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Start to Move: Measuring the Feasibility of a Teacher-Led Digital Fundamental Movement Skills Assessment Tool

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1 Start to Move (S2M): Measuring the feasibility of a teacher-led digital fundamental
2 movement skills assessment tool

3
4 Abstract

5 **Purpose:** This study evaluated the feasibility of the ‘Start to Move’ (S2M) digital
6 assessment of children’s fundamental movement skills being implemented by primary
7 school teachers within PE lessons. **Methods:** Nine primary school teachers in the
8 United Kingdom trialled S2M weekly over a 6-week period. Post-trial surveys and
9 interviews were used to ascertain responses.

10 **Results:** Feasibility was measured using seven dimensions of Bowen et al. (2009)
11 framework; acceptability, demand, implementation, practicality, adaptation, integration
12 and expansion. Acceptance and demand of S2M was high with participants feeling that
13 its contents aligned to the PE curriculum. Participants were able to implement S2M
14 within PE lesson times without assistance and stated that they would continue to use it
15 within their teaching. They felt S2M would enhance their teaching and would
16 recommend it to other teachers.

17 **Discussion/Conclusion:** S2M is feasible for primary teachers to implement within PE
18 lessons and has the potential to heighten the use of assessment for learning within PE in
19 primary schools.

20
21 Key words: Physical education, movement competence, measurement, primary school,
22 assessment for learning

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Start to Move (S2M): Measuring the feasibility of a teacher-led digital fundamental movement skills assessment tool

Fundamental movement skills (FMS) are developed and learnt movements that include stability (balance), object control, and locomotor skills (Goodway, Ozmun & Gallahue, 2019). Performing FMS underpins movement competence, which enables participation in sports (Barnett et al., 2016), and is positively associated with increased physical activity and health-related fitness in children (Holfelder & Schott, 2014; Robinson et al., 2015; Xin et al., 2020) and educational outcomes (Jaakola et al., 2015). A typically developing child has the requisite physical and psychological attributes to reach a maturational stage of FMS development by seven years of age (Goodway et al., 2019), with early-mid childhood (typically 4-7 years of age) being a critical period to develop competence in performing these skills (Payne & Isaacs, 2011).

It is recognised that primary (elementary) schools are ideal environments for children to learn and practise FMS (Morgan et al., 2013; Wick et al., 2017). Indeed, UNESCO (2015) states that FMS should feature within Physical Education (PE) curriculum as early as the first year of primary school and recent international guidelines and curricula for quality PE in primary schools emphasise the importance of young children developing competence in a broad range of FMS (Australian Curriculum Assessment and Reporting Authority [ACARA], 2015; Department for Education [DfE], 2013, European Physical Education Association, 2017; Society of Health and Physical Educators America, 2013). Specifically in the United Kingdom (UK), children aged 4-7 years should “be taught to master basic movements including running, jumping, throwing and catching, as well as developing balance, agility and

50 co-ordination” (DfE, 2013, p.2). Despite this, there is concerning evidence that some children
51 have low levels of FMS appropriate for their age in the UK (Morley et al., 2015; Jarvis et al.,
52 2018) and globally (Bolger et al., 2021).

53 Assessment within PE, specifically in the form of assessment for learning, is
54 recognised as a key mechanism to promote learning as the results provide teachers with
55 information to optimise instruction and practice (Dinan-Thompson & Penney, 2015;
56 Tolgfors, 2018). There is evidence from Robinson et al. (2015) to suggest that further
57 attention should be given to the assessment of children’s FMS in school to subsequently
58 enhance children’s learning and development of these skills. There is a plethora of FMS
59 assessment tools currently available, yet most of these are principally intended to be used in
60 clinical and/or research settings (Burton and Miller, 1998; Cools et al., 2009), rather than in
61 schools where additional factors (e.g., access to equipment; space and time constraints) can
62 impact the feasibility of teachers using these assessments (Bardid et al., 2019; Eddy et al.,
63 2020; Klingberg et al., 2019). In addition to the contextual challenges of implementing FMS
64 assessments within PE lessons, the specificity of these tools can also mean that training is
65 needed to accurately administer the assessment and a certain level of knowledge and
66 understanding of FMS is required to interpret the outcomes and to modify practice and
67 instruction (Logan et al., 2017) to facilitate learning of FMS. Whilst specialist PE teachers
68 might have the requisite knowledge and understanding to assess FMS, generalist primary
69 school teachers, who, in the UK, only receive approximately 6 hours of PE training during
70 Initial Teacher Training (Harris, Cale, & Musson, 2012), report that they lack the requisite
71 knowledge (Eddy et al., 2021; van Rossum et al., 2019) and confidence (Morgan & Bourke,
72 2008) to effectively implement FMS assessments without further support. These factors have
73 contributed to calls for an enhancement of FMS assessment tools that are informed by input

74 from teachers so that their requirements, such as instructional content, are met (Chan et al.,
75 2023; Lander et al. 2022).

76 Empowering primary school teachers to assess FMS is in line with current calls
77 within the UK for schools to identify and address gaps in FMS more quickly (Ofsted, 2023).
78 To facilitate the assessment of FMS in educational settings, school-based methods have been
79 developed in recent years for both generalist and specialist teachers of PE to use (Eddy et al.,
80 2021; Herrmann, Gerlach, & Seelig, 2015; Lander et al., 2016). The MOBAK (Hermann,
81 Gerlach & Seelig, 2015) is a product-oriented FMS assessment specifically to be used by
82 teachers containing eight skills (locomotor n=4, object control n=4) aligned to the PE
83 curriculum in Germany. The authors reported that there was a high level of acceptance of the
84 assessment by teachers. However, the methods used to collect and evaluate teachers'
85 acceptance were not reported, thus providing only a limited understanding of the suitability of
86 the assessment method for teachers. Based on fidelity observations of teachers delivering the
87 assessment, FUNmoves (Eddy, Preston et al, 2021) reports to be a feasible measure of FMS,
88 yet has limitations as it requires two members of staff to assess a class of children and has a
89 product-oriented assessment format, thus does not provide feedback to the teacher about the
90 quality of the movement. The Canadian Agility and Movement Skills Assessment (CAMSA)
91 is feasible, reliable and valid for use by secondary school teachers of Year 7 girls PE (Lander
92 et al., 2016; Lander et al., 2017). However, the feasibility and reliability of the protocol when
93 administered by non-specialist teachers of PE in primary schools has not yet been examined.
94 Furthermore, the CAMSA's method of assessment, allowing only one child to be active at a
95 time during the assessment process, poses a potential challenge for a primary teacher to
96 conduct the assessment whilst managing a class of children.

97 When assessing FMS, movement competence has typically been quantified using
98 standardised tools that measure specific features of a movement (Logan et al., 2017). For

99 example, product-oriented assessments (e.g. Athletic Skills Track; Hoeboer et al., 2018)
100 measure competency based on the accuracy of achieving certain outcome-goals (e.g., time
101 taken to complete a circuit of skills). Process-oriented assessments (e.g. TGMD-3; Ulrich,
102 2020) measure the accuracy of movement-production against pre-defined behavioural criteria
103 (e.g. two-handed catch = arms are extended and held in front of the body). This form of
104 assessment can be complex, yet it provides evaluative feedback on how the movement was
105 performed, akin to assessment for learning. A small number of assessment tools combine
106 product- and process- oriented scoring (e.g., CAMSA; Lander et al., 2016) to measure
107 movement competence.

108 Due to the limited time provided for PE within primary school timetables, and lack of
109 appropriate resources and training on FMS for primary school teachers, a tool to be used by
110 teachers to assess FMS should be simple and quick to administer and have the functionality
111 to help assess and inform teaching and learning of these skills (van Rossum et al., 2019).
112 Providing teachers with appropriate resources and tools that they can incorporate within their
113 curriculum delivery are likely to require planning and understanding of what is appropriate
114 for teachers (Tompsett et al., 2017). Consistent with previous work (Casey, Goodyear &
115 Armour, 2017; Graham, Holt-Hale & Parker, 2013) and our own recent work (van Rossum et
116 al., 2019) it is considered that an FMS assessment housed on a digital platform would be
117 favourable to teachers. This would allow information and instructions (e.g., video and audio)
118 to be integrated to help the user (i.e. teacher) access information to understand how to assess,
119 provide feedback from an assessment, and to provide instructions on how to enhance
120 children's learning of FMS (Lander et al., 2022).

121 To this end, the purpose of this study was to assess the feasibility of primary school
122 teachers using a new digital FMS assessment tool called 'Start to Move' (S2M) within PE
123 lessons to assess children aged 4 to 7 years old. This is an important step in the development

124 and expansion of S2M to be used in schools as the effectiveness of FMS assessment tools for
125 teachers is reduced if they are not feasible to use in the time and space afforded to PE in
126 school or require extensive training and specialist knowledge to administer them (Klingberg
127 et al., 2019).

128 **Methodology**

129 **Research design**

130 This study used a mixed-methods research approach to investigate the feasibility of
131 S2M being used by primary school teachers in PE lesson time. The principles of design-
132 based-research (Anderson and Shattuck, 2012) were drawn on to explore how well S2M
133 could be implemented and adopted in a PE lesson setting. For this reason, feasibility was
134 measured using a modified version of a framework proposed by Bowen et al. (2009)
135 consisting of seven dimensions of feasibility; acceptability, demand, implementation,
136 practicality, adaptation, integration and expansion (see Table 1 for further description). An
137 eighth dimension of feasibility, efficacy, will be the focus of a future study using a controlled
138 experimental research design. A convergent design (Cresswell & Plano Clark, 2018) was
139 used, in which data from surveys and semi-structured interviews were collected
140 independently at the same time and then brought together to provide a more complete
141 understanding of the teachers' perspectives and experiences of using S2M over a six-week
142 trial period. To converge the data, the findings have been integrated and reported in a joint
143 visual display (Guetterman, Fetters, & Creswell, 2015) constructed around the previously
144 mentioned dimensions of the modified feasibility framework (Bowen et al., 2009).

145

146 [Insert Table 1]

147

148 **Start to Move app**

149 S2M is housed within a digital app to be used on an Apple iPad tablet and contains 14
150 fundamental movement skills grouped within sub-categories of stability [4 skills], object
151 control [5 skills] and locomotor [5 skills] (see Figure 1 for complete list of skills contained
152 within the assessment). The steps taken to establish the arrangement of skills and format of
153 the assessment via consensus from teachers and academic and practitioner experts have
154 previously been reported (Morley et al., 2019; van Rossum et al., 2019; van Rossum et al.,
155 2021).

156

157 [Insert Figure 1]

158

159 In accord with Goodway et al. (2019) that FMS development is age-related, not age-
160 dependent, and following expert perspectives for the format of a teacher-led assessment of
161 FMS (van Rossum et al., 2021), within S2M, children's competence to perform each skill is
162 assessed on a continuum of development stages (emerging, developing and established). A
163 process-oriented scoring approach is used with the assessment framework for each skill
164 having been adapted from previous movement frameworks and development sequences. Each
165 skill has three aspects of observation (focused on head, arms, legs and/or body) providing the
166 teacher with a holistic perspective on how the movement is performed (See Table 2 for an
167 example of the assessment criteria).

168

169 [Insert Table 2]

170

171 van Rossum and Morley's (2018) practical principles for the development of digital
172 platforms for assessing children's movement informed the design and development of the

173 app. A demonstration of the skill to be assessed by the teacher is provided via the video
174 integrated within the app (See Figure 2 for examples of content). The skills in the assessment
175 require equipment that would typically be found in a school PE department (e.g. basketball,
176 tennis ball, gym mat) and space of no more than 8 x 5 metres is needed. The app contains
177 instructions for how to set up each skill to be assessed and the equipment needed
178 (see Figure 2) along with a library of 56 videos which provide a 10-20 second demonstration
179 of each skill being performed as well as examples of children at each of the three stages of
180 development. An advisory panel of five academics with expertise in assessing children's
181 FMS was used to determine the videos to include for each stage of development through
182 consensus agreement.

183 [Insert Figure 2]

184 **Participant sample and recruitment**

185 A purposeful sampling strategy (Creswell & Plano Clark, 2018) was employed to
186 recruit participants from a group who had contributed to a previous study (van Rossum et al.,
187 2019) that elicited teachers' perceptions of assessing FMS. The participant sample consisted
188 of six schools and nine teachers, with the following characteristics: gender (female, n=5,
189 male, n=4), length of teaching experience (Mean 10.4 years, SD = 7.1 years), teaching role
190 (PE specialist, n=3; Early Years Foundation Stage (EYFS) teacher = 1, Year 1 teacher = 1,
191 Year 2 teacher = 2), and school status (state, n=8; and independent, n=1). All schools were
192 located in England; five were in the North of the country, and one in the South-West. Ethical
193 approval for the study was obtained from the research ethics committee of Liverpool John
194 Moores University and informed consent was gained from each participant prior to the study
195 commencing. To protect their anonymity, participants have been given a pseudonym during
196 the reporting and discussion of the findings.

197

198 **S2M trial period**

199 Immediately prior to the commencement of the trial period, the lead author provided
200 one hour of training in each school to participants on how to set up the S2M app and
201 administer the assessment, which included instruction on how to access the assessment pages
202 for each activity, enter and view assessment scores, and record and playback video. At the
203 end of the training session, participants verbally confirmed that they understood how to use
204 the app and that they felt ready to begin the trials. Participants were given the contact details
205 of the lead author to discuss any questions or issues that they had using the app during the
206 trials. No communication was received during the trials.

207 Each participant trialled S2M for six weeks, spanning a half term in school, within
208 their timetabled PE lessons. Participants selected a half term period between February and
209 June to conduct the trials which would be most suitable for S2M to fit within their planned
210 PE learning programme and mitigated for interruptions such as holidays and events in school.
211 Participants were asked to use S2M in a minimum of one lesson per week (ranging from 45
212 minutes to 1 hour). The primary school PE curriculum in England provides a framework of
213 the learning content and standards that children should meet but schools and teachers have
214 the freedom to develop their own schemes of learning and configure the lesson content (DfE,
215 2013). Thus, no instruction was provided to participants on how to incorporate the S2M
216 assessment within their schemes of learning or how to practically implement the assessment
217 during the lessons. It was intended that providing teachers with the autonomy to decide how
218 to incorporate the S2M assessment within lessons would elicit greater insight of the potential
219 ways in which the resource could be used and highlight pedagogical issues that may arise.

220

221 **Measures**

222 *Surveys*

223 Upon completion of the trial period, each participant completed a survey to provide a
224 quantifiable and generalised perspective of their experiences of using S2M. The seven
225 feasibility dimensions described in Table 1 (Bowen et al., 2009) were used to frame the
226 scaled response questions to establish teachers' response to using S2M in PE lessons. The
227 survey contained 18 items, including introductory questions to gather process information
228 from the participant (e.g. class they teach and number of occasions that they administered
229 S2M) and scaled response statements such as; *The content of S2M was appropriate to the PE*
230 *curriculum at EYFS and Key Stage 1*. A Likert scale of 0-10 (0 = strongly disagree – 10 =
231 strongly agree) was used to capture responses.

232

233 *Semi-structured interviews*

234 Semi-structured interviews were used with each participant to explore their experiences of
235 implementing S2M (Berg, 2009). The interview schedule was constructed around the same
236 seven dimensions of feasibility (Bowen et al., 2009) that informed the survey design.
237 Individual interviews were offered, but due to time constraints in school, some participants
238 asked for group interviews to take place at lunch time. In total, four individual interviews
239 (ranging between 25-40 minutes) and two small group (group one n=2, group two n=3)
240 interviews (ranging between 36-37 minutes) were conducted at convenient times for the
241 participants during the school day. To reduce the risk of hierarchical factors impacting on the
242 data, the group interviews were conducted with staff who had the same role in school. To
243 encourage participation within the group interviews, participants were informed that they
244 were free to contribute at any point (Fontana & Frey, 2008) and the discussion was

245 moderated by the interviewer to mitigate a dominant voice taking over (Berg, 2009). All
246 interviews were conducted by the lead author within one week of the participants' trial
247 ending. The individual and one group interview were conducted face-to-face at the
248 participants' school and the other group interview was conducted via Skype video-
249 conferencing software due to the geographical distance between the school and the research
250 team.

251

252 **Data analysis**

253 The survey responses were analysed using standard descriptive statistics, collated and
254 tabulated to align with the seven dimensions of the modified version of Bowen et al. (2009)
255 feasibility framework (acceptability, demand, implementation, practicality, adaptation,
256 integration and expansion) (see Table 3). All interviews were digitally recorded, transcribed
257 verbatim and a deductive approach (Patton, 2002) was then used to systematically code each
258 transcript with quotes extracted and positioned within a qualitative thematic framework
259 (Braun & Clark, 2006) based on the same seven dimensions of Bowen's (2009) feasibility
260 framework. Upon completion of the initial analysis of each of the interview transcripts by the
261 lead author, the transcripts and coding table were shared with the authorship team to
262 reflexively consider (Smith & McGannon, 2018) the themes and corroborate the coding
263 patterns. During the analysis process, some quotes converged across multiple dimensions of
264 the feasibility framework. For example, some quotes were initially placed within both the
265 "implementation" and "practicality" dimensions. In these cases, the authorship team
266 discussed and agreed upon a position of 'best fit' for the results and the quotes were re-
267 positioned accordingly. This clarification of quotes allowed axial coding to be conducted
268 more accurately to avoid duplication and strengthen the connectedness with the data.

269 In accordance with the procedure of the convergent design (Creswell & Plano Clark,
270 2018), analysis of the findings from the surveys and interviews took place at the same time
271 and brought together so that the data could be combined and compared. During this process,
272 the findings of both methods were converged in a joint visual display (Guetterman et al.,
273 2015) involving a similar arrangement as used in a previous study in a related field (Morley
274 et al., 2018).

275

276

Results

277

278 Findings are represented within a joint visual display constructed upon the dimensions
279 of the modified feasibility framework (Bowen et al., 2009). Merging the data from the
280 surveys and interviews in this way is a hallmark of mixed-methods research (Morse, 2010)
281 and assisted in drawing new insights of teachers' experiences of using S2M to establish its
282 feasibility (Guetterman, Feters, & Creswell, 2015). Here, we 'show' the data and invite
283 readers to construct their own knowledge and explore the ways and extent to which these data
284 resonate with them (Smith, 2018), before we move onto the analytical 'tell' in the Discussion.

285

286 **Teachers' experiences and perspectives of using Start to Move**

287 [Insert Table 3]

288

Discussion

289 This study aimed to evaluate the feasibility of the S2M assessment tool, used across 6 weeks
290 by primary teachers in PE lessons. Overall, the experiences of specialist PE teachers and
291 generalist teachers, who identified as having not received specialist PE training, were
292 similarly positive. High levels of demand and acceptability for S2M were evident which is
293 reflective of the paucity of digital teacher-oriented FMS assessment tools and the

294 acknowledgment from teachers for the need for resources to support their use of assessment
295 of FMS (van Rossum et al., 2019). S2M provided teachers with a greater understanding of the
296 skills to assess and the level of detail required to observe and provide feedback for each skill.
297 This is important considering that primary school PE in the UK is typically delivered by
298 generalist teachers who cite a lack of confidence and understanding in the subject as a barrier
299 to assessing FMS more frequently (Eddy et al., 2021; van Rossum et al., 2018). The results of
300 the post-trial survey indicated that all but one teacher reported an increase in their confidence
301 in their ability to assess FMS. It is encouraging, that the one teacher who reported having the
302 lowest confidence in being able to assess FMS praised S2M for offering her the direction and
303 support that she had not had before to assess the FMS of her class of children.

304 With regards to implementation of S2M within lessons, almost all participants felt
305 they were able to administer the assessment within the lesson time and in the space they had
306 available, which are key indicators of the feasibility of FMS assessments for use in school
307 settings (Eddy et al., 2020; Klingberg et al., 2019). Traditionally, the assessment of children's
308 FMS has involved conducting measures in a clinical, engineered environment such as a
309 medical setting (Burton & Miller, 1998; Cools et al., 2009). These existing assessments
310 typically require the child to perform a variety of skills (ranging between 8 and 16 skills
311 depending on the assessment battery being used) in a circuitous manner whilst being
312 observed by the assessor, with little or no feedback given to the child during the assessment.
313 In recent years, Morley et al. (2019) proposed that in the context of a FMS assessment being
314 delivered by teachers, there is reason to consider assessing children performing skills in a
315 more natural, ecologically framed environment. Teachers involved in this present study had
316 the freedom to implement S2M within the lesson in a format that they wished. This meant,
317 for example, that the teacher could select a single skill, or multiple skills, to assess within a
318 lesson and provide feedback and instruction immediately, informing their pedagogy during

319 the lesson. Prior research has suggested that teacher-led FMS assessment tools should include
320 pedagogical content knowledge and instructional content (Lander et al., 2022), particularly if
321 intended for generalist teachers (Tompsett et al., 2017). The S2M app provides some
322 direction for use as the 14 skills are grouped within the sub-categories of FMS (stability,
323 object control and locomotor) and listed in the order that they should be learnt. Yet, in the
324 trials, the teachers had autonomy to create their own lesson plans and decide how to integrate
325 the assessment within their lesson. It could be suggested that allowing teachers to use their
326 own pedagogical awareness to integrate the assessment in ways that suited their children and
327 the environment they work within enabled a more authentic assessment environment that is
328 encouraged by Hay and Penney (2009). Empowering the teacher to implement more
329 authentic forms of assessment is recognised as a key mechanism to promote learning (Dinan-
330 Thompson & Penney, 2015; Tolgfors 2018) and has been shown to be an effective
331 pedagogical tool for secondary school teachers to assess FMS in lessons (O'Brien et al.,
332 2023). This autonomous approach offered by S2M for teachers to integrate the assessment
333 within their primary PE lessons differs to some other FMS assessments (Eddy, et al., 2021;
334 Hoeboer et al., 2018), that require a precise process to set up and administer the assessment
335 which limits one child being able to take part at one time. Thus, S2M could become a tool to
336 empower primary teachers to construct assessment practices with a more considered
337 pedagogical approach (Kim and Lee, 2021) which in turn could enable them to create more
338 supportive and impactful learning experiences for children to develop FMS. However, there
339 is risk that a lack of pedagogical instruction could negatively influence implementation of an
340 FMS assessment by teachers (Chan et al. 2023).

341 Drawing on the work of Scheuer et al. (2019) and Klingberg et al. (2019), the
342 implementation of an FMS assessment is seen as a key indicator of its feasibility for use by
343 teachers in lesson time. Thus, it is encouraging that almost all participants reported that they

344 could use S2M within their lesson without assistance. The responses from participants who
345 used S2M on a greater number of occasions demonstrated that they had greater confidence
346 using it within lessons, indicating that some brief, initial familiarisation of S2M is beneficial.
347 Specifically, participants drew attention to the time it took to become familiar with navigating
348 and using the assessment features on the digital platform. This emphasises the assertion that
349 digital literacy, that is possessing the knowledge and understanding to use digital technology
350 as is it intended (Greve et al., 2022), and technological pedagogical knowledge (Koekoek &
351 van Hilvoorde, 2018) are both critical factors to consider when establishing new digital
352 technology for use by teachers of PE. In this study, the experience of Vince exemplifies this
353 as he found that he initially felt that having the iPad in his hands was a distraction during the
354 lesson, yet, over a short period of time he was able to adjust his teaching to incorporate the
355 use of the app. To remedy this, further development of S2M is warranted to enhance
356 navigation within the app and include more tuition and guidance of how to interact with its
357 digital features.

358 Despite some distraction caused by the video content in the early use of S2M,
359 participants were able to use the embedded videos and felt this feature greatly supported their
360 understanding and expectations of how children should perform each movement task at each
361 stage of development. This has positive ramifications as the effects of FMS interventions
362 have been found to be stronger when delivered by more knowledgeable assessors (Tompsett
363 et al., 2017). It is noteworthy that the value of video recording and playback within S2M to
364 enhance feedback opportunities corroborates prior research (Chan et al., 2023). This is
365 suggestive that the functionality allowed by digital technology to integrate video
366 demonstrations and video recording features could be used as tools to better inform the
367 teacher, subsequently enhancing their knowledge, and could provide more meaningful results
368 in supporting children's development of FMS (Dinan-Thompson & Penney, 2015; Tolgfors,

369 2018). This is recognised by students who felt that use of digital technology in PE increased
370 their motivation and enhanced their learning (Wallace et al., 2023).

371 In relation to the feasibility dimension of adaptation, importantly, all participants
372 reported that the S2M assessment aligned with the primary PE curriculum (DfE, 2013),
373 which is considered essential for demonstrating curricular validity (Scheuer et al., 2019).
374 Furthermore, at the end of the trial period, teachers reported that S2M had increased their
375 confidence in assessing children's FMS and felt that it would enhance their teaching of FMS.
376 This is particularly significant as previous research has highlighted that low confidence has
377 limited primary teachers use of assessment in PE (Eddy et al., 2020; van Rossum et al.,
378 2018). Unlike other FMS assessment tools recently developed for use in primary schools
379 which have adopted product-oriented scoring (eg. Athletic Skills Track [Hoeboer, 2018]),
380 teachers reported that the process-oriented assessment scoring within S2M provided them
381 usable feedback in relation to the quality of the children's movement. This suggests that S2M
382 is well-suited for use in schools as research about best practises of assessment in PE (Ní
383 Chróinín & Cosgrave, 2013; Tolgfors, 2018) advocate assessment for learning being
384 integrated to enhance delivery and promote learning in teaching environments.

385 With regards to integration, the survey responses indicate that all participants would
386 recommend S2M to other teachers, suggesting that encouraging colleagues in school to adopt
387 the assessment would not be difficult. There is further promising evidence from a national
388 survey of primary teachers (Eddy et al., 2020) that reported that Senior Leaders in school
389 would be very supportive of teachers wanting to adopt FMS assessments within school.
390 Further responses provided in the interviews in this present study emphasise that adopting the
391 platform across the school would allow knowledge to be transferred between staff and for
392 parents to be given more detailed information about the progress of their child in PE. Thus,
393 drawing on the recommendations of Ma et al. (2021), the success of S2M to develop

394 children's FMS could be heightened if it was integrated across the whole school, enabling
395 progression of learning as children transition through school.

396 Whilst it is recognised in the UK that minimal training is provided in Physical
397 Education Teacher Education for generalist primary school teachers (Harris, Cale & Musson,
398 2012), there is a drive to provide more expansive and innovative Continuous Professional
399 Development (CPD) opportunities to develop primary teachers' PE confidence and subject
400 knowledge (Lander et al., 2022; Tannehill et al., 2020) and create digitally supported tools to
401 support their teaching (Morley et al., 2019). The responses from teachers using S2M indicate
402 that as well as being a suitable method of assessment, it is an instructional tool that can
403 directly develop teachers' knowledge and understanding of assessing FMS, and over time
404 could influence their pedagogical practise. Further integration of pedagogical content
405 knowledge is required to maximise the potential of assessment on digital platforms to
406 enhance teaching and learning (Chan et al. 2023). One participant suggested that S2M could
407 be used as a training tool to inform and enrich PE CPD delivered to other teachers in school.
408 These finding supports those of others who have suggested that teachers' professional
409 learning should move away from traditional forms of training (i.e. courses and manuals)
410 (Keay, Carse & Jess, 2018) and utilise opportunities presented by digital technology (Lander
411 et al., 2022). Thus, further consideration could focus on expanding S2M to include features
412 and activities to improve training opportunities and support teachers in developing their
413 curriculum and pedagogical knowledge.

414 Despite its contribution, the study does have limitations. Due to the relatively small
415 number of participants within this study, it is recognised that the findings are not
416 generalisable for all teachers. However, the depth of detail and understanding gained from the
417 perspectives of each participant and the lessons learned from each individual may be
418 applicable in a variety of situations (Bennett, 2010). In this respect, the findings provide

419 evidence from teachers of the feasibility of S2M, as well as highlight suitable
420 recommendations to make further improvements to S2M to meet the needs of teachers.

421

422 **Conclusions and implications for practice**

423 Overall, the in-depth perspectives and experiences of teachers using S2M reported
424 within this study add further clarification around the feasibility of a teacher-led FMS
425 assessment being used in primary school settings (Klingberg et al., 2019; Scheuer et al.,
426 2019). This study has demonstrated that S2M, a digital app based, process-oriented
427 assessment of FMS is feasible for teachers to use in primary school PE lessons. Furthermore,
428 it provides evidence to suggest that an FMS assessment utilising digital technology can be an
429 effective approach to support teachers (Lander et al. 2022). Although efficacy was not a
430 measured outcome of this study, findings suggest that S2M has potential to enhance the
431 teaching of FMS, thus further work is now warranted to measure its effectiveness over a
432 sustained intervention period.

433 To our knowledge, this is the first digital app-based FMS assessment that has been
434 designed specifically for primary school teachers to use in PE. Of particular significance,
435 these findings demonstrate that S2M can be administered by teachers with minimal
436 assessment training. As a result of using S2M over the trial period, teachers within this study
437 reported improvements in their understanding and awareness of assessing children's FMS
438 competence. Integrating the FMS assessment on a digital platform and enabling video content
439 to be provided, has shown in this study to increase teachers' confidence and perceived
440 understanding of what to assess. We recommend S2M and other digital FMS assessments
441 provide clear instruction of how to navigate and implement the assessment (i.e. support
442 pedagogical content knowledge) to enhance further enhance teaching and improve children's
443 FMS.

444 Overall, the findings of this study suggest that S2M has the potential to enhance the
445 use of assessment, specifically in the form of assessment for learning, within the teaching of
446 FMS within primary schools. In turn, this could strengthen primary teachers' ability to teach
447 and evaluate children's learning in line with PE national curriculum requirements. Positively
448 impacting on children's learning and development of FMS in this way may then help children
449 to break through the proficiency barrier (Seefeldt, 1980) during this critical period of their
450 physical development (Wick et al., 2017). Considering the positive association between FMS
451 competence and physical activity and health related fitness through childhood and
452 adolescence (Holfelder & Schott, 2014; Xin et al., 2020), S2M could therefore be a
453 successful mechanism for promoting physical activity levels of children and adolescence.

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664 **Table 1. Description of the modified version of the feasibility framework (adapted from**
 665 **Bowen et al., 2009).**

Dimension	Area of interest specific to the assessment of FMS	Resultant feasibility concepts relating to Start to Move
Demand	Estimated use or actual use of the assessment	Perceived demand, intent to use
Acceptability	How teachers react to the assessment	Satisfaction, reaction
Implementation	The extent and manner in which the assessment can be implemented as planned	Degree of execution, success or failure of execution
Practicality	The extent to which the assessment can be delivered within the constraints of the school setting (e.g. time and resources)	Factors affecting implementation, ease of use
Adaptation	Focuses on changing the assessment content or procedures to be appropriate	Degree to which similar outcomes are obtained in new format
Integration	Assesses how the assessment can fit within existing school structures	Intent to continue use, perceived fit within school, perceived sustainability
Expansion	Examines the potential use of the assessment to provide a different purpose	Broader benefits, alignment with school ethos/goals

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667 **Table 2. Assessment criteria for kicking a ball**

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	Emerging	Developing	Established
Feet	Feet remain stationary and kicking foot reaches for the ball	Approaches ball with small step forwards	Large step (or leap) forwards to place non-kicking foot next to or just behind the ball
Legs	Limited leg backswing and/or follow through	Leg bends at the knee and then extends to kick ball	Hips extend to begin kicking action Kicking leg bends during backswing and extends as ball is kicked
Arms	Arms held by sides No swing of arms	Small amount of arm swing	Arms are held out to sides and swing in opposition to legs

Table 3. An integrated joint visual display of teachers' experiences and perspectives of using Start to Move

Theme	Survey	Interview data
Demand (Estimated use or actual use of the assessment)	8 of 9 participants agreed that they felt confident in their ability to assess children's FMS. 5 participants strongly agreed with this statement Linda gave a neutral response, indicating she was neither confident nor unconfident.	<p>"As a non-specialist in PE I think this is good for those who want a bit more direction in what you're doing. I've been teaching a long time but it's still not my area of expertise, but I think this does focus you in on it." <i>Linda</i></p> <p>"I think it would be really powerful because as they've gone away from levels across the board in schools, they are at power to assess how they like, I think just something like that almost gives ownership to schools doing it their own way" <i>Jose</i></p> <p>"I think that'll help with that as some do think they are perfect, but at least when it's a piece of writing you can show them where they've gone wrong, but in PE actually it's very hard to show them where they need to improve, but the video will do that." <i>Zoe</i></p> <p>"I think the app will help to get teachers thinking more about skills rather than games. It's getting people away from thinking what they're teaching and instead focus on how they're teaching it. And I think that's where PE lacks and the app will help" <i>Louise</i></p>
Acceptability (How teachers react to the assessment)	<p>All participants agreed that the data generated in S2M helped them to better understand children's FMS. 6 participants strongly agreed with this statement.</p> <p>All participants agreed that S2M engaged students during the PE lessons. 5 participants agreed strongly with this statement.</p>	<p>"It's [S2M] given me a better understanding of how in-depth I need to go at teaching the skills" <i>Lisa</i></p> <p>"The visualness [sic.] of it is really good and then obviously [the children] can watch themselves played back as well so there was a bit of a wow factor for the kids as well. So it's not just us standing there with an iPad, I found it very engaging for them as well, which was nice." <i>Jenny</i></p> <p>"The videos and the photos helped, they were a prompt and made me think of different things that I wouldn't have normally looked for in the skills. Rather than just looking at the obvious things, it was like the time on the balances and things as well." <i>Louise</i></p> <p>"The children enjoyed watching the demonstration videos and then assessing themselves from it. Ours are only very young but it was a really good skill to learn." <i>Jenny</i></p> <p>"It's definitely increased my knowledge and confidence in my ability to judge, so before I didn't know what level to assess children for balancing, but now with the app I've got more knowledge on saying if they're a beginner and what they should do to improve. It's built my confidence on that side of knowing the different levels on different topics." <i>Vince</i></p> <p>"When it came to the throwing I was able to give them those descriptions from the app. That was my main teaching points, which I hadn't used previously when we first started doing it. So that just gave me three easy bits of criteria to use with them, they could understand as well." <i>Rick</i></p>

		<p>“You saw Lisa, she’s not the most engaged child in PE, but she wanted to be involved and she loved the video and I think for some children it helps to draw them in a bit more, and keep them focused and on task. It doesn’t work for all of them, but some of them it did.” <i>Jenny</i></p>
<p>Implementation (The extent and manner in which the assessment can be implemented as planned)</p>	<p>8 participants felt that they could administer S2M within PE lessons without assistance. 1 participant (Linda), gave a neutral response.</p> <p>8 participants strongly disagreed that the video was a distraction within S2M. 1 participant gave a neutral response.</p> <p>All participants agreed that they could understand the data generated within the app, with 7 participants strongly agreeing with this statement.</p> <p>7 participants felt that they could integrate S2M into their lessons without disrupting children’s learning. Of these, 4 participants strongly agreed with the statement. 2 other participants (Jenny and Linda) gave a neutral response to this statement.</p>	<p>“They were working in small groups. It enabled me to see each child work at that particular station because they were moving around 8 different stations looking at different skills so when they got to my station, I was there with the iPad and I was able to video them.” <i>Rick</i></p> <p>“We looked at what the lesson intention was and then we looked to put the app into that, so for instance when it was our balance, it was easy because we could use the one legged balance and we’d set up three groups and we’d have an assessment group and then the other two groups would be doing an activity in and around balancing so then all of a sudden you have three groups and then you just keep on rotating so that everyone is having a go at all three different ones.” <i>Neil</i></p> <p>“They might do it twice and I’ll look at the arms and legs then I’d get them to go again and do the next one. It sort of worked as well but obviously with a class of 30 it was quite hard.” <i>Vince</i></p> <p>“To be honest it was quite hard at first, because trying to have the tablet in your hand and then you’re trying to score as well as teach. Whereas myself, I like to use my hand when I’m teaching PE and I like to move around, be a bit crazy. And I think it sort of stopped the way I teach, but at the same time it was still useful, so it helped me with getting, like, pointing out like “she’s done it well” and getting the points that what she’s doing right and what she’s doing wrong and the videos actually show this is how you’re supposed to do it and things like that” <i>Vince</i></p> <p>“I use the videos in the lesson now as well, so instead of me showing them I try to use a different way of doing it, so getting it on the board and trying to get different ways of doing it.” <i>Vince</i></p> <p>“I love the three clips of the development stages. I’ve still not got that in my mind and even if I’ve got it on paper, I’ve gone with that, I’ve judged them on those stages.” <i>Zoe</i></p> <p>“Instead of changing my lessons around the assessment, I added the assessment into what I was already going to do because my PE lessons are quite free flowing anyway.” <i>Louise</i></p>
<p>Practicality</p>	<p>5 participants strongly agreed that the MAT can</p>	<p>“The simplicity is great as it doesn’t take a long time to show them how to do it and for them to have a go with it.” <i>Jose</i></p>

(The extent to which the assessment can be delivered within the constraints of the school setting [e.g. time and resources])	be conducted within PE lesson time, 3 participants agreed that S2M can be conducted in lesson time	<p>“The only downside to that obviously it is a little bit more time consuming, but again, the more competent we become with it, the quicker we’ll be able to do things. I found I was having to wait as I was having to go back into a page to find video, or to take video.” <i>Zoe</i></p> <p>“Once we get it working regularly, then we can come to it and get more proficient at using it and more confident at using it, because I still feel a little bit unsure with it.” <i>Linda</i></p> <p>“I think the scoring took too long because you’re trying to do your scoring as they’re getting bored, trying to wait for you to get all your scoring down, so I think shorten the things or putting them in bullet points all together.” <i>Vince</i></p> <p>“The videos are really, really good and some of the explanations were good, some were a bit interesting but the only thing I didn’t like was you couldn’t click quickly on them to say where there are, it’s a long process to go through on each one.” <i>Neil</i></p>
Adaptation (Focuses on changing the assessment content or procedures to be appropriate)	All 9 participants strongly disagreed that the content of S2M is inappropriate for to the PE curriculum at EYFS and Key Stage 1, indicating that teachers believe the content of S2M to be highly suitable for children aged 4-7 years old.	<p>“We’ve basically been applying it to the core curriculum areas, so for striking and fielding games, we’ve broken it down into the fundamental skills you’d need to be successful at striking and fielding and then just a brief description of how that skill would look, for emerging, developing or established.” <i>Jose</i></p> <p>“I think the Key Stage 1 team found that there wasn’t enough challenge with some of the skills. That they found a lot of the children could master those skills quite easily.” <i>Louise</i></p> <p>“It’s made me think about the finer details of skills, like I think before I would just see the big picture and I wasn’t focused on the smaller things, unless they were really obvious. So it’s made me think about all the aspects of the skills and not just the skill as a whole part.” <i>Zoe</i></p> <p>“I think it will make your teaching a lot more focused and I think it will make your teaching better.” <i>Louise</i></p>
Integration (Assesses how the assessment can fit within existing school structures)	<p>7 participants strongly agreed with the statement that they will continue incorporate S2M within PE lessons, 1 participant agreed with this statement, and 1 participant gave a neutral response.</p> <p>All 9 participants would recommend S2M to other primary school teachers. Of these, 7 participants,</p>	<p>“The way I see this being used is the more we introduce it into schools, is most of this being done in reception and then building up the children’s portfolio’s in reception, and when they come to us [year 1] we’re then going through and can cherry pick as not all the children are going to be starting off from day 1, so we’re going to be able to look at that and decide who’s going to need to do ABC - the children who haven’t got great co-ordination skills – so I’ve been using it and starting from scratch,” <i>Jenny</i></p> <p>“We’ve developed a new PE scheme, the ABC scheme that we introduced, we’ll now be able to build this into it.” <i>Jenny</i></p> <p>“I’d try and get a slot at a staff meeting because we’re looking at assessment through the school as well in terms of how they get measured in other areas so obviously they have other tests which are similar to SATs.” <i>Rick</i></p>

	strongly agreed with the statement.	<p>“I really like the transferability of it, so if I was ever to teach another class I could pick that up and use it even if I don’t know the children very well, I could go down to reception to teach a PE lesson and know how to use it” <i>Jenny</i></p> <p>“Showing the parents the assessment that we use. Because they won’t know anything about it and they’ll go “wow, this is really good, what else are you doing?” <i>Neil</i></p>
Expansion (Examines the potential use of the assessment to provide a different purpose)	<p>All teachers felt that S2M had increased their confidence in assessing children’ FMS. Of these, 4 participants strongly agreed that S2M had increased their confidence.</p> <p>All participants felt that S2M would enhance their teaching of FMS. 6 participants strongly agreed with this statement.</p>	<p>“I’ve used it when I support in other schools with their PE curriculum or physical literacy programs to upskill them in what movements look like. So it’s been quite handy from a CPD delivery angle as well as it’s enabled me to work in a different angle with subject leaders or school leaders and kind of demonstrated to them within the physical literacy side of things to look at the different competencies of movements. They think it’s brilliant and can’t wait to get it when it comes out.” <i>Jose</i></p> <p>“That’s really useful for non-PE specialists more than anything. Because you know they’re [child] is not quite right, but you don’t know how to help it not be right.” <i>Zoe</i></p> <p>“For the teachers that don’t teach PE, if they were to video and have that evidence it would be good to have activities within the app to help them know what they should be doing.” <i>Lisa</i></p> <p>“I’ve changed the words on the PE bit in my report to reflect their agility, balance and co-ordination and talk about how they’ve become more aware of their own body and how to use their bodies more. Which I don’t think we would have done before without using something like this [the app].” <i>Jenny</i></p>

Figure captions

Figure 1. Skills contained within the Start to Move assessment

Figure 2. Example of Start to Move on screen assessment content and information and content