

Practice architectures and sustainable curriculum renewal

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1 **Abstract**

2 While there are numerous pedagogical innovations and varying forms of professional
3 learning to support change, teachers rarely move beyond the initial implementation of
4 new ideas and policies and few innovations reach the institutionalised stage. Building
5 on both site ontologies and situated learning in communities of practice perspectives,
6 this paper explores the theory of practice architectures to offer a different and
7 legitimate perspective on sustainable curriculum renewal. Specifically, a practice
8 architecture either enables or constrains particular practice and constitutes the
9 construction of practice from semantic (e.g. language), social (e.g. power relations),
10 and physical (e.g. materials) spaces. Through the juxtaposition of practice
11 architectures with an empirical illustration of longer-term pedagogical change, the
12 paper argues that for pedagogical change to be sustained a practice architecture that
13 relates to an innovation's intended learning outcomes and the contexts in which an
14 innovation can be used needs to be created. Consequently, the theory of practice
15 architectures can guide reform programmes. Curricularists can begin programmes
16 with a pre-planned approach to assist, a) teachers' understanding of how to use an
17 innovation, and b) the deconstruction and reconstruction of practice architectures to
18 support an innovation's survival.

19 *Keywords: pedagogy, curriculum renewal, pedagogical approaches, practice*
20 *architecture*

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23

24 **Introduction**

25 Technological innovation, economic crises, environmental and climate changes, and a
26 whole host of other factors will continue to transform the types of knowledge and
27 skills required in society (Apple 2014, Evans *et al.* 2008, Kemmis *et al.* 2014).
28 Consequently, the pressures and expectations on schools and teachers to renew their
29 practices and keep pace with the sheer reach of change is enormous (Ball 2013, Evans
30 *et al.* 2008, Moore *et al.* 2002). Certainly, and using the context of the last three
31 decades of state funded education in England as an example, education is caught in a
32 cycle of innovation upon innovation with schools expected to continuously embed
33 new approaches, policies, methods, and ideas (Ball 2013, Brown *et al.* 2000, Evans *et*
34 *al.* 2008, Moore *et al.* 2002). The dangers of near-constant innovation are overload
35 and teacher burnout that, in turn, result in little more than pseudo-innovation without
36 noticeable change to curricular practices (Ball 2013, Fullan 2013, Hargreaves and
37 Goodson 2006, Sahlberg 2011, Wallace and Priestley 2011). Consequently, teachers
38 rarely move beyond initial implementation, and very few innovations ever reach the
39 institutionalised stage (Fullan 2013, 2007, Hargreaves and Goodson 2006, Macdonald
40 2003). Fundamentally, an enduring problem that faces education is a lack of
41 transformative and yet sustainable curriculum change.

42 Macdonald (2003) posited that conventional ways of thinking about
43 curriculum innovation, ‘top-down’, ‘bottom-up’, and ‘partnership’ approaches, have
44 not been helpful in assisting curriculum researchers and developers meet the
45 challenges of near-constant curriculum reform, and therefore, we need to consider
46 other perspectives. The purpose of this paper is to examine the theory of practice
47 architectures and its usefulness for thinking differently about how we might sustain
48 curriculum renewal. Consequently, this paper draws on Kemmis and colleagues’

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49 conceptualisation of practice architectures (cf. Kemmis *et al.* 2014) to explore how
50 this practice theory provides a new perspective on sustainable curriculum renewal.
51 Although this paper is not primarily an empirical study, we explore the concept and
52 further explain and present this theory by using an empirical illustration of longer-
53 term pedagogical change. This empirical illustration (which is taken from work in a
54 UK secondary school) allows the theory to be contextualized with longer-term change
55 and juxtaposed with sustainable curriculum renewal.

56 Though practice architectures is a ‘new view of practice’ (Kemmis *et al.* 2014:
57 3) and has scope and potential to provide a different perspective on curriculum
58 change, the current application of the theory to empirical data on change is limited.
59 While Kemmis and colleagues have suggested that practice architectures transform
60 over time, shaping and re-shaping practice, empirical examples to date have been
61 mostly used to explain the theory and to interpret school and classroom practices.
62 Furthermore, such understandings are predominantly associated within Kemmis and
63 colleagues’ work in New South Wales and Queensland, Australia (Kemmis 2012,
64 Kemmis *et al.* 2014) and haven’t therefore been applied outside Australia. We only
65 have a limited sense of how the theory can be applied to different educational
66 contexts and how it can be used to inform educational judgements about pedagogical
67 change. By using practice architectures to explain longer-term change this paper aims
68 to make recommendations regarding how curricularists could think differently about
69 sustainable curriculum renewal. The research question guiding this paper is, ‘*how*
70 *can the theory of practice architectures be used to guide our thinking about*
71 *sustainable curriculum renewal?*’

72 The next section of this paper discusses the theory of practice architectures. In
73 this section we show how practice architectures move from a focus around an

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74 innovation, professional learning, and the varying reform approaches toward a
75 consideration of how people inside (stakeholders, school leaders, teachers) and
76 outside (curriculum developers, policy makers) schools create ‘*working conditions*’
77 (Kemmis and Grootenboer 2008: 61, *original emphasis*) that enable or constrain the
78 use of new classroom practices. Following this initial discussion we provide a
79 context, through an empirical illustration, to interpret and exemplify the theory. In this
80 section we also identify the methods employed. Subsequently, empirical examples of
81 the ‘working conditions’ that existed and were created are presented. In concluding
82 this paper, we will suggest that curricularists could begin their reform programmes
83 with a conceptualisation of the innovation, a model of professional learning and/or the
84 approach to reform with an understanding of the ‘working conditions’ that will
85 constrain and enable sustainability. Indeed, if education is to enact change and help
86 teachers to sustain their use of innovations, a conceptualization of the ‘working
87 conditions’ could become embedded into change and reform programmes.

88 **Practice architectures**

89 The term practice architectures suggests that the use and development of new
90 practices are influenced by a variety of situated and contextual factors (Kemmis
91 2012). This theory is, therefore, similar to other perspectives on curriculum reform
92 since it acknowledges that the reported failures in curriculum change cannot be
93 narrowly attributed to teachers’ misinterpretations of innovations or policies (Coburn
94 2005, Cohen and Hill, 2008, Cohen *et al.* 2007, Fullan 2007, Hargreaves 1994,
95 Spillane 1999, Spillane *et al.* 2002). The theory suggests that every practice enacted
96 in classrooms is a result of a practice architecture consisting of semantic (e.g.
97 language), social (e.g. power relations), and physical (e.g. materials) spaces (Kemmis
98 2012).

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99 Practice architectures support the idea that the use of an innovation is
100 influenced by, the social and structural aspects of practitioners' work and their pre-
101 existing knowledge (Coburn 2005, Cohen and Hill 2008, Cohen *et al.* 2007, Spillane
102 1999, Spillane *et al.* 2002). Extending this previous work, practice architectures posits
103 the interdependent nature of all of these influences, or as Kemmis *et al.* (2014) term
104 them, conditions. Moreover, this theory allows for an understanding of how teachers
105 not only make sense of new practices but how these conditions reciprocally impact
106 the constructions of current and emerging practices. Indeed, Kemmis (2012: 886,
107 *original emphasis*) suggest the practices constructed in and by the organizations,
108 institutions and settings, and the people in them, '*hang together*' to pre-figure and
109 pre-define practice (Kemmis 2012: 886, *original emphasis*). Instead of
110 implementation being primarily mediated by teachers' personal resources (Spillane
111 1999, Spillane *et al.* 2002), both personal and external resources (for example, pupils,
112 professional contacts and associations, and national and local policies) are
113 interdependent and work together to construct and constitute practice.

114 *The theoretical underpinnings of practice architectures*

115 While practice architectures have similarities with other approaches to
116 curriculum policy implementation, the theory was built upon and combines Schatzki's
117 (2005, 2002) interpretation of 'site ontologies' and Lave and Wenger (1991) and
118 Wenger's (1998) discussions around 'situated learning in communities of practice'.
119 Practice architectures is based upon understandings of the connectedness between
120 features of practice that exist at the site and how these features are embedded both in
121 organizations (Schatzki 2005, 2002) and the social-cultural relations of teachers' work
122 (Lave and Wenger 1991, Wenger 1998). Despite offering different perspectives on
123 practice, Kemmis and colleagues argue that Schatzki's and Lave and Wenger's views

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124 are dialectally related. Kemmis and Grootenboer (2008: 55-56, *original emphasis*)
125 claim that we cannot merely assume the ‘social world ‘writes itself’ onto individual
126 persons’ or that people are ‘active *agents* ‘writing themselves into’ practices’. Instead
127 practice is constructed by and in cultural, social and material practices and thus,
128 practice architectures are created (Kemmis and Grootenboer 2008).

129 *Interdependent arrangements of practice architectures*

130 According to Kemmis (2012), a practice architecture has three interdependent
131 arrangements - cultural-discursive, material-economic, and social-political - that
132 ‘hang together’ to create ‘working conditions’ to enable or constrain particular
133 practices. These cultural-discursive, material-economic, and social-political
134 arrangements, together shape existing practices and development of new practices
135 (figure 1).

136 [Insert figure 1 about here]

137 The cultural-discursive can be understood to be the medium of language and
138 thus occurs in a semantic space. Kemmis *et al.* (2014: 32) argue that we can see this
139 feature at work in terms of ‘what language or specialist discourse is appropriate for
140 describing, interpreting, and justifying the practice’. For example, a teacher might
141 justify their use of a teacher-led approach by using terms or phrases such as ‘tighter
142 control’, ‘well-managed’, and ‘students remain on task and are working at expected
143 levels of proficiency’.

144 The social-political occurs in a social space and is the medium of power and
145 solidarity between those with a specific investment in a particular practice. This
146 arrangement can be seen at work in the organization’s functions, rules and roles, and
147 in the shared understandings and practical agreements a group of practitioners have
148 about what to do in particular situations (Kemmis *et al.* 2014). For example, teachers

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149 within the same school may have shared understandings that a teacher-led approach is
150 most effective for enabling students to learn subject content. This understanding could
151 be further endorsed through national and school policies and curriculum documents
152 that suggest successful lessons occur when learning is observable and when teachers
153 manage and control an effective learning environment.

154 The material-economic is manifested in the physical space through activity
155 and work. Activity and work are the resources that make practice possible. For
156 example, this feature works by ‘constraining what can be done amid the physical set-
157 ups of various kinds of rooms and indoor and outdoor spaces in a school’ (Kemmis *et*
158 *al.* 2014: 32). A classroom with tables in rows and a whiteboard at the front is a good
159 example of this arrangement. This kind of layout of a teaching space pre-determines
160 the one-way conveyance of information, limits opportunities for dialogue between
161 students, supports a well-managed and teacher-controlled environment and
162 subsequently, ‘hangs together’ with the cultural-discursive and the social-political
163 arrangements that also endorse knowledge and discipline.

164 Through the consideration of the cultural-discursive, social-political, and
165 material-economic arrangements of practice architectures (figure 1), it seems
166 reasonable to argue that in order for there to be new practices that are ‘innovative’ and
167 for longer-term change to occur, new practice architectures need to be created. In this
168 sense, practice architectures can help us think differently about sustainable curriculum
169 renewal. Instead of being primarily concerned with the innovation, professional
170 learning, or the approach to pedagogical change (i.e. ‘top down’, ‘bottom up’, or
171 ‘partnership’), practice architectures suggest that pedagogical change is either
172 constrained or enabled by cultural, social, and material features of schools.

173 **Methods**

174 *Setting and participants*

175 The empirical illustration used in this paper, physical education teachers’
176 voluntary uses of Cooperative Learning (Johnson and Johnson 2009), is drawn from
177 one UK comprehensive secondary school. The school was situated in a small market
178 town in England where the school’s students were predominantly from white middle-
179 class backgrounds. At the time of this study the UK government’s Office for
180 Standards in Education (OfSTED), who inspect schools on the quality of their
181 educational provision, considered that the school was offering a satisfactory level of
182 education. The grading of satisfactory meant that the school was below average in
183 National examinations grades and required improvements to the quality of teaching
184 and learning. Consequently, senior leaders within the school observed and assessed
185 teachers’ lessons each academic term. Assessments were based on how teachers were
186 meeting the OfSTED teaching and learning criteria, for example, teachers were
187 required to demonstrate how students made progress in their learning during lessons.

188 A physical education department consisting of six qualified physical education
189 teachers (3 male and 3 female qualified teachers) were involved in the study from
190 which this example is drawn. The teachers varied in their age (24–37) and their
191 professional career phases (less than two years to more than fifteen years of
192 experience as qualified physical education teachers). Prior to their use of the
193 innovation we are about to describe the teachers characterised their approach to
194 physical education as being teacher-led with a skills-based sports orientated focus. In
195 other words, teachers adopted a ‘do-as-I-do’ approach to lessons where they gave
196 instructions to the whole class and demonstrated technical skills (for example, how to
197 pass a football or how to volley in tennis) for students to practice in decontextualized
198 skill-based drills (for example, by students standing in lines passing the ball to one

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199 another or by hitting the tennis ball against the wall). Similar to the format of starter,
200 main activity, plenary, a typical lesson structure followed warm up, skill practice, and
201 game. The primary objective of learning in this approach is on performing skills and
202 not on understandings or any form of social learning.

203 A pedagogical researcher (that we have defined elsewhere as a boundary
204 spanner cf. Author 2013, Williams 2002) crossed her institutional boundary to work
205 with the teachers and explore their changing practice. The boundary spanner had
206 experience of teaching physical education through the innovation and her research
207 explored the use of the innovation in school-based settings.

208 The innovation used by the teachers was Cooperative Learning. Cooperative
209 Learning has been widely used in general education and readily applied to varying
210 classroom contexts (Gillies and Boyle, 2005, Johnson and Johnson 2009, Kyndt *et al.*
211 2013). However, despite the dynamic and adaptable nature of this innovation, in
212 physical education Cooperative Learning is still considered to be a new practice and
213 has not been widely adopted or used over a sustained period of time (Author 2015).
214 In physical education Cooperative Learning is described as a type of student-centred
215 pedagogical approach that promotes the achievement of physical, cognitive, social,
216 and affective learning outcomes (Dyson and Casey 2012). Rather than teaching and
217 learning being solely based on skills and techniques, students are encouraged to
218 develop their skills and techniques (physical) alongside, for example, their
219 understanding (cognitive), their interpersonal skills (social), and their self-esteem
220 (affective). The focus of lessons is around students being active, social, and creative
221 learners where students are interdependent to learn in their small structured
222 heterogeneous groups (Dyson *et al.* 2004). The teacher's role is less direct and based

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223 upon encouraging students to construct their own understandings with the support of
224 their peers (Dyson and Casey 2012, Gillies and Boyle 2005).

225 The distinctive features of Cooperative Learning that support the achievement
226 of the multiple learning outcomes are five separate elements (Author 2015). These
227 elements are positioned as a pentagonal scaffold that guides and authenticates
228 teachers' use of Cooperative Learning (Dyson and Casey 2012). The five elements
229 are, positive interdependence, individual accountability, group processing, promotive
230 face-to-face interaction, and small group and interpersonal skills.

231 *Data gathering*

232 Ethical approval was sought prior to data gathering. Data were drawn from the
233 first academic year of the study and at a time when the teachers began using
234 Cooperative Learning i.e. October 2011-July 2012. During this time each teacher had
235 selected at least one class to teach through Cooperative Learning. The classes
236 involved were all single sex and ranged from year 7 (age 11-12) to year 10 (age 14-
237 15). Over the course of the year all teachers taught at least five separate units of work
238 (6-12 lessons of one hour each) to these classes using Cooperative Learning. Data
239 were gathered through video recorded lessons, interviews, the boundary spanner's
240 field journal, and from teaching and learning documents that existed in the
241 department.

242 The first and last lesson of each unit was video recorded. These lessons were
243 analysed using the Cooperative Learning Validation Tool (CLVT), which involved a
244 systematic process of note taking to validate the use of Cooperative Learning and to
245 determine whether the learning outcomes reported on were a result of the authentic
246 use of the innovation (Author 2015). For example, the boundary spanner noted how
247 the teachers had used the distinctive features of Cooperative Learning (for example,

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248 group processing) and reported on the type of learning that was observed (for
249 example, cognitive learning).

250 Semi-structured interviews, each lasting between 5-20 minutes, were
251 conducted both before and after each of the video recorded lessons. These pre- and
252 post- lesson interviews provided an interpretation of the teacher's plans for a lesson
253 and their immediate interpretations of the lesson. Semi-structured interviews also took
254 place before and after each unit. These unit interviews lasted between 20-50 minutes
255 and focussed on each teacher's unit goals and their experiences of using the
256 innovation across a series of lessons. At the end of the academic year semi-structured
257 interviews, which lasted between 30-60 minutes, were conducted with each teacher to
258 understand their longer-term use and engagement with Cooperative Learning. All
259 interviews were recorded and transcribed.

260 Throughout the year data were gathered from the boundary spanner's field
261 journal and the department's documents for teaching and learning. Entries were made
262 to an electronic field journal immediately following each of the boundary spanner's
263 visits to the school and were focussed on events, informal discussions (i.e. those not
264 recorded and which took place in, for example, the department's office), and the
265 boundary spanner's interpretations of the teachers' changing practice. Departmental
266 documents i.e. the programme of study (i.e. the planned content for units in a specific
267 time period), the schemes of work (i.e. learning outcomes for units and lesson-by-
268 lesson content), and teachers' plans and resources for the lessons that were video
269 recorded were also collected and analysed.

270 *Data analysis*

271 In keeping with the research question '*how can the theory of practice*
272 *architectures be used to guide our thinking about sustainable curriculum renewal?*'

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273 data were analysed inductively using typological analysis (Goetz and LeCompte
274 1984, Hatch 2002) and constant comparison (Glaser and Strauss 1967). This involved
275 placing the data into three categories: cultural-discursive, social-political, and
276 material-economic. With data placed in three categories analytical induction (Goetz
277 and LeCompte 1984) took place within each category. The data were coded and
278 placed in a series of emerging categories and subcategories. This process identified
279 the features of each of the cultural-discursive, social-political, and material-economic
280 arrangements. We then identified commonalities across each of the three categories
281 and identified features of each of the arrangements that ‘hung together’. From this
282 process the dominant features of practice architectures that constructed and
283 constituted practice within each category were identified. Each arrangement was then
284 mapped over time to identify when changes to practice occurred and if changes were
285 similar across the three arrangements.

286 To increase the validity of the empirical illustration the peer examination
287 strategy was used throughout (Gall *et al.* 1996, Merriam 1995). This involved the
288 authors member-checking, noting how items were placed into the three categories and
289 how features of practice within each category were coded. Data were moved between
290 different categories and placed under different codes until the authors reached an
291 agreement. In reporting on the findings of this analysis below it is important to note
292 that the identities of the teachers have been masked through the use of pseudonyms.

293 **The changing ‘working conditions’**

294

295 In this section we show the initial ‘working conditions’ for practice that
296 existed in our study and then the new conditions for practice that were created, which
297 supported teachers’ uses of Cooperative Learning. We do this by exploring the
298 cultural-discursive, material-economic, and social-political arrangements of practice

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299 architectures (figure 1) and show how they changed over the course of the academic
300 year.

301 This section shows that initially, a practice architecture existed that endorsed a
302 teacher-led, skills-based, sports-orientated approach. The language used to interpret
303 and justify practice reflected 'leading', skills, and sports. This cultural-discursive
304 arrangement 'hung together' with the curriculum documents that existed (and thus the
305 shared expectations for teaching and learning) and the school's expectations for
306 practice (social-political arrangement). A teacher-led, skills-based, and sports-
307 orientated approach was further endorsed by the facilities (i.e. the vast space of the
308 sports hall), large class sizes, and the equipment or physical spaces that brought
309 heightened safety implications (material-economic). Therefore, and similar to other
310 school subjects, despite teachers being willing and enthused by the use of an
311 innovation (Cooperative Learning), a dominant cultural-discursive justification for a
312 teacher-led approach, teachers' interpretations of department expectations and the
313 criteria for practice from, for example, OfSTED (social-political), and the classroom
314 size, large class sizes and the materials and resources for lessons (material-economic)
315 'hang together' to create 'working conditions' that constrained teachers use of new
316 practices.

317 After a period of approximately six months (or three separate units of
318 activity), new working conditions were being created that were more coherent in
319 relation to Cooperative Learning. In cultural-discursive terms, the teachers positioned
320 learning in multiple domains (physical, cognitive, social, and affective) as being
321 important and justified students working interdependently in small groups with the
322 teacher being less direct as an effective pedagogical approach. In social-political
323 terms and in keeping with this change in language, the department created new shared

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324 expectations for teaching and learning that mirrored the innovation's intentions and
325 the department now saw the innovation as capable of meeting governmental and
326 school expectations for teaching and learning. However, while new cultural-
327 discursive and social-political arrangements were created, new material-economic
328 arrangements were not. Certainly it would be unrealistic to suggest that the creation of
329 new physical spaces to facilitate the use of Cooperative Learning would be remotely
330 viable. They did, however, adapt their *uses* of the physical space to better facilitate the
331 practise of Cooperative Learning.

332 Before discussing the three arrangements it is important to acknowledge that,
333 similar to the J-curve of implementation (where attitudes and understandings get more
334 confused before an improvement in practice occurs (Bunderson 2003)), the
335 development of new working conditions was a messy process (Cook 2009).
336 Following the initial use of the innovation, and at a time when it was being
337 implemented within the pre-existing conditions for practice, we suggest that the
338 teachers moved into a 'messy area' (Cook 2009: 281) of practice change. Consistent
339 with Cook's (2009) interpretation, this was a time when multiple viewpoints about
340 practice existed that conflicted and contrasted with each other. However, this 'messy
341 area', as Cook (2009) suggests, acted as a precursor for the creation of something new
342 and enabled new practices to be revealed, developed, and articulated. Indeed, when
343 practitioners are '*within the mess*' (Cook 2009: 286, *original emphasis*), they begin to
344 clarify what is known and what is nearly known. Practitioners move backwards and
345 forwards between old and new practices until new working conditions are developed.

346 *Cultural-discursive: the semantic space*

347 The specialist discourse the teachers initially brought into their classrooms
348 reflected a sport-focused, skills-based, teacher-led approach. Teachers prioritised and

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349 legitimised effective teaching and learning as being focussed on the physical learning
350 domain, specifically, skills for sport. Indeed, when they began using the innovation, it
351 was seen as ‘working in different sports’, a way of ‘teaching the skills of sport’ and
352 ‘preparing them [the pupils] to play sport’. The teacher-led approach was justified and
353 perceived as an effective way of teaching different sports. This justification can be
354 understood from the following comment from a teacher who had more than 15 years’
355 experience of teaching physical education.

356 I have never given a lesson away as such.... physical education has always
357 been teacher leads the practice, teacher leads the differentiation, teacher leads
358 the progress, and the next steps.... when I teach basketball it is always watch
359 and focus, focus on this part, what am I doing, focus on that part, two, or three
360 teaching points to discuss. I thought with Cooperative Learning nah sod it get
361 them doing it, which may have been the downfall (Sean, Post-Lesson
362 Interview, January 2012).

363
364 His comment shows that he felt a teacher-led approach had been an inherent
365 part of his teaching of physical education. When using Cooperative Learning, and in
366 attempting to take less of a teacher-led role in the classroom, he suggested that his
367 perception of a lack of student progress was a result of Cooperative Learning.

368 Over the course of the year, the ‘centrality’ of a sport-focused, skills-based,
369 teacher-led approach moved to the periphery of the teachers’ justifications for their
370 practice. Although other factors may have played a role, this change in teachers’
371 perception most evidently occurred as a result of students’ positive responses to the
372 innovation. As an experienced teacher, Sean suggested the feedback from the
373 students confirmed that a different approach was effective for his practice.

374 The feedback from students was very positive...listening to the students and
375 them saying that they enjoyed the method of delivery as opposed to what they
376 had experienced in the past...I like the structure, the feedback from the
377 students is good, so I guess my focus is now on developing it (Post-Unit
378 Interview, March 2012).

379
380 However, and similar to Spillane *et al.* (2002), it took more than a single

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381 discrepant event to challenge teachers' interpretations of their practice. Certainly, and
382 reflective of the 'messy area' (Cook 2009), the teachers' perceptions of their practice
383 moved backwards and forwards between the innovation and their previously
384 dominant practices of sport, skills, and a teacher-led approach. Yet, the teachers'
385 perception of and enthusiasm for using the innovation did not decline and it was the
386 repeated positive feedback from their students and observations of their students
387 learning that contributed to a change in their perception of their role in the teaching
388 and learning process, and subsequently, the language that was used to justify their
389 practice. For example, following an understanding that the innovation was effective
390 for his practice, in the first lesson of the next unit Sean suggested that 'they would
391 find it really difficult to do without my input' (Pre-Lesson Interview, April 2012).
392 However, at the end of this lesson his perception of Cooperative Learning was
393 changing. In response to his observations of his students' learning and engagement
394 during the lesson he said that it went 'surprisingly well...they are still engaged and
395 they performed very well...it has certainly opened my eyes to teaching Athletics'
396 (Post-Lesson Interview, April 2012). Thus, this teacher was beginning to perceive that
397 his students did not require a teacher-led approach in order to learn.

398 At a time when most teachers had taught approximately three separate units of
399 activity, most teachers drew on their observations of students' responses to the
400 innovation to construct an understanding that moving from a teacher-led approach and
401 focussing on multiple learning outcomes and the holistic development of the child
402 were important. The teachers began to consider that their previously dominant sport-
403 orientated curriculum was ineffective, and perhaps incapable of meeting some of the
404 social learning outcomes that were now valued. The language used reflected students'
405 ability to listen and communicate with each other (social learning) and be creative

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406 (cognitive learning), where these outcomes were seen as more beneficial than a sport-
407 centred curriculum focussed on merely skills and techniques (physical learning).
408 Indeed, as the teachers used Cooperative Learning and observed and listened to their
409 students' responses, they were beginning to see that catering for multiple learning
410 outcomes was more effective for students' development and that Cooperative
411 Learning was an effective way of meeting these multiple learning outcomes.

412 You know even though sport hasn't been at the centre, they have learnt to
413 teach each other, they have learnt to listen to each other, and they have learnt
414 to actually create and challenge each other, and I think having a more holistic
415 development of the child, rather than having a sport-centred curriculum, has
416 definitely been more beneficial. (Sophie, Post-Unit Interview, May 2012)

417 Multiple learning outcomes were seen as beneficial because they were noted
418 to be vital learning outcomes that could contribute to preparing young people for their
419 own cultural engagement in society. Significantly, a direct association was made
420 between student learning in the social and cognitive domains when the teachers
421 moved from their predominant use of a teacher-led approach. This change can be seen
422 in the comment below. A new vocabulary for describing practice emerged that
423 reflected providing students with 'independence' rather than the 'teacher leads the
424 practice'. 'Independence' was then seen as an effective way of supporting
425 'cooperation' (social learning) and enabling students to 'think divergently' (cognitive
426 learning). Cooperative Learning became further legitimised, as a curriculum practice,
427 since such 'independence' and social and cognitive learning were not seen as possible
428 within their previous use of a teacher-led approach.

430 It was the kind of independence you give the kids and without that
431 independence in their lives and their ability to think kind of divergently away
432 from their groups and kind of the cooperation element fulfils a lot more needs
433 rather than being spoon fed and therefore they are going to develop a lot more
434 as a rounded person and that skill set and that skill base will aid them in
435 multiple curriculum areas rather than your bog standard physical education
436 lesson where they are given a demonstration, they are told what to do and how
437 to do it and they then perform the task (Aaron, Post-Unit Interview, July

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438 2012).

439

440 *Social-political: the social space*

441 Shared rules and expectations for practice based on sports, skills and,
442 techniques existed within the department. Certainly, in examining the programme of
443 study and the schemes of work, the content and focus of units and lessons were
444 around sports and skills. The programme of study pre-determined that teachers would
445 teach a minimum of five different six-lesson units focusing on different types of sport.
446 The schemes of work also pre-determined that the focus of learning would be skill-
447 based. The learning outcomes drawn from the netball scheme of work exemplify the
448 emphasis on the skills and techniques for sport: ‘pupils will be able to consolidate
449 basic skills in skill practices and full-sized games focusing on accuracy, quality and
450 control of techniques...’.

451 For the first units taught, the department’s teaching and learning documents
452 were used as a primary resource for choosing the content of lessons. The teachers
453 drew on the programme of study and the schemes of work to plan for their lessons
454 and units. Indeed, the department had a shared understanding that the content within
455 these curriculum documents was appropriate for planning units and lessons. As the
456 field notes show below, the teachers used these documents as a way of constructing
457 their use of Cooperative Learning.

458 She [Vanessa] began by looking at the whole year...and what areas of range
459 and content [activities or sports] she was on...it seemed she needed a basis of
460 where to go [in the planning of lessons] and she needed the content of the unit
461 to be able to adapt it to Cooperative Learning (Field Journal, December 2011).

462

463 Beyond the programme of study and the curriculum guides that the teachers
464 used to construct their initial lessons and units, the school’s rules and socially shared
465 expectations for teaching and learning influenced the teachers’ use of the new
466 practice. This influence on practice was particularly evident during each teacher’s

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467 routine lesson observations by senior leaders in the school. These lesson observations
468 focused on each teacher meeting specific criteria related to OfSTED's framework for
469 practice. One of the criteria stated that teachers needed to show that students made
470 significant progress in their learning during a lesson. Subsequently, the teachers
471 claimed that they couldn't use Cooperative Learning for the duration of the one hour
472 lesson; 'I only used that for certain bits of it I didn't do it for the whole lesson it is
473 quite hard to do it for a whole lesson observation' (Claire, Post-Lesson Interview,
474 February 2012). However, the teachers were not frustrated by the need to adhere to
475 the school's expectations. Instead it was almost accepted that Cooperative Learning
476 could not fulfil all of the school's teaching and learning expectations. The following
477 field notes further this point and highlight that in order for the teachers to show
478 students were meeting the skill based learning outcome, a teacher-led approach was
479 an acceptable way of responding to the expectation of showing progress. In this way,
480 the school's rules for teaching and learning that was a result of their adherence to
481 OfSTED became a socially shared way of teaching lessons within the department.

482 One of the success criteria was the students would be able to adopt the ready
483 position [skill], therefore when they weren't applying this and this was a small
484 part of her outcomes, she had to pause the whole class and make sure that they
485 were doing it. If she had gone around the groups and asked partners what they
486 were doing and how they needed to be doing it then this would have taken the
487 20mins of her lesson observation and potentially the students wouldn't have
488 been meeting the criteria (Field Journal, April 2012).

489 While challenges existed in the using Cooperative Learning within the
490 school's expectations for practice, at a time period when teachers began to value the
491 effectiveness of the innovation (that was evidenced in their on-going use of new
492 language to describe what they and their students were doing in lessons, as discussed
493 in cultural-discursive condition), a shared understanding within the department was
494 emerging that Cooperative Learning was an effective curriculum practice. Indeed,
495

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496 discussions about Cooperative Learning became an agenda point within the formal
497 scheduled meetings with teachers sharing units and plans for lessons.

498 The physical education department had a meeting yesterday and shared their
499 units that they had planned to teach of Cooperative Learning. This was one of
500 the first times the department had scheduled time in a meeting and have
501 chosen to speak about Cooperative Learning rather than it being enforced by
502 me (Field Journal, April 2012).

503 The teachers and department's belief that Cooperative Learning adhered to
504 and could meet the OfSTED criteria emerged into these departmental meetings. Prior
505 to the next scheduled lesson observations by senior leaders in the school the assistant
506 curriculum leader in the department suggested that 'the inclusion of the OfSTED
507 criteria into Cooperative Learning should be the focus of all the department's next
508 units, if they were going to be able to use it' (Field Journal, May 2012). This 'was
509 something she felt she would share in the next department meeting' (Field Journal,
510 May 2012). Consequently, and as evidenced through all teachers' willingness to
511 modify their approach, the department reached a shared agreement that they would
512 begin to refine their use of Cooperative Learning. For example, instead of using a
513 teacher-led approach that contrasted with the intentions of Cooperative Learning, one
514 teacher used additional questions during group processing (a distinctive feature of
515 Cooperative Learning) to allow students to communicate their progress.
516

517 I have added a third question so what went well in your team, what does your
518 team need to do to do better and I was always focussing on as a team not as
519 the practise, and my third one is how have you made progress in this lesson
520 and how do you know, which is for OfSTED and is making sure that they can
521 state how they think they have made progress and how they think and why
522 they think they have made progress. (Vanessa, Post-lesson Interview, May
523 2012).

524 However, while the department had reached a shared agreement that they
525 would attempt to adapt their practice to meet the school's teaching and learning
526 expectations, for some teachers this process of change was problematic. Although all
527

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528 teachers engaged with the process of adaptation, an understanding amongst all
529 members of the department that Cooperative Learning was capable of meeting the
530 school expectations did not immediately occur. For example, some teachers ‘felt that
531 the OfSTED criteria didn’t match the expectations of student-centred lessons’ (Field
532 Journal, June 2012). It was only through the repeated attempts to change and align
533 the use of the Cooperative Learning elements with OfSTED criteria and through
534 sharing plans and resources within department meetings, that a shared agreement
535 emerged that Cooperative Learning was capable of meeting the school-based teaching
536 and learning expectations. Certainly, every member of the department chose to teach
537 through Cooperative Learning as part of the routine school observations toward the
538 end of the academic year. The fear and resistance to the use of Cooperative Learning
539 in formal lesson observations disappeared, and it was noted that, ‘all the teachers
540 seemed to be quite up for it and getting an external opinion of Cooperative Learning
541 but to also see how it matches with Ofsted criteria’ (Field Journal, June 2012). With
542 all lessons subsequently graded as good or outstanding, Cooperative Learning was
543 increasingly becoming a socially shared and accepted way of teaching and learning
544 within the department and within the school. Where previously practice was
545 constrained and the teachers adopted a teacher-led approach to show student progress,
546 the teachers felt that were able to modify their approach in a way that allowed them to
547 demonstrate progress.

548 I thought it was less teacher-led...every single person improved, every person
549 progressed, some more than others and all the OfSTED criteria was met
550 (Aaron, Post-lesson Interview, July 2012).

551 Around the same time, when the teachers began to modify their use of the
552 innovation to include OfSTED criteria, the teachers also restructured their lessons and
553 the curriculum. This was largely in response to the frustrations caused by whole
554

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555 school events (for example, school trips or whole school themed events), the weather,
556 and teachers' extraneous pastoral responsibilities in the school that caused lessons to
557 be cancelled (i.e. the class was either absent, students were taught by a cover
558 supervisor, or three classes (approximately 90 students) were required to be taught in
559 one space and, as a result, the use of Cooperative Learning wasn't seen as possible).
560 For example, 'during an informal conversation with Aaron, he commented on how he
561 just 'gets going on something and then bam you have got to change to a different unit'
562 (Field Journal, February 2012). Following a period (most evidently through the
563 second and third units taught) where teachers were required to cancel their lessons
564 and units were shortened to less than six lessons teachers' attitudes changed. They
565 made the decision in future units that 'they didn't want to cut the units short' (Field
566 Journal, May 2012). The school-based restrictions to their practice seemed to
567 influence the teachers to not only maintain the six lesson units but to now extend the
568 unit length and begin choosing their own content (or topics). In some cases, this
569 meant that the teachers created new unit outcomes and objectives and units that lasted
570 eight, ten and in some cases twelve lessons.

571 Toward the end of the year, the innovation was seen to be part of the culture of
572 the department. Extending the discussions in formal meetings, as one teacher said
573 'there's always an open conversation about it [the innovation] and sharing of
574 experience' (Vanessa, End of Academic Year Interview). Moreover, the department
575 created new schemes of work and resources for Cooperative Learning: 'we are
576 redesigning our schemes of work...and we are having a Cooperative Learning box...
577 setting up a central resource for each of the sports through Cooperative Learning
578 (Vanessa, End of Academic Year Interview). While it was evident that there was still
579 a focus on sport, it had moved to the periphery within the department and their

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580 individual and collective pedagogical approach. Subsequently Cooperative Learning's
581 inherent focus on multiple learning domains (physical, social, cognitive, and
582 affective) became the primary focus of each unit's scheme of work. In this way, the
583 department overcame the school's expectations by finding ways to incorporate
584 OfSTED criteria into their lessons and they had created new teaching and learning
585 documents within the department that were coherent with both OfSTED and the
586 features, aims, and objectives of the innovation.

587 *Material-economic: the physical space*

588 The pre-planned programme of study that teachers followed and determined
589 their activity or sport for their first few units taught (as discussed within the social-
590 political arrangement) also pre-determined the physical space where lessons would
591 take place. 'Hanging together' with the social-political arrangement and a sports-
592 orientated focussed programme of study, most lessons were pre-determined to take
593 place with classes of approximately thirty students over one hour and in the sports
594 halls, on the sports fields, or on multi-purpose surfaces, such as the Astroturfs.

595 Large spaces and class sizes, coupled with the time constraint of a one-hour
596 lesson, proved to be problematic for the teachers in using Cooperative Learning. For
597 example, 'during his [Aaron's] Football lesson on the Astro[turf] he seemed
598 frustrated... he said he just wanted to bring them in and tell them what to do and how
599 to do it' (Field Journal, February 2012). Indeed, for many teachers it was noted that
600 they wanted to 'control the structure of the lesson' (Field Journal, January 2012),
601 something that was possible in the teacher-led approach but that was challenging
602 when students worked in small teams on different activities spread out in a field or a
603 sports hall. On a number of occasions, the teachers brought the students in from
604 various areas of the hall, field or Astroturf for a whole class discussion. These whole

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605 class discussions, as the observation notes on one lesson show, allowed the teachers to
606 stick to their pre-planned timings of the tasks in their one hour lessons where the class
607 discussions most often occurred at three time points: after the warm up, after the skill
608 practice, and after the game (or the starter, main activity, plenary).

609 Sophie controls the structure of the lesson by telling students when and what
610 they should be doing by bringing the whole class into the middle of the
611 [Football] pitch. For example, after the warm up she tells them that they
612 should be moving on to the skill part of the lesson and that the coaches and
613 equipment manager should be setting up the drills, she then brings the class in
614 and tells them its time to move onto the game. (CLVT, January 2012)

615
616 Similar perhaps to lessons that take place in Science laboratories, the
617 perceived need to adopt a teacher-led approach was also particularly prevalent when
618 learners were required to use certain equipment that had enhanced safety implications
619 (for example, Javelins, vaulting boxes, or trampolines) and in physical spaces that had
620 specific safety regulations (for example, the swimming pool). By using an example
621 from swimming the influence of the pre-determined safety regulations on practice can
622 be better understood. The comment below reflects one teacher's decision to only use
623 Cooperative Learning in swimming when he taught classes of less than thirty
624 students. This teacher considered that, due to safety considerations, allowing thirty
625 students to work in small groups in the swimming pool was not possible. This
626 constraint on where and with what classes the innovation could be used was further
627 exacerbated by the duration of swimming lessons. Due to changing time and the use
628 of the swimming pool, which was in an off-site facility (i.e. within a public leisure
629 centre) that required students to travel to the facility within their one hour lesson, the
630 teacher felt that students would have less time to be active in the pool and develop
631 their skills. As a result, this teacher only ever used Cooperative Learning in
632 swimming when working with a class of fifteen students or less.

633 Boundary Spanner: why have you chosen to use this class?

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634 Liam: Due to the swimming pool environment and the timings of 20/40
635 minutes. If larger groups, it will be difficult to have as much active time in the
636 pool to develop and analyse their techniques...and for safety reasons if I have
637 individuals working in the pool I need to know where they are all the time.
638 (Liam, Pre-Unit Interview, December 2011)

639
640 While the teachers could not change the physical spaces or the safety
641 regulations (and by this we mean they could not create or construct a new sports hall,
642 buy new fields, multi-sports surface, or develop new equipment and implement new
643 safety regulations) to facilitate their use of Cooperative Learning, they were able to
644 reconstruct how these physical spaces were used. Although the sports hall was seen as
645 a space that had previously been used for traditional sports, this space was
646 restructured during the year to allow students to work in their groups together to
647 create (as an example of cognitive and social learning) their own sports and games.
648 Indeed, and at a similar time to when the teachers' perceptions of their role in the
649 teaching and learning process and the language used to justify their practice was
650 changing (as discussed in cultural-discursive), the teachers reduced their amount of
651 control in lessons by adopting a role of active supervision. As one teacher suggested,
652 'students had the space to create their own Frisbee golf courses....it was absolutely
653 manic because there were Frisbees flying everywhere' (Sophie, Post-Unit Interview,
654 May 2012). Although some teachers felt that they needed to 'make the activities more
655 structured as while they [the students] were creative it could become quite disruptive
656 (Liam, Post-Unit Interview, May 2012), what became 'thinkable' during lessons
657 changed.

658 A change in what was 'thinkable' seemed to occur as a result of the teachers'
659 observations and the understanding gained from their experiences of using the
660 innovation. Indeed, an understanding developed that students required more space and
661 time to learn in multiple learning domains and be able to work together independently

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662 (key changes in language seen in the cultural-discursive arrangement) of the teacher's
663 direct instructions. It was considered that time and space allowed students to learn
664 interdependently in the social and cognitive domains with the teacher supporting
665 learning only when students required it:

666 When they are practising you need to give them a space to practise, the time to
667 talk to each other and the time to work things out for themselves and learn
668 from their mistakes...what I have realised is that I don't need to be with the
669 learning teams all of the time, sometimes its just standing back and watching
670 and then facilitating the learning when the students need your support.
671 (Sophie, End of Academic Year Interview)

672
673 A change in what was 'thinkable' in the physical spaces was also reflected in
674 teachers' practice with reference to the perceived safety constraints of using the
675 innovation with certain equipment and with large class sizes. Where previously they
676 avoided situations, such as the case in swimming, they began to modify their
677 approach and used the innovation in these physical contexts. As the comment below
678 reflects, teachers started to consider that they now only needed to control the safety
679 (in a teacher-led way) for small parts of lessons or in parts of the units when there
680 were specific safety concerns. The teachers placed an emphasis on the interdependent
681 nature of learning (as a reflection of the cultural-discursive arrangement) and it was
682 much more a case of ensuring students understood the safety regulations to allow
683 students to learn from each other 'safely'.

684 I think there are certain aspects where you have to come in and take over and
685 safety and stuff, like Javelin... but when you do that and let them go away
686 they are absolutely fine. So I do think there are aspects where you do have to
687 take over and do that teacher role but then give them chance to go out and do
688 it for themselves. It would only be in terms of safety or explaining what they
689 need to do for that unit and what to do to start with. (Claire, Post-Unit
690 Interview, July 2012).

691
692 Enabling students to work in new spaces when there were safety concerns was
693 one of the last of the new working conditions to be developed. Despite attempts to
694 afford students more ownership and responsibility, it was a need for safety that often

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695 caused teachers to revert back to a teacher-led approach. As Claire suggested, even
696 within the units toward the end of the academic year, ‘I spent ages talking and
697 controlling the safety at the beginning of lessons’ (End of Academic Year Interview)

698 **Discussion**

699 To keep pace with the sheer expectation of change, schools and teachers have
700 been presented with a near constant stream of innovations to better align practice with
701 contemporary economic and social challenges (Ball 2013, Brown *et al.* 2000, Evans *et*
702 *al.* 2008, Moore *et al.* 2002). However, despite the pressures and expectations on
703 schools and teachers to renew their practices year-on-year, the near-constant state of
704 innovation has resulted in teacher burnout, with limited sustained change to curricular
705 practices (Ball 2013, Fullan 2013, Hargreaves and Goodson 2006, Sahlberg 2011,
706 Wallace and Priestley 2011). Indeed, the opportunities for sustainable curriculum
707 renewal, that would see teachers develop and adapt their practices over time, have
708 been sparse (Fullan 2013, 2007, Hargreaves and Goodson 2006, Macdonald 2003).
709 Certainly, conventional ways of thinking about curriculum reform, ‘top-down’,
710 ‘bottom up’, and ‘partnership’, have not been capable of meeting the challenges of
711 supporting longer-term change (Macdonald 2003). Therefore, and as we identified at
712 the beginning of this paper, there is a need to consider other perspectives in our quest
713 for sustainable curriculum renewal.

714 The purpose of this paper has been to examine the theory of practice
715 architectures and its usefulness in understanding curriculum renewal. Through an
716 empirical illustration we have shown that the creation of new working conditions (that
717 aligned with an innovation’s intentions) contributed to longer-term pedagogical
718 change. Therefore, in order for teachers to sustain their use of an innovation and for it
719 to become capable of being institutionalized a practice architecture that relates to an

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720 innovation's intended learning outcomes and the pedagogical circumstances for an
721 innovation's use needs to be created. We argue that this theory and concept offers a
722 different perspective on sustainable curriculum renewal and has the scope and
723 potential to influence change and reform programmes. This paper will now critically
724 explore how practice architectures could be used and further explored by
725 curricularists to facilitate sustainable curriculum renewal.

726 It seems important to emphasise firstly that the diverse and varying
727 professional learning and the differing reform approaches (i.e. bottom up, top down,
728 or partnership) approaches should not be excluded or replaced by approaching change
729 through practice architectures. Moreover, the theory of practice architectures
730 compliments but yet extends policy implementation approaches and/or models
731 (Coburn 2005, Cohen and Hill 2008, Cohen *et al.* 2007, Spillane 1999, Spillane *et al.*
732 2002) by focussing on the interdependent nature of cultural, social and material
733 conditions and how these, together, not only influence interpretation of innovations
734 but an innovation's longer-term use. Therefore, we argue that the concept of practice
735 architectures should work with these approaches and be used to inform reform
736 approaches.

737 In particular, the concept of practice architectures provides an alternative
738 starting point for thinking differently about educational change. From the very onset,
739 pedagogical change can be approached with an identification of what is needed for an
740 innovation's longer-term use. Curricularists who introduce an innovation could begin
741 by identifying a practice architecture and, specifically, the language, the materials,
742 and the socially shared rules and routines that could 'hang together' and pertain to the
743 innovation's longer-term existence. From this end point, curricularists can begin to
744 develop programmes with a pre-planned approach to assist a) teachers' understanding

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745 of how to use an innovation, and b) the deconstruction and reconstruction of practices
746 to ensure an innovation's survival.

747 While curricularists could introduce programmes and support the development
748 of new practices, it is also worth noting that practitioners could embark on
749 pedagogical change by engaging with the theory of practice architectures. Firstly,
750 practitioners could examine their beliefs and interpretations of practice (culturally-
751 discursive), the materials and resources available (material-economic) and the rules
752 and routines that exist in their context (social-political), exploring how these relate to
753 their current practices. Following this, practitioners could identify what language
754 (culturally-discursive), materials and resources (material-economic), and rules and
755 routines (social-political) need to be in place to use and sustain an innovation. Thus,
756 practitioners could approach curriculum change and sustainable curriculum renewal
757 through a critical consideration of how and why certain practices have been sustained
758 (deconstruction) and how and why new practices could be sustained (reconstruction).
759 It was identified in this paper that students' responses to the innovation and a
760 department's collective investment in change supported a modification in the
761 'working conditions'. In this sense, experience using an innovation and engaging in
762 processes, such as participatory action research, that involve constructing
763 understandings with colleagues and students in the local context (Kemmis and
764 McTaggart 2008), could support the deconstruction and reconstruction of new
765 practices. A more comprehensive understanding, however, of the contextual needs
766 and the professional learning that aids the development of new practice architectures
767 is required.

768 Although a practice architecture that pertains to an innovation's use can be
769 identified, by referring back to the original theoretical perspectives of site ontologies

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770 (Schatzki 2005) and situated learning (Lave and Wenger 1991, Wenger 1998), the
771 pre-existing ‘working conditions’ may vary between sites and between communities
772 of practitioners. Indeed, through their positioning of practice as being constructed in
773 and by cultural, social and material practices Kemmis *et al.* (2014) have
774 fundamentally acknowledged that practices between sites and communities differ.
775 Although those constructed outside of the site may have somewhat homogenous
776 expectations - such as curriculum guides and OfSTED expectations - it is how these
777 practices are interpreted and mediated in the school, between practitioners, and in the
778 classroom, that determines how they are used. For example, and in the broadest sense,
779 how do practices constructed outside the school and brought into the site vary
780 between Free Schools (or independent schools (Sweden) or Charter Schools (USA)),
781 and state schools (Hatcher 2011)? Moreover, how curricular or pedagogical strategies
782 are interpreted may vary between groups of teachers and between individuals (Brown
783 *et al.* 2000, Cohen and Hill, 2008, Cohen *et al.* 2007, Spillane 1999, Spillane *et al.*
784 2002).

785 It is important to acknowledge that practice architectures are transformative
786 and will change over time depending on how an individual or group of individuals
787 choose to accept or reject new practices that come into being (Kemmis 2012). Thus
788 the process of deconstruction and reconstruction is dependent on how the current
789 dominant and valued practices have been constructed in and by cultural, social, and
790 material practices. Consequently, although further research which explores the
791 deconstruction and reconstruction of a practice architecture may provide valuable
792 insights into how to facilitate sustainable curriculum renewal, we emphasise here that
793 the process may vary between sites, between teachers, and may change over time.

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794 In this paper we presented a practice architecture that pertained to one
795 innovation or pedagogical approach and we showed how the creation of a practice
796 architecture supported sustainable curriculum renewal. Thus, the key message
797 emerging from this study, and the contribution to literature on curriculum
798 development and change, is that practice architectures offers a new perspective and
799 approach for curricularists and professional learning providers to support sustainable
800 curriculum renewal. Moreover, the empirical data has sought to provide new insights
801 into how teachers might engage with on-going curriculum development by using
802 practice architectures to frame their curriculum programmes.

803 **Conclusion**

804 In concluding this paper, we reemphasise that sustainable curriculum renewal
805 is a central problem in education (Fullan 2013, Hargreaves and Goodson 2006,
806 Sahlberg, 2011, Wallace and Priestley 2011). With few examples of longer-term
807 change, practice architectures presents itself as a theory and a conceptual approach to
808 guide innovations and reform approaches. Despite this, there are a number of
809 limitations in this study and to the theory of practice architectures that should be
810 acknowledged.

811 The empirical illustration used in this paper was based on a small sample of
812 teachers and in the context of one school and one curriculum subject. In addition to
813 limiting generalizability, sustainable curriculum renewal could have occurred because
814 of a design experiment (Fishman and Krajcik 2003). In other words, we created the
815 ‘perfect’ conditions for sustainable curriculum renewal to occur and for sustainable
816 curriculum renewal to then be explained through practice architectures. It is also
817 worth noting that the teachers in this study voluntary chose to develop their
818 curriculum around Cooperative Learning. Many proposed curricula changes in

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819 education, however, are not teacher-initiated, with policy often requiring teachers to
820 change their practices and embed new curricula or standards (Spillane et al., 2002).
821 While other theories have proved particularly useful in explaining why teachers
822 engage and reject policy change (Coburn 2005, Cohen and Hill, 2000, Cohen *et al.*
823 2007, Spillane 1999, Spillane *et al.* 2002), resistance could have been minimal in this
824 study. As a result, the extensive body of research that indicates how the alignment of
825 policy with teachers' beliefs impact on the intensity of change (Cohen *et al.* 2007,
826 Spillane et al., 2002), suggests that teacher beliefs may play a more pivotal role in
827 sustainable curriculum renewal than was portrayed in this study. Finally, when
828 aligning practice architectures to sustainable curriculum renewal, this perspective
829 does not account for how teachers' knowledge of an innovation, or how the
830 complexity of an innovation or policy, may effect teachers' approach to sustainable
831 curriculum renewal (Fullan 2007, Cohen and Hill, 2000, Cohen *et al.* 2007). As a
832 result, we suggest that teachers' knowledge and an innovation's complexity should be
833 considered as key influencers of sustainable curriculum renewal.

834 The limitations that we have identified highlight that a further empirical
835 understanding of practice architectures is required. Evidence from large sample sizes
836 and from diverse educational contexts would ensure that the theory is a viable and
837 credible approach to sustainable curriculum renewal. Moreover, and to further
838 understand the usefulness of the theory, we need to a) empirically understand how
839 practice architectures can be used to frame sustainable curriculum renewal, b) to
840 understand how they can be used to guide a curriculum programme, and c) to
841 understand how teachers develop their use of pedagogical approaches over time once
842 practice architectures have been constructed to facilitate their sustainability.

843

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