the skills or strategies, for example, 3-on-2 or 2-on-1. So, during the lesson we would [be
270 ready to] execute the skills on the game play based on the comments given by the basketball
271 players [within the group] and they will guide us on how to do them [the drills].

272 Such interactions also made the learning process more cognitively stimulating and enjoyable:

273 We had fun because we can tap on each other's memory and try to recall how we were
274 supposed to follow the videos. Because we were supposed to do the same thing shown in the
275 video. Sometimes some of us weren't sure of how to do the drills shown in the video and we
276 would tap on each other's skills. (Olivia)

277 **Promote self-directed learning.** Among the key benefits of using FL-based
278 basketball lessons in the PETE program is the promotion of self-directed learning.

279 Participants reflected that instructional videos encouraged greater ownership of their own
280 learning, with some even taking the initiative to seek extra information from additional
281 resources before class. This suggests a proactive and purposeful enhancement in learning
282 behavior that led to both exploration and knowledge construction.

283 **Pre-class preparation transfers responsibility to students and encourages self-directed**
284 **learning.** The task of studying learning materials before classes encouraged independent and
285 proactive learning behavior which enhanced their learning. Olivia aptly explained how the
286 flipped classroom enhanced her learning, and led to better information retention:

287 I think that as a learner, it [the flipped-based lesson] promotes self-directed learning which
288 requires us to have the responsibility of finding out what exactly the skills are. If we didn't
289 understand [the skill] from the video, we have to search it on ourselves or go ask around....

290 We will be able to learn better because we are involved in the process of learning [and given
291 the responsibility] instead of having somebody give us the information.

292 **Exposure to learning materials before class allows space for knowledge exploration**
293 **and therefore becomes another context for self-directed learning to take place** With greater
294 flexibility of time outside the constraints of lesson schedules, the FL approach encouraged
295 some participants to explore pre-class materials and even research for more information to
296 address their doubts. **This has the effect of encouraging self-initiated knowledge exploration**
297 **but** also eased the transition of the pre-service PE teachers into the face-to-face lesson
298 through deeper learning of the materials before lessons. Minimizing students' unfamiliarity in
299 learning content facilitated comprehension and focused practice. Aiden explained how this
300 was useful:

301 If I don't have prior experience in basketball, I will not know that skill. Hence, before the
302 lesson I can practice on my own or find out how to do it, the concept behind it, or teaching
303 cues. So even before the lesson, I already know how to do it through watching the videos and
304 applying the teaching cues. When I go to the lesson, it will be easier and smoother.

305 **Encourage real-world application.** The use of ICT tools in the PETE basketball
306 class sparked the possibilities of real world application to future school physical education
307 teaching situations. Participants felt that the videos could be a useful resource for future
308 teaching and learning. As illustrated by Javier:

309 I felt that these ICT tools would be used more after the course. For example, when we go for
310 our teaching practicum or when we are posted out [to schools], we have the resources on
311 hand, and we can show them to the students. So, we would be able to use this method of
312 delivery on the students.

313 Participants felt that having to research and share additional basketball resources with
314 classmates allowed for accumulation of basketball resources for future reference. Alex shared
315 a specific example to illustrate this point:

316 I feel that searching additional basketball resources after lessons not just generating
317 resources for yourself, it also helped to enhance my collection of basketball resources
318 because we were told to share with our classmates...the exchange of resources helped to
319 build a library of resource where everyone can use for future teaching of this sport...it is
320 definitely helpful.

321 **Challenges Associated with Flipped Learning Lessons**

322 Two themes were generated that reflected the challenges faced by learners in the
323 flipped lessons: (a) insufficient avenues to assess understanding, and (b) students perceive
324 pre-class preparation to be time-consuming.

325 **Insufficient avenues to assess understanding.** Although the instructional videos
326 enabled participants to have a better understanding of the lesson content and learning
327 outcomes, limitations existed. Participants had doubts about the rationale of the skills
328 presented in the video and were not able to have them addressed prior to class:

329 I think sometimes the videos only explained how to execute the skills but they don't really
330 explain why you have to do certain actions. But for face-to-face, if the instructor tells you to

331 take a step further, he would explain that it [the action] would give you more strength and the
332 ball will travel further ... (Lucas)

333 Specifically, this challenge was a constraint for the participants in the application of
334 what they had learned in more complex game situations. Ethan said:

335 Some of my classmates, after watching the videos, only knew that what each [team] member
336 needed to do but they didn't know the reason behind it. We find it hard to use what we learnt
337 in game play. Maybe this is because the video did not explain why we need to do that.

338 Participants were often unsure if they were performing the practice correctly. This
339 challenge was particularly prevalent among participants with relatively less experience in
340 basketball: "during the flipped-based lessons where we were working in groups, we
341 sometimes did the drills wrongly as a group and we wouldn't know until the instructor
342 walked around and reached us" (Olivia).

343 Olivia also highlighted that since the FL-based lessons were **subject** to participants'
344 interpretation, there was a likelihood of inadvertent mistakes:

345 For flipped learning, it is mainly based on your own interpretation of how you are supposed to
346 follow the video; sometimes you don't trust the other groups, because you don't think they are
347 doing it right. So you would do what you think is right. But for face-to-face lessons, the
348 demonstration comes from the instructor, he was the one who told us exactly what to do,
349 instead of how we interpreted the video...

350 Enabling the learners to learn and progress at their own pace is a key benefit of
351 flipped-based learning. Allowing groups to proceed at their own pace however could be
352 challenging for the instructor to spot mistakes and give feedback to everyone at the same
353 time. Olivia highlighted the contrast in the kind of feedback provided between flipped-based
354 and traditional lessons:

355 ...I think most of the time the feedback is different. For example, the traditional lessons, if the
356 instructor sees a lot of people are doing the drills wrongly, he would gather everybody and

357 give feedback at one go. But for flipped-based lessons, every group is at different pace, so
358 we're not doing exactly the same thing at the same time. It makes it more difficult for him
359 [the instructor] to observe, so usually he would correct one group at a time.

360 Alex further attributed the important role played by the instructor in facilitating learning by
361 providing diverse feedback to each group or a particular learner. Owing to the nature of FL
362 where the task may differ, and learners are progressing at different pace, the role of the
363 instructor in facilitating knowledge through diverse feedback is important.

364 I think ICT-based lessons can facilitate what we're supposed to do and some details about
365 how the skills should be executed. However, during lessons, we are on our own most of the
366 times...sometimes it's like hitting a target in a dark – you don't really know what you're
367 doing or whether you are doing it right...so the role of the teacher is still very important –
368 knowing when to facilitate the discussion, getting students to share their knowledge, rather
369 than giving them the answers directly. These are important skills that the teacher needs to
370 master.

371 **Pre-class preparation too time-consuming.** Some participants shared that the FC
372 involved extensive pre-class preparation that was time-consuming. They highlighted
373 constraints in watching the videos provided due to heavy workload, school schedules, and the
374 time frame given to view them (i.e., two days prior to a lesson). This may be a barrier in
375 promoting self-directed learning through FL. Charlotte shared:

376 The instructor reminded everybody should watch the videos and read the materials before
377 lessons...but sometimes, some of us were just too busy with our school work and may not
378 have time to complete the tasks before class...the teaching approach gives responsibilities to
379 the learners, but whether they would like to set aside time to watch the video and learn or they

380 just forget about it, you have no control over them...time is an important factor to promote
381 this kind of learning.

382 Participants with less experience in basketball expressed that they had to spend more time
383 watching the videos repeatedly in order to comprehend the content. In particular, videos that
384 focused on complex concepts. Emma shared:

385 You need time to sit down and watch it [a video clip] and if we don't have prior knowledge
386 about it [basketball], you might need to watch the video a few times to get a full
387 understanding. For individual techniques, it is still not too bad because there are teaching cues
388 in the video. But when it comes to the more tactical strategy, we don't have an understanding
389 of why the players are doing what they do.

390 **Participants' Recommendations to Improve Flipped Learning Lessons**

391 Recommendations proposed by the pre-service teachers could be subsumed under the
392 main theme of "modification of materials and structure". These recommendations revolved
393 around modifications to pre-class materials and lesson structures to better support the FL's
394 aim in facilitating independent knowledge acquisition. In this regard, two sub-themes were
395 identified: (i) more comprehensive materials to facilitate self-directed learning, and (ii) lesson
396 structures that encourage reflection and application of learned content.

397 **Modification of materials and structure.** The videos used in the basketball class
398 provided a simple rationale and a demonstration of how the skill or task should correctly be
399 performed. Participants suggested that the videos should present both correct and incorrect
400 execution of the movement techniques and skills. Demonstrating common incorrect
401 executions in the video could facilitate improvement in the learners' understanding of the
402 learned skill as it creates greater awareness of inappropriate techniques. Hence, learning may

403 be enhanced when the task practice is perceived by the learner as more purposeful and
404 rewarding. Ethan elaborated on how this can help students learn better:

405 Students will know what to look out for if they got a wrong concept, as they would know
406 what is wrong. Instead of showing the correct way of doing it, maybe showing the wrong way
407 of doing it would be good.

408 Secondly, additional explanations of the rationale behind the skill learning would help
409 students to have an enhanced understanding. This would aid in more effective application of
410 learned skills to game play situations. Ethan provided this suggestion:

411 ...if the videos can include some possible scenarios where we can use the skill or strategy
412 then it will be better for our understanding. So perhaps there can be text boxes that explain
413 “we are doing this because of...” It would also be better if there are different scenarios. For
414 example in scenario A, how do we execute this skill set or strategy? Why do we use 3-on-2 or
415 2-on-1?

416 Other suggestions by the participants included greater emphasis on teaching cues in the
417 videos to which viewers should pay attention.

418 **Lesson structures that encourage reflection and application of learned content.**

419 The videos used in the basketball class were “one-off”, preparing students for a single day’s
420 lesson, rarely connecting with previous or subsequent learning. Complementary activities like
421 sequencing or continuity in the videos to enhance the element of progression and skill
422 transferability in learning were suggested by the participants to gain a deeper understanding
423 of the content shown in the videos. . Emma elaborated on the possible approach to implement
424 this suggestion:

425 We learned in our flipped-based lesson that the best way to use a video is when you have a
426 pre-video activity, followed by watching the video and then a post-video activity. The pre-
427 video activity will prepare you for what to look out for while the post-video activity is about
428 what you can transfer from the video. So you make meaning out of it...

429 To facilitate meaningful learning in flipped-based lessons, it is important for teachers to
430 design follow-up activities after watching the videos to reinforce the skill learned and how it
431 can be applied to teaching. This approach can promote deeper learning and facilitate transfer
432 of skill learned. Javier provided an example to illustrate this point:

433 For the videos, I think it required a bit of thinking after watching them...it's not very straight
434 forward likes telling you what you should do and when your opponent will act in certain
435 manners...so if you want to bring the skill to the next level such as using it in game
436 situations, the teacher needs to provide students with situation based video so that they can
437 better gauge what is the situation, and decide on when and how they are going to use this skill
438 in game situations.

439 **Discussion**

440 Echoing the call to use and research FL in higher education (Akçayır & Akçayır,
441 2018; Krause et al., 2019; O'Flaherty & Phillips, 2015), this study examined pre-service PE
442 teachers' perceptions of a FL basketball course in a PETE program. Congruent with findings
443 of previous studies, our results provide further evidence that incorporating a FL approach in
444 PETE facilitates student-centered and self-directed learning; two related and important
445 pedagogical approaches that are highly lauded and advocated by scholars in the educational
446 literature (Bergmann & Sam, 2012; Knowles, 1975). Furthermore, the practical issues related
447 to material and lesson structure highlighted by the pre-service PE teachers represent a
448 challenge that should be addressed in order to better support and optimize learning via FL.

449 Our results showed that the use of instructional videos in a FL lesson played an
450 important role in facilitating student-centered learning – catering to different learning needs
451 of students (Bergmann & Sam, 2012). This is in contrast to the traditional approach of
452 teaching sports courses that typically rely on instructors to deliver the content while students
453 passively listen at the expense of movement time (Killian, Graber, & Woods, 2016). The
454 present study provides corroborative evidence that the FL approach could be purposeful in

455 the context of PETE to allow more physically active time in instructional tasks (Goodyear &
456 Dudley, 2015; Sargent & Casey, 2020) and enhance specialized content knowledge
457 acquisition through explicit teaching during lessons (Ward, Tsuda, Dervent, & Devrilmez,
458 2018). This finding was reflective of the planned and structured approach of the FL process
459 and the supportive ICT environment that both stimulated and facilitated the pre-service PE
460 teachers to complete the pre-lesson tasks. These attributes of the FL-based pedagogical
461 planning also aided conceptual clarity, knowledge development and understanding that
462 eventually translated as time optimization during the lessons (Sargent & Casey, 2020).
463 Considering the limited curriculum time allocated to PE courses and challenges in achieving
464 optimum time for physical activity during lessons, the FL approach can therefore offer a
465 potential and purposeful pedagogical solution in PE teaching.

466 Another well-documented pedagogical approach supported by the flipped classroom
467 was self-directed learning. The phenomenon of self-directed learning involves the elements
468 of taking initiative, diagnosing one's learning needs, formulating goals, identifying human
469 and material resources, choosing and implementing appropriate learning strategies, and
470 evaluating learning outcomes (Knowles, 1975). This component was also realized in the
471 present study with many participants highlighting the benefits of being able to access the
472 online learning materials and given the autonomy to learn at their own pace, which to a
473 certain extent was perceived to enhance their learning experiences. The findings support the
474 existing literature that FL encourages students to take greater responsibility and initiative in
475 their learning (Østerlie, 2018; Strayer, 2012). This process of self-directed exploration
476 facilitates active knowledge construction among learners. In this study, while studying the
477 pre-class materials, some participants took the initiative to trial the learning activities or
478 search the Internet for gaining a better understanding of the topic. This reflected the students
479 actively overcame barriers associated with FL and appreciated the learning benefits of this

480 approach which encouraged deeper appreciation of learning materials through self-directed
481 learning.

482 According to SDT (Deci & Ryan, 2000), an individual's motivation to learn is
483 enhanced within a social context that satisfies their basic psychological needs. Our results
484 showed that the use of FL may facilitate intrinsic motivation to engage in learning activities
485 via satisfaction of autonomy and competence needs. The use of instructional videos provided
486 the participants with the choice to determine their pace of learning and encouraged self-
487 initiated learning (autonomy). The option to replay the videos multiple times facilitated their
488 progression through the lessons according to their own abilities (competence). This finding
489 also suggests that the routine of FL was acceptable to pre-service PE teachers, as they
490 became progressively familiar and comfortable.

491 Collaborative learning environments created by the flipped instructional approach can
492 satisfy the learners' need for relatedness. This was reflected by participants **who** watched the
493 pre-lesson videos together for preparing the group tasks. By so doing, a learning environment
494 for social interactions was created for enhancing participants' relatedness and collaboration
495 skills (Deci & Ryan, 2000; Strayer, 2012). Furthermore, the three basic psychological needs
496 are interactive in nature. For example, a learning environment that satisfies learners'
497 relatedness may also satisfy their need for competence. Indeed, participants in the present
498 study with less basketball knowledge often sought help and clarified doubts with their more
499 knowledgeable counterparts through cooperative learning. This process benefits the
500 knowledge-seekers in the aspect of improving conceptual and content clarity and peer
501 teachers' pedagogical skills in basketball (Ward et al., 2018).

502 The exposure to ICT tools appeared to influence attitudes towards technology-
503 enhanced teaching of participants in our study. Similar findings on FL experience better
504 informing participants' practices have also been reported in past studies (Koekoek et al.,

505 2018; Tou et al., 2020). Such exposure may promote behavioral intentions to integrate FL-
506 based components in future teaching. Previous research found that PE teachers' negative
507 perceptions towards ICT and perceived lack of competence in using ICT tools were major
508 barriers in integrating these tools in their teaching (Kretschmann, 2015; Tou et al., 2020).
509 Moreover, there is no established pedagogical approach for optimal ICT use in PE (Casey et
510 al., 2017; Koekoek et al., 2018). Our study suggests that using FL approach in PETE
511 programs may be a worthwhile pedagogical approach to enhance pre-service PE teachers'
512 attitudes towards its use PE lessons. Considering the strong emphasis by the Ministry of
513 Education towards the use of ICT for teaching in schools (Tou et al., 2020) and that PE
514 teachers are at the forefront of educational initiatives, it is crucial that PETE programs
515 prepare pre-service PE teachers adequately to meet the needs of young learners who live in a
516 digital world (Casey et al., 2017).

517 Owing to their potential benefits in teaching and learning, digital technologies and
518 technology-enabled pedagogies are increasingly accepted and adopted in mainstream higher
519 education. However, incorporating ICT may also lead to sub-satisfactory, negative, or even
520 detrimental learning experiences (Selwyn, 2016). Findings from the present study indicate
521 that while using ICT may benefit learners' attitudes, behaviors, and learning outcomes,
522 certain critical accounts of learners' perceptions and experiences on technology-enabled
523 learning should be specifically noted. In particular, practitioners should be mindful of the
524 potential challenges while planning and implementing FL-based sports lessons. FL also
525 presents open-ended experiences that create problems (e.g., doubts in knowledge) to be
526 solved (Bergman & Sam, 2012). Most of the challenges faced by the pre-service PE teachers
527 in this study were related to insufficient avenues to clarify their doubts. Firstly, while the
528 instructional videos were very helpful in providing practical examples for how lessons can be
529 conducted, participants were unable to clarify higher-order concepts such as the rationale of

530 the activities prior to class. For instance, participants with relatively less knowledge of
531 basketball found some of the concepts in the videos difficult to understand, increasing the
532 challenge to apply them in a real game situation. A recent systematic review also stated this
533 issue as one of the main challenges faced in flipped classrooms (Akçayır & Akçayır, 2018).
534 Although this experience may not be considered as diminished or detrimental, it does suggest
535 an element of perceived sub-satisfactory learning experience. Furthermore, results of the
536 present study suggest that while the learners might demonstrate high motivation levels,
537 adequate engagement, and reflections of self-directed learning related to the uploaded
538 content, they may not have the proclivity to make additional efforts to gain deeper insights on
539 the higher knowledge constructs of the content. Therefore, organizations and instructors need
540 to be aware of potential digital downsides in the form of certain perceived gaps in the content
541 knowledge leading to sub-optimal experiences (Selwyn, 2016). Collectively, our results
542 suggest that FL requires considerable planning, environmental and resource organization,
543 contextual clarity of the content, embedded explanations in the videos, and a clear sense of
544 theory-practice transferability of learning.

545 A second challenge identified was the substantial time needed by participants to study
546 the pre-lesson materials. According to Selwyn (2016), investment of additional time on
547 digital content can be a source of difficulty for the learners and adversely affect their comfort
548 levels of managing the logistical aspects of study and negotiating the social requirements of
549 student life. Therefore, concerns over “spending too much time” may underpin a downside of
550 using ICT. Results of the present study suggest that to promote and facilitate self-directed
551 learning using FL, instructors need to be cognizant that time is required for the learners to
552 adjust and transition from passive learners to active learners. In addition, these participants
553 perceived that the role of the instructor shifted from using direction instruction (i.e., teacher-
554 centered) to indirect instruction (i.e., student-centered). While this shift in perception is an

555 intended and desirable phenomenon in flipped classrooms (Krause et al., 2019; O'Flaherty &
556 Phillips, 2015), the change in role associated a student-centered pedagogical approach in FL
557 lessons can be challenging for the instructor. For example, participants perceived that it may
558 be difficult for the PETE instructor to spot mistakes and provide immediate feedback to the
559 class in flipped-based lessons. This contrasts with traditional PE classes where instructors
560 address the class as a whole on common or major mistakes observed. This may result in an
561 illusion that feedback-giving is more effective as more students are reached. However, the
562 content of the feedback given may be in fact more standardized and less targeted to the needs
563 and questions of individual students or groups unlike in FL. Targeted feedback-giving
564 becomes a more pronounced challenge for FL in the more dynamic PE setting where
565 instructors have to move around and attend to a group at any point in time when the learners
566 are at different stages of a learning task. Therefore, it is important for instructors to recognize
567 the shift in class dynamics and resultant student needs (e.g., diverse questions), therein
568 structuring classes (e.g., follow-up discussion and modes of clarification) and prepare
569 materials that can address these unique needs in FL.

570 **Implications for PETE Programs**

571 While the present study showed that FL can be an effective teaching strategy in PETE
572 and can have positive effects of students' learning motivations and behaviors, the findings
573 offer greater insights into several practical implications of adopting FL in PETE. Firstly, the
574 need to plan and provide clear and concise pre-class materials is evident when the
575 participants had to clarify their doubts due to lack of comprehension. Another consideration
576 may be to include multiple formative assessments (e.g., quizzes or physical skill
577 demonstration) based on the PSI model (Metzler, 2000). This will require instructors to
578 design self-paced learning content to allow flexibility and adaptability in learning and self-
579 evaluation for the learners. Knowing that all learners learn differently and at varied rates of

580 knowledge and skill acquisition, the PSI model allows for differences among learners.
581 Indeed, past studies indicated the model has the potential to increase learners' content
582 knowledge based on individual differences (Pritchard, Penix, Colquitt, & McCollum, 2012),
583 reduce the management and demonstration time during lesson, allow instructors to provide
584 high rate of individual feedback, and facilitate high rate of practice time for the learners
585 (Cregger & Metzler, 1992). Secondly, as the dynamics of FL settings differ from a traditional
586 one, educators should find novel, diverse, interactive and adaptable ways of feedback to
587 learners in a timely (e.g., during and after class) and effective (e.g., provide answers to
588 frequently asked questions online or social application platforms) manner. Thirdly, FL
589 approach helps teachers provide students with purposeful feedback. Such feedback also
590 serves to feed-forward into the after-lesson reflections and the preparedness for the
591 subsequent lesson. Therefore, to encourage deeper reflection and application of knowledge,
592 follow-up activities should be considered to allow students to clarify doubts and discuss
593 about transference of knowledge learned beyond lessons. In summary, successful and
594 effective implementation of FL in PETE programs will require significant planning, resource
595 preparedness and adequate mastery of both ICT and pedagogical skills (facilitate behaviors).

596 **Limitations and Future Research Directions**

597 A few limitations of the present study need to be acknowledged. First, qualitative data
598 were used to understand participants' perceptions of the FL-based lessons. Consequently, it is
599 improbable to quantify the associated benefits and challenges through measurable outcomes.
600 Future studies could use these qualitative interpretations and deductions to formulate
601 quantitative measures to assess the outcomes of FL in PETE. Second, the participants were a
602 small group of first-year pre-service PE, who were considered adult learners. Therefore, the
603 findings should be cautiously applied to other contexts where students are of different age
604 groups as their levels of cognition and needs are likely to differ. This is especially true for

605 flipped classrooms that often require a higher degree of self-monitoring and cognitive ability
606 which might pose a challenge for younger learners (Liu et al., 2018). Future studies should
607 also investigate the applicability and impact of the present study protocol in younger groups
608 such as secondary school students. Furthermore, longitudinal studies are needed to determine
609 the likelihood and extent of carry-over of ICT-based pedagogies from PETE programs to
610 schools.

611 **Conclusion**

612 The findings of the present study contribute to the currently scant literature on
613 discipline-specific technology integration in PETE (Casey & Sargent, 2020; Krause et al.,
614 2019). It can be concluded that implementing a FL approach in PETE was beneficial for
615 learning of specialized content knowledge, facilitating student-centered and self-directed
616 learning, and encouraging application of knowledge in real-world settings. Simultaneously
617 important challenges exist; especially if multiple pedagogical changes are made at once.
618 Notwithstanding, these changes may serve to enhance and evolve the pedagogical practices in
619 PETE programs and ultimately school PE.

620 **References**

- 621 Abeysekera, L., & Dawson, P. (2015). Motivation and cognitive load in the flipped
622 classroom: Definition, rationale and a call for research. *Higher Education Research &*
623 *Development, 34*(1), 1-14. doi:10.1080/07294360.2014.934336
- 624 Akçayır, G., & Akçayır, M. (2018). The flipped classroom: A review of its advantages and
625 challenges. *Computers & Education, 126*, 334-345.
626 doi:10.1016/j.compedu.2018.07.021
- 627 Bergman, J., & Sams, A. (2012). *Flip your classroom: Reach every student in every class*
628 *everyday*. Washington, DC: International Society for Technology in Education.
- 629 Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative*
630 *Research in Sport, Exercise and Health, 11*, 589-597.
631 doi:10.1080/2159676X.2019.1628806
- 632 Casey, A., Goodyear, V. A., & Armour, K. M. (2017). Rethinking the relationship between
633 pedagogy, technology and learning in health and physical education. *Sport, Education*
634 *and Society, 22*, 288-304. doi:10.1080/13573322.2016.1226792
- 635 Cregger, R., & Metzler, M. (1992). PSI for a college physical education basic instructional
636 program. *Educational Technology, 32*(8), 51-56.
- 637 Deci, E. L., & Ryan, R. M. (2000). The " what" and " why" of goal pursuits: Human needs and
638 the self-determination of behavior. *Psychological Inquiry, 11*, 227-268.
639 doi:10.1207/S15327965PLI1104_01
- 640 Gawrisch, K., Richards, K. A., & Killian, C. (2019). Integrating technology in physical
641 education teacher education: A socialization perspective. *Quest*.
642 doi:10.1080/00336297.2019.1685554
- 643 Goodyear, V., & Dudley, D. (2015). "I'm a facilitator of learning!" Understanding what
644 teachers and students do within student-centered physical education

- 645 models. *Quest*, 67, 274-289. doi:10.1080/00336297.2015.1051236
- 646 Liu, J., McBride, R. E., Xiang, P., & Scarmardo-Rhodes, M. (2018). Physical education pre-
647 service teachers' understanding, application, and development of critical
648 thinking. *Quest*, 70, 12-27. doi:10.1080/00336297.2017.1330218
- 649 Killian, C. M., Graber, K. C., & Woods, A. M. (2016). Flipped instructional model in
650 physical education. In Novak, D., Antala, B., & Knjaz, D. (Eds.), *Physical education
651 and new technologies* (pp. 102-111). Zagreb, Croatia: Croatian Kinesiology
652 Association.
- 653 Knowles, M. S. (1975). *Self-directed learning: A guide for learners and teachers*. New York:
654 Association Press.
- 655 Koekoek, J., van der Mars, H., van der Kamp, J., Walinga, W., & van Hilvoorde, I. (2018).
656 Aligning digital video technology with game pedagogy in physical education. *Journal
657 of Physical Education, Recreation & Dance*, 89(1), 12-22.
658 doi:10.1080/07303084.2017.1390504
- 659 Krause, J. M., & Lynch, B. M. (2018). Faculty and student perspectives of and experiences
660 with TPACK in PETE. *Curriculum Studies in Health and Physical Education*, 9(1),
661 58-75. doi:10.1080/25742981.2018.1429146
- 662 Krause, J. M., O'Neil, K., & Jones, E. (2019). Technology in physical education teacher
663 education: A call to action. *Quest*. doi:10.1080/00336297.2019.1685553
- 664 Kretschmann, R. (2015). Physical education teachers' subjective theories about integrating
665 information and communication technology (ICT) into physical education. *Turkish
666 Online Journal of Educational Technology-TOJET*, 14(1), 68-96.
- 667 Metzler, M. (2000). *Instructor's manual for the Personalized System Instruction series*.
668 Boston, MA: Allyn & Bacon.
- 669 Moraros, J., Islam, A., Yu, S., Banow, R., & Schindelka, B. (2015). Flipping for success:

- 670 Evaluating the effectiveness of a novel teaching approach in a graduate level
671 setting. *BMC Medical Education*, 15, 27. doi:10.1186/s12909-015-0317-2
- 672 O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A
673 scoping review. *The Internet and Higher Education*, 25, 85-95.
674 doi:10.1016/j.iheduc.2015.02.002
- 675 Østerlie, O. (2018). Can flipped learning enhance adolescents' motivation in physical
676 education? An intervention study. *Journal of Research in Arts and Sports Education*,
677 2(1), 1-15. doi:10.23865/jased.v2.916
- 678 Patton, M. Q. (2002). *Qualitative research & evaluation methods*. London: Sage Publications
679 Ltd.
- 680 Porcaro, P. A., Jackson, D. E., McLaughlin, P. M., & O'Malley, C. J. (2016). Curriculum
681 design of a flipped classroom to enhance hematology learning. *Journal of Science*
682 *Education and Technology*, 25, 345-357. doi:10.1007/s10956-015-9599-8
- 683 Pritchard, T., Penix, K., Colquitt, G., & McCollum, S. (2012). Effects of a weight training
684 personalized system of instruction course on fitness levels and knowledge. *Physical*
685 *Educator*, 69(4), 342-359.
- 686 Sargent, J., & Casey, A. (2020). Flipped learning, pedagogy and digital technology:
687 Establishing consistent practice to optimise lesson time. *European Physical*
688 *Education Review*, 26, 70-84. doi:10.1177/1356336X19826603.
- 689 Selwyn, N. (2016). Digital downsides: Exploring university students' negative engagements
690 with digital technology. *Teaching in Higher Education*, 21(8), 1006-1021.
691 doi:10.1080/13562517.2016.1213229
- 692 Smith, B., & McGannon, K. R. (2018). Developing rigor in qualitative research: Problems
693 and opportunities within sport and exercise psychology. *International Review of Sport*
694 *and Exercise Psychology*, 11(1), 101-121. doi:10.1080/1750984X.2017.1317357

- 695 Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation,
696 innovation and task orientation. *Learning Environments Research*, 15, 171-193.
697 doi:10.1007/s10984-012-9108-4
- 698 Tearle, P., & Golder, G. (2008). The use of ICT in the teaching and learning of physical
699 education in compulsory education: How do we prepare the workforce of the future?
700 *European Journal of Teacher Education*, 31, 55-72.
701 doi:10.1080/02619760701845016
- 702 Tou, N. X., Kee, Y. H. A., Koh, K. T., Camiré, M., & Chow, J. Y. (2020). Singapore
703 teachers' attitudes towards the use of information and communication technologies in
704 physical education. *European Physical Education Review*, 26, 481-494.
705 doi:10.1177/1356336X19869734
- 706 Wanner, T., & Palmer, E. (2015). Personalizing learning: Exploring student and teacher
707 perceptions about flexible learning and assessment in a flipped university
708 course. *Computers & Education*, 88, 354-369. doi:10.1016/j.compedu.2015.07.008
- 709 Ward, P., Tsuda, E., Dervent, F., & Devrilmez, E. (2018). Differences in the content
710 knowledge of those taught to teach and those taught to play. *Journal of Teaching in*
711 *Physical Education*, 37, 59-68. doi:10.1123/jtpe.2016-0196
712