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Complex transitions of early career academics (ECA): a mixed method study of with whom ECA develop and maintain new networks

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7 **Keywords: professional development, Early-Career, transition, social network analysis, web**
8 **crawling**

9 **Abstract**

10 The purpose of this article is to explore how Early Career Academics (ECAs) cope with their
11 complex and multiple transitions when starting their new role. By focussing on the participants'
12 lived experiences in a professional development (PD) training programme to discuss and share
13 practice, we explored how ECAs developed and maintained social network relations. Using
14 social network analysis (SNA) with web crawling of public websites, data was analysed for 114
15 participants to determine with whom they shared practice outside PD (i.e., external connectors),
16 the seniority of these connectors, and similarity to their job area. The results highlight that ECA
17 networks were hierarchically flat, whereby their sharing practice network of 238 external
18 connectors composed of their (spousal) partner and (male) colleagues at the same hierarchical
19 level. The persons whom ECAs were least likely to discuss their practice with were people in
20 senior management roles. The results of this study highlight that the creation of a community of
21 practice for discussing and sharing of practice from PD programmes appear to be insular.
22 Activities within the organisation and the formation of learning communities from PD may
23 become lost as most of the sharing of practice/support comes from participants' partners.
24 Organisations may have to create spaces for sharing practice beyond the PD classroom to
25 further organisational learning.

26 **1 Introduction**

27 Early Career Academics (ECAs) go through many transitions in their early stages of their career. While
28 there are many definitions of ECAs, in this study we define ECAs as individuals who have a maximum
29 of four years' academic teaching and/or research experience following the completion of their PhD.
30 While there are many routes that teachers and ECAs can take after completing a professional doctorate
31 or PhD to further their careers ([Jindal-Snape and Ingram, 2013](#); [Spurk et al., 2015](#)), for those who want
32 to stay in academia often a teacher-route, researcher-route, or combined teacher-researcher route is
33 paved with substantial challenges ([Adcroft et al., 2010](#); [Uttl et al., 2017](#)), uncertainties ([Spurk et al., 2015](#)),
34 and risks ([Kalyani et al., 2015](#); [Mittelmeier et al., 2018](#)). As highlighted by a recent report by
35 the [Wellcome Trust \(2020\)](#), of the 4,267 surveyed academics 70% of respondents indicated to be
36 stressed at work, and to experience mental health issues. Furthermore, less than a third of ECAs felt

37 secure in pursuing a research career, and a substantial number of ECAs indicated a desire to leave
38 academia. Obviously when ECAs are uncertain about their own roles, identities, and careers, this could
39 have substantial negative impacts on supporting the transitions of students and pre-service teachers as
40 well.

41 One potential solution to these complex issues are to provide appropriate professional development
42 (PD) and support. Across the globe, ECAs follow a range of PD and training programmes in order to
43 help them to make a “successful” transition from ECA to obtaining tenure, or to continue their careers
44 outside academia ([Tynjälä, 2008](#); [Jippes et al., 2013](#); [Pataraiia et al., 2013](#)). On a macro level, several
45 studies (e.g., [Bartel, 2000](#); [Almeida and Carneiro, 2009](#)) have found positive return on investment
46 effects of training. On a micro level, a large number of PD studies found that employees were satisfied
47 with training activities ([Kirkpatrick and Kirkpatrick, 2006](#); [Stes et al., 2010](#)), indicated to have learned
48 to become more student-centred ([Author A, 2013b](#)), and gained confidence ([Author A, 2015a](#))
49 However, limited empirical research is available about the underlying mechanisms how and with whom
50 ECAs learn outside a PD programme. Furthermore, given the focus of this special issue we were keen
51 to explore how people around ECAs (e.g., fellow PD colleagues, colleagues in their department, family,
52 friends) helped or perhaps hindered ECAs’ complex transition to become established teachers and/or
53 academics.

54 This study is specifically focussed on whether and with whom ECAs engage, socially co-construct and
55 share knowledge beyond the “PD training room” ([Bevelander and Page, 2011](#); [Roxå et al., 2011](#)).
56 Uptake of PD and “successful” transition may be dependent on the “external” (i.e., outside the PD
57 training) network of participants ([Akkerman and Bakker, 2011](#); [Roxå et al., 2011](#); [Van Waes et al.,](#)
58 [2018](#); [Thomas et al., 2019](#)) and/or the organisational cultures within the participants’ organisational
59 units or departments ([Daly and Finnigan, 2010](#); [Pataraiia et al., 2013](#); [Van Waes et al., 2018](#); [Wellcome](#)
60 [Trust, 2020](#)). For example, our prior studies on ECAs outside the PD training network of participants
61 ([Author A, 2014a](#); [2015a](#)) indicated that although ECAs developed on average 4.00 social ties after
62 nine months within their PD programme, they also maintained on average 3.63 external social ties
63 outside the PD classroom to discuss the insights from the PD programme.

64 Although identifying the potential impact of “externals” on the complex transition processes is
65 notoriously complex and difficult ([Jindal-Snape and Ingram, 2013](#); [Thomas et al., 2020b](#); [Author A,](#)
66 [2020a](#)), one potential methodology that holds some promise is the use of Social Network Analysis
67 (SNA). An emerging body of research has indicated that SNA can provide transition researchers
68 several analytical tools to make these (in)formal relations amongst participants and people outside the
69 learning context “visible” ([Jindal-Snape, 2016](#); [Jindal-Snape and Rienties, 2016](#); [Author A, 2020a](#)). A
70 consistent finding of research using SNA is that formal and informal social network relations strongly
71 influence with whom people learn ([Thomas et al., 2019](#); [Thomas et al., 2020b](#); [Author A, 2020a](#)),
72 develop coping strategies ([Daly and Finnigan, 2010](#); [Daly et al., 2010](#); [Moolenaar et al., 2012](#)), establish
73 new friendship relations ([Author A, 2014a](#)), and build (in)formal communities to effectively learn
74 together ([Thomas et al., 2020a](#); [Author A, 2020a](#)). At the same time, people (sub)consciously develop
75 strategic network relations with a range of people in order to maximise their network potential
76 ([Coleman, 1988](#); [Burt, 1992](#); [Lin, 2001](#); [Roxå et al., 2011](#)). For example, some people link strategically
77 with powerful connectors (e.g., senior managers) within their organisation ([Lin, 2001](#)), others primarily
78 connect with similar people (e.g., colleagues in the same unit and/or on a similar hierarchical level)
79 ([Coleman, 1988](#); [Rehm et al., 2014](#)), while others may maintain relatively more ties with people outside
80 their organisation ([Bresman, 2010](#)).

81 These connections can also be linked with the Multiple and Multi-dimensional Transitions (MMT)
 82 model of [Jindal-Snape \(2010\)](#), which conceptualises that in line with a Rubik’s cube analogy a change
 83 in one aspect (e.g., getting a ECA grant, failing probation) can lead to changes for the ECA in several
 84 aspects; changes for one person can lead to changes for the significant others (e.g., having to stay in
 85 the region after a successful ECA grant of the partner, having to consider to leave after failed probation
 86 of the partner) and vice versa. As argued in the MMT model ([Jindal-Snape and Ingram, 2013](#);[Jindal-
 87 Snape, 2016](#)), while most transition research focusses on the individual transition only, a more holistic
 88 approach taking the wider network of relations into consideration is important to understand the
 89 complex multiple transitions that people go through.

90 Using principles of social capital theory in conjunction with MMT theory, the prime goal of this study
 91 is to understand with whom ECAs developed external social relations. While our first (explorative)
 92 studies ([Author A, 2014a;2015a](#)) have found that ECAs indeed maintained a range of internal and
 93 external social relations, using a larger sample of 114 participants in this follow-up large-scale study
 94 we are particularly interested in the characteristics of these “external connectors”, and how these
 95 external connectors might facilitate or hamper transition processes of ECAs. In particular, given recent
 96 findings that hierarchy and seniority of connectors might influence network formations ([Edmondson,
 97 2002](#);[Rehm et al., 2014](#);[Thomas et al., 2020a](#)), we specifically focussed on the frequency of contact,
 98 the hierarchical position, and type of job role of these external connectors. Therefore, the following
 99 research questions were formulated:

- 100 1. With whom do ECAs maintain external relations in order to discuss and share experiences of
 101 their transitions from the PD programme? What is the basis for their social network relations?
- 102 2. To what extent do hierarchical levels and job roles of external connectors influence the type
 103 and frequency of contact?
 - 104 a. Are ECAs primarily maintaining strategic connections with senior
 105 academics/managers/teachers?, or
 - 106 b. Are ECAs primarily maintaining social relations with fellow peers on a similar
 107 discipline/hierarchical level/job role?

108 While a number of studies have conceptualised how professionals build, maintain, and reconstruct
 109 their networks ([Wenger, 1998](#);[Akkerman and Bakker, 2011](#);[Pataria et al., 2014](#)), the unique
 110 contribution of our study is to measure empirically whether (or not) ECAs share their expertise and
 111 lessons-learned in the PD with external connectors, whom have substantial power to influence the
 112 strategic direction of an organisation, or whether ECAs are primarily sharing with their colleagues on
 113 similar hierarchical positions. In this study, we employ a rather innovative approach to link SNA
 114 with web crawling techniques to unpack the “public” characteristics of each named external
 115 connector. By integrating these two approaches, we aim to unpack whether the boundary impact of
 116 PD is primarily shared on a horizontal level, or whether some of the innovative practices discussed in
 117 PD are also shared on a vertical level.

118 2 Social network theory, Multiple and Multi-dimensional Transitions and professional 119 development

120 A range of studies have highlighted the importance of social network formation for learning for
 121 ECAs ([Pataria et al., 2014](#);[Rehm et al., 2014](#);[Thomas et al., 2020a](#)). For example, [Pataria et al.
 122 \(2014\)](#) investigated the informal networks of teaching academics using a SNA approach. They were
 123 interested in whom academics who were not part of a PD programme spoke to about their teaching,
 124 the frequency of contact and the themes arising from this conversation. [Pataria et al. \(2014\)](#) found

125 that the personal networks were strongly localised to the academics' departments and disciplines, and
126 were dependent on whether the majority of the members knew each other well. Similarly, in a
127 schooling context a range of studies have found that with whom an early-career teacher networks is
128 essential for successful transition ([Thomas et al., 2019](#); [Thomas et al., 2020a](#); [Thomas et al., 2020b](#)).
129 For example, in a year-long study of 10 beginning teachers in Belgium ([Thomas et al., 2020b](#))
130 combining four SNA measurements with in-depths interviews with both beginning teachers and their
131 colleagues indicated that many early-career teachers went through diverse complex transitions. Those
132 who effectively managed their network relations and actively built and maintained networks with
133 both experienced colleagues and others outside the school were more able to successfully make their
134 transition ([Thomas et al., 2020b](#)).

135 A substantial body of research has highlighted that the social network around an individual employee
136 influences his/her attitudes ([Van den Bossche and Segers, 2013](#); [Author A, 2015a](#); [Thomas et al.,](#)
137 [2020a](#)), motivation ([Daly et al., 2010](#)), behaviour ([Jippes et al., 2013](#); [Pataraja et al., 2013](#)) and action
138 ([Thomas et al., 2020b](#)). A social network consists of set of nodes (i.e., participants in a PD
139 programme) and the relations (or ties) between these nodes ([Wassermann and Faust, 1994](#)). In social
140 network theory, the focus of analysis is on measuring and understanding the social interactions
141 between entities (e.g., individuals, organisational units, companies), rather than focussing on
142 individual behaviour ([Lee, 2010](#); [Bevelander and Page, 2011](#)).

143 **2.1 Social capital and network building**

144 Social capital is a concept with probably the largest growth area in organizational network research
145 ([Borgatti and Cross, 2003](#)), which is concerned with the value of resources that social network ties
146 hold. Social capital can be defined as “resources embedded in a social structure which are accessed
147 and/or mobilized in purposive action” Social capital is concerned with the value of resources that social
148 network ties hold ([Borgatti and Cross, 2003](#)). Social capital can be defined as “resources embedded in
149 a social structure which are accessed and/or mobilized in purposive action” ([Lin, 2001](#)). A recent
150 review of the conceptualisation of social capital by [Lee \(2010\)](#) highlighted three conceptual issues: the
151 use and accessibility of potential resources, social capital formation processes, and network
152 orientations. For example, in a fine-grained analyses of 11 UK academics [Pataraja et al. \(2013\)](#) found
153 that academics strategically manage their pool of network contacts to provide and receive professional
154 and emotional support.

155 Generally there are four explanations why sources embedded in social networks will enhance the
156 returns on an individual's actions ([Lin, 2001](#)). The first explanation is that embedded resources
157 facilitate *information and knowledge flows* between professionals, which consequently reduces
158 transaction costs, such as sharing of ideas, new innovative practices, or lessons-learned ([Moolenaar et](#)
159 [al., 2012](#)). In terms of information flows within organisations, in organisational behaviour research and
160 to a certain degree in educational research it is well-documented that professionals share information
161 with people with whom they have a common identity, such as colleagues from their
162 division/department ([Moolenaar et al., 2012](#); [Author A, 2015a](#)). In terms of information flows within
163 organisations, in organisational behaviour research and to a certain degree in educational research it is
164 well-documented that professionals share information with people with whom they have a common
165 identity, such as colleagues from their division/department ([Daly and Finnigan, 2010](#); [Daly et al.,](#)
166 [2010](#); [Thomas et al., 2020b](#)). This is sometimes referred to as the proximity principle. Thus, when
167 participants return to their daily practice after PD training, how knowledge and insights from the
168 training are shared, translated, and embedded into the organisation may depend on the formal and

169 informal networks of their colleagues within the department, their respective identity/position (such as
170 a manager), and relationships within the department.

171 Second, social ties have a substantial *influence* upon how employees deal with PD and organisational
172 change ([Daly et al., 2010](#); [Moolenaar et al., 2010](#); [Spurk et al., 2015](#); [Van Waes et al., 2018](#)). For
173 example, if an academic wants to explore a new teaching approach (suggested during the PD) to further
174 fine-tune a particular module or programme, and (s)he has a strong connection with senior
175 management, this academic may be more likely to be given support to develop this “innovation”, and
176 would be allowed more risk-taking than someone who has no or weak relations to senior management.
177 For example, [Edmondson \(2002\)](#) found that lower level management employees were more concerned
178 about how senior management and their colleagues perceived them and their quality of work, and hence
179 were less likely to take risks. Furthermore, in an online PD programme for 249 managers of a global
180 organisation, [Rehm et al. \(2014\)](#) found that senior managers were more central in contributing to
181 discourse in discussion forums, while participants who had a lower hierarchical rank were positioned
182 mostly on the outer fringe of the network. [Rehm et al. \(2014\)](#) argues that the expertise and networks of
183 senior managers could be used by lower level management employees to make their voices heard.

184 Third, social ties may be conceived as certification of *social credentials*, as it reflects teacher’s
185 accessibility to resources through (powerful) social networks and relations, thus his or her social capital
186 ([Lin, 2001](#)). If this academic’s innovation is successful and his/her colleagues and senior management
187 (i.e., connectors) provide (in)formal recognition, others are more likely to adopt the same innovation,
188 even when no social support is given. For example, in a study measuring the spread of a new medical
189 approach amongst 727 medical specialists, [Jippes et al. \(2013\)](#) found that uptake and spread of this
190 new approach was dependent on the centrality of the clinical supervisor (i.e., senior connector) and the
191 connectivity of its members within the department.

192 Finally, social networks provide substantial psycho-social support ([Moolenaar et al., 2010](#); [Moolenaar
193 et al., 2012](#)), a sense of belonging ([Thomas et al., 2020b](#)), and *reinforces identity and recognition* ([Lin,
194 2001](#)). [Author A \(2015a\)](#) found that participants in an 18 months PD programme used their network
195 contacts for academic, professional, and emotional support. While participants connected with fellow-
196 ECAs in the PD primarily for academic support (i.e., how to cope with the various tasks in the PD
197 programme), several ECAs looked for professional support from senior management, either during
198 formal job appraisal sessions or informal meetings ([Author A, 2015a](#)). In other words, how and with
199 whom people build formal and informal social relations outside PD may have an influence how they
200 can leverage the power of those external connectors to use and apply the concepts from the PD into
201 their own practice and organisational unit.

202 Beyond the social capital theory often in social network theory a distinction is made between the
203 strength of a tie and the structure of the social network. *Strong ties* support the transfer of tacit, complex
204 knowledge, and joint problem solving ([Daly et al., 2010](#)). [Coleman \(1988\)](#) indicates that high, frequent
205 and intensive levels of connectedness between people can encourage formation of trust and stable
206 relations, which in turn enhances fine-grained knowledge sharing and performance ([Moolenaar et al.,
207 2012](#)). In social network studies this is commonly referred to as *homophily*, whereby people will be
208 attracted to work (formally/informally) together and develop ties when individuals are (perceived to
209 be) similar in terms of surface-level attributes, such as same gender ([Bevelander and Page, 2011](#)),
210 similar interests ([Borgatti and Cross, 2003](#)), similar hierarchical position ([Rehm et al., 2014](#); [Thomas
211 et al., 2020b](#)), or following the same programme/discipline. For example, in study amongst 106
212 academics, [Roxå et al. \(2011\)](#) found that most academics relied on a relatively small network of key,

213 trusted network contacts to discuss their teaching practice. In particular, proximity of people might
214 influence to whom ECAs might turn to if they have specific issues ([Borgatti and Cross, 2003](#)).

215 In contrast, research by [Granovetter \(1973\)](#) indicates that *weak ties* can allow (new) brokerage
216 information that is not known within a strong dense network. For example, a colleague from university
217 A may meet a network contact from university B from a different discipline only twice a year during
218 a local network event. Nonetheless, substantial new and most importantly non-redundant information
219 (e.g., new grant opportunities, job vacancies, teaching innovations) could be mutually exchanged,
220 which would make these infrequent meetings extremely valuable. [Burt \(1992\)](#) argues that individuals
221 will gain more from social networks if they are able to position themselves on either side of a “bridge”,
222 which may provide non-redundant information from different parts of the social network. In line with
223 [Borgatti and Cross \(2003\)](#), a combination of strong ties with a substantial number of weak ties in
224 different social networks will allow people to benefit from the diversity of social capital connections,
225 while maintaining sufficient close and strong links with network connections who can be trusted.

226 In line with theories of strong versus weak ties, [Putnam \(2001\)](#) distinguishes between bonding and
227 bridging social capital. *Bonding social capital* provides solidarity, mutual reinforcement and support,
228 as commonly found amongst people from the same disciplinary background, or working together in
229 the same PD programme ([Bevelander and Page, 2011](#); [Author A, 2015a](#)). In contrast, *bridging social*
230 *capital* may provide linkages with different (non-redundant) parts of the social network, thereby
231 facilitating social mobility and potentially new innovations ([Burt, 1992](#); [Putnam, 2001](#)). In a PD
232 context, this bridging capital could be developed when ECAs from different organisational units
233 work together and over time build “interdisciplinary” social relations ([Author A, 2014a](#)). Finally, in
234 line with social capital theory [Lin \(2001\)](#) argues that having access to a few but powerful (in terms of
235 reputation, credentials, seniority) connectors may be more important than having many links with
236 “powerless” connectors.

237 **2.2 Multiple and Multi-dimensional transition**

238 In the MMT model ([Jindal-Snape, 2010](#); [Jindal-Snape and Ingram, 2013](#); [Jindal-Snape, 2016](#)) there is a
239 further recognition that beyond the professional network significant others (e.g., friends, family,
240 partner) can have a substantial impact on transitions of the ECA, as well as ECAs having an impact on
241 their peers’ transitions. For example, in a study of international doctoral students [Jindal-Snape and](#)
242 [Ingram \(2013\)](#) found that PhD students were not only focused on their own transition needs but also
243 of their family. In a study amongst 22 Chinese international students studying in New Zealand, [Skryme](#)
244 [\(2016\)](#) found that the involvement in Christian religious groups helped several international students
245 to transition to their new lives abroad, while at the same time providing new perspectives to the host-
246 nationals in these Christian groups. In a recent longitudinal study of an interdisciplinary PD for 15
247 doctoral students from nine institutions in six European countries showed a complex development of
248 knowledge transfer and knowledge integration over time between participants ([Xue et al., 2020](#)).
249 Qualitative follow-up interviews showed that both the set-up and design of the online PD as well as
250 the relative engagement by doctoral students explained why some developed strong knowledge
251 integration while others did not ([Xue et al., 2020](#)).

252 Beyond the local impact of physical connections between ECAs and the local community, there are
253 several studies using SNA and other methodologies who show that several people use social media for
254 support in their transitional journeys. For example, in a study of extreme right-wing groups in Sweden,
255 [Törnberg and Törnberg \(2020\)](#) found that network connections between individual were facilitated by
256 Facebook and other social media outlets. Similarly, [Rehm et al. \(2020\)](#) explored how 2695 teachers

257 used Twitter to discuss about a new educational policy called Education2032, with follow-up
258 interviews of 22 teachers indicating that the discussions helped teachers to make sense of their own
259 identity and the new policies.

260 In other words, beyond the formal networks arranged within a PD programme as well as the formal
261 networks within a particular school or department, informal network relations outside the boundaries
262 of these formal networks could have a substantial impact on transitions of ECAs. In this quantitative
263 study we aimed to explore how 114 ECAs developed relations with external connectors to help them
264 transition into a role as an academic, or perhaps consider to work in a professional context.

265 3 Method

266 3.1 Setting

267 114 ECAs from four faculties (arts & social science, business & economics, engineering & physics,
268 health & medical science) at a university ranked consistently in the top 10 percent of league tables in
269 the UK participated in a 18 month PD programme. Participants could only join this programme if a
270 substantial part of their tasks were related to teaching undergraduate and post-graduate students.
271 Participants were selected based upon recommendations from senior management, mostly a head of a
272 department. One element in the tenure of these ECAs is successful completion of this PD and becoming
273 a Fellow of the UK Higher Education Academy normally within the first three years of joining the
274 organisation. With an estimated workload of 300 hours, the majority of hours were self-study, as only
275 ten face-to-face group meetings of two-to-three hours with a professional coach were arranged.
276 Previous studies ([Author A, 2014a;2015a;2016a](#)) have found that this PD programme was considered
277 to be valuable to participants in terms of enhancing their teaching and learning practice, network
278 formation, and social support. Furthermore, qualitative follow-up analyses ([Author A, 2015a](#)) indicated
279 that PD participants primarily relied on their PD peers in terms of academic, professional, and
280 emotional support to make sense of the programme, as well as to learn from their peers how to critically
281 reflect on their own teaching and learning practice.

282 3.2 Participants

283 The average age of the 114 participants was 36 (range 26-57) and 56% of the ECAs were male.
284 Although there was a large age range, all participants were at similar stages of their academic career
285 (i.e., post PhD, post Post-doc). No significant differences in terms of demographics or organisational
286 backgrounds were found between the two consecutive implementations, so we merged the datasets.
287 Participants were from 23 different departments, primarily from business (14%), engineering,
288 hospitality & tourism (both 11%), mathematics (7%), psychology and biosciences (both 6%). Ten
289 participants had no other department member following the programme in their respective cohort.
290 While according to [Finkelstein et al. \(2013\)](#) most American universities are still relatively
291 homogenous, in our context a large cultural diversity of 27 different nationalities was present, typical
292 for an international science community, within which the largest group of participants (49%) were
293 from the UK. International participants primarily were from Latin-European and Confucian Asian
294 countries (both 10%), followed by countries from Germanic and Eastern Europe (both 7%).

295 3.3 Instruments

296 A sequential mixed-method approach was used ([Creswell, 2003;Froehlich, 2020](#)). A close-network
297 analysis survey was first used to determine the external connectors in the ECAs social networks.

298 Secondly, using the results from the survey, an online document analysis was performed to determine
299 the job profile and hierarchical positions of the external connectors.

300 **3.3.1 Social Network Analysis of friendship, working, and learning and teaching networks**

301 We used the closed-network analysis ([Daly et al., 2010](#); [Bevelander and Page, 2011](#); [Author A, 2014a](#))
302 after participants had worked together for nine months to measure the social networks within the PD
303 programme consisting of three social network questions (e.g., “I have learned from...”), whereby lists
304 with names of the 54 and 60 participants of the two cohorts were provided. Secondly, and most
305 importantly for this study, in order to measure and investigate the role of “external” connectors in PD,
306 we asked participants in an open network approach the following: “In addition to members of the [PD]
307 programme, we are interested to know with whom you discuss your learning and teaching issues (e.g.,
308 how to prepare for a lecture, how to create an assessment, how to provide feedback). This could for
309 example be with a colleague, a friend, family, or partner who is not following the [PD] programme.”
310 Participants were asked the name of each external connector, the frequency of contact (as proxy for
311 strength of tie), the type of relation, and where each external connector works (e.g., same department,
312 same institution, external institution, namely). A response rate of 88% was established for the open and
313 closed SNA questions.

314 **3.3.2 Job profile and hierarchical position of external connectors**

315 In total 289 external connectors were mentioned by participants. Based upon the provided names and
316 institutional details, the authors identified, through a document analysis approach, whether a public
317 website profile for each connector was present using the Google search engine and the world largest
318 professional network LinkedIn, a practice that is common in SNA ([Davison et al., 2011](#); [Rehm et al.,
319 2020](#)). For 251 (87%) connectors, a public website profile was indeed available. For 35 connectors no
320 specific public website was available, of which nine network contacts referred to people from a wider
321 group (e.g., “my colleagues in my department X”), and for seven contacts no specific name was
322 provided (e.g., my wife, my mother).

323 In order to develop a coherent, reliable coding scheme of the job profile and hierarchical position of
324 external connectors, both authors first independently coded a sample of 20 websites. Most connectors
325 had a clearly identifiable job role and hierarchical function listed on their website, and the pilot sample
326 coding led to nearly identical results between the two coders. Afterwards, four separate rankings were
327 established. First, both authors independently analysed and constructed 56 functional roles based upon
328 the information provided on these websites (e.g., graduate teaching assistant, tutor, lecturer, associate
329 professor, professor). Second, based upon these functional roles, three separate aggregate rankings
330 were generated, namely *seniority in organisation* (0-7), *seniority in management role* (0-7), and
331 *seniority in teaching* (0-8), where the higher number denoted more seniority. For 36 network contacts,
332 a second role was identified (e.g., programme director & director of lab) while for two network contacts
333 a third role was coded (e.g., programme director & director of lab & associate dean). Consensus about
334 the categorisation of the hierarchical levels and job roles was reached after discussions between the
335 two authors. After agreement of the coding structure, the remaining websites were coded by the second
336 author. Finally, the final codings were discussed by both authors and where needed functional roles
337 were realigned.

338 **3.4 Data analysis**

339 The 114 ECAs participated voluntarily in the SNA and free-response exercise. Participants who were
340 not present during the session(s) were contacted via email. The participants were guaranteed that the
341 results would be completely anonymised and participation was voluntary. Social network data were

342 analysed on a network level using UCINET version 6.694. In terms of the structure of the network, we
343 computed *in-degree Freeman's centrality* of the nodes, as well as the *number of ties* a node was
344 connected to. *Strength of ties* with external connectors was measured by frequency of contact (daily,
345 weekly, monthly, quarterly, yearly). As previous research ([Bevelander and Page, 2011](#); [Kalyani et al.,
346 2015](#)) indicated that gender strongly influenced how people developed links over time, we included
347 *gender* in our modelling. As we were primarily interested in the network relations with external
348 connectors, all data was coded and organised in SPSS 22, and Pearson correlations and linear
349 regression modelling were conducted.

350 4 Results

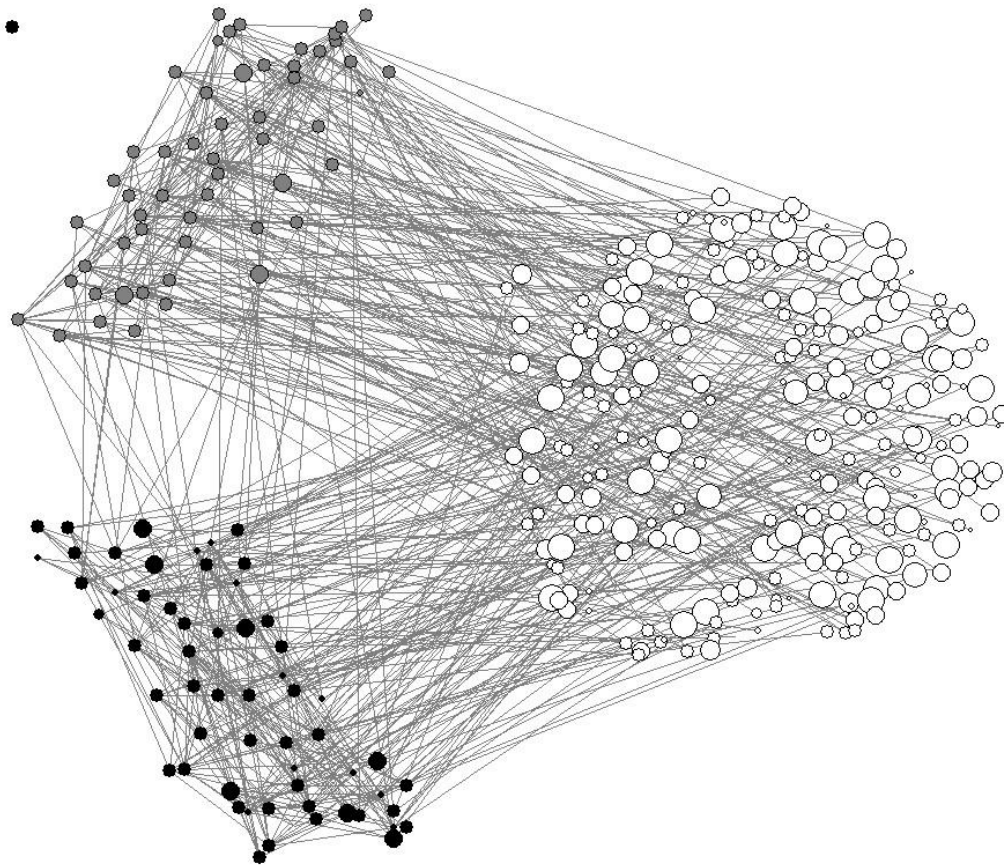
351 4.1 Social network connections within and outside PD

352 279 “external” connectors (i.e., outside the PD programme) were used by the 114 ECAs. Most of these
353 external connectors were male (59%). In terms of frequency of contact, 39% of these connectors were
354 contacted on a weekly basis, 38% on a monthly basis, 11% on a quarterly basis, and 3% were contacted
355 once a year. 9% of these connectors were contacted on a daily basis by ECAs to discuss their teaching
356 practice. In line with proximity theory, 166 (52%) external connectors were colleagues, 52 (16%) were
357 supervisors/senior managers, 51 (16%) were friends, and 36 (13%) were partners. As participants could
358 indicate multiple relations (e.g., friend, colleague, supervisor), these numbers do not add up to exactly
359 279. 133 (48%) external connectors worked at the same department, and 192 (69%) worked in the
360 same discipline, but not necessarily in the same institute, in line with proximity and homophily
361 principles. In total 114 (41%) of the external connectors did not work at the same institute at the PD
362 participants, indicating potential “weak” ties and bridge building opportunities. This is an important
363 finding as in most research on ECA success and transitions in particular few studies focus on these
364 types of external relations.

365 As illustrated in Figure 1, a complex web of network relations was present during the PD programme.
366 On the left of Figure 1, the two consecutive implementations of the PD are illustrated as grey and black
367 nodes, whereby on average 4.84 (SD = 2.43) relations were developed and maintained within the PD
368 per academic. Note that several participants from the second implementation learned from participants
369 from the first implementation, as illustrated by the lines between the grey and black nodes. At the same
370 time, a substantial number of links between the PD nodes and people outside the PD (white nodes)
371 were developed. On average 3.17 (SD = 2.31) external connectors per ECA were used, indicating that
372 PD participants extensively used connectors outside their PD. In terms of management expertise of
373 these external connectors, a mix of seniority was present (as represented by the relative size of each
374 node). Note that one participant from the second PD implementation did not have any connector to
375 discuss his teaching practice with (and none of the 113 fellow participants indicated to have learned
376 from him), and as a result he was not connected to the network (see the top left in Figure 1).

377

378 Figure 1 External and internal learning and teaching network (size nodes based upon management role)



379

380 4.2 To what extent do hierarchical roles of connectors influence social network formations?

381 As a next step, we analysed data for those external connectors whom we could identify a web presence
 382 with specific job role descriptors. This implied that 238 connectors were included in our follow-up
 383 analyses. In Table 1, the mean descriptives and correlations of the number of ties, centrality in the
 384 network, frequency of contact, gender (female), the four functional roles/seniority levels, and dummies
 385 for the type of relation (e.g., colleague, same discipline) are illustrated. While no significant
 386 correlations in terms of functional roles/seniority were found in terms of number of ties or centrality,
 387 there were moderately strong negative correlations between frequency of contact and the four
 388 hierarchical roles. In other words, ECAs in the PD programme were more inclined to maintain frequent
 389 network relations with people on similar or lower hierarchical levels while frequency was less with
 390 more senior colleagues. As the rhos for the four hierarchical roles were rather similar, this seems to
 391 indicate that ECAs preferred to discuss their practice with ECAs in similar (or lower) positions.

392

393 Table 1 Basic descriptive and correlation matrix of external connectors

	M	SD	Range	Number of ties	In degree centrality	Frequency of contact	Gender
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Number of ties	1.20	0.58	1-5				
In degree centrality	1.18	0.54	1-5	.90**			
Frequency of contact	3.37	0.91	1-5	.03	.07		
Gender (female)	1.37	0.49	1-2	-.12	-.16*	.03	
Functional role	31.52	13.24	0-53	.06	.04	-.31**	-.24**
Seniority in organisation	4.19	1.89	0-7	.04	.01	-.28**	-.24**
Seniority in management role	4.19	1.89	0-7	.04	.01	-.28**	-.24**
Seniority in teaching	4.56	2.73	0-8	.08	.06	-.29**	-.27**
Colleague	0.67	0.47	0-1	.18**	.17*	.02	.03
Friend	0.17	0.38	0-1	.08	.10	-.05	.02
Supervisor	0.21	0.41	0-1	-.01	.01	-.13	-.07
Partner	0.08	0.28	0-1	-.10	-.10	.25**	.02
Family	0.02	0.14	0-1	-.05	-.05	.01	.13
Same department	0.56	0.50	0-1	.06	.04	.01	.00
Same discipline	0.76	0.43	0-1	.08	.08	-.11	-.05
External link	0.31	0.46	0-1	-.14*	-.14*	-.03	.04

394 n = 238 * p < .05, ** p < .01

395 As a final step, using linear regression modelling in Table 2 we analysed which of our variables
 396 predicted the strength of ties with external connectors, in this study approximated by frequency of
 397 contact. As the four functional role parameters were strongly correlated and overlapping, we used
 398 seniority in management role as a proxy for hierarchical position. In Model 1, strength of ties was
 399 primarily negatively predicted by seniority in management role. Adding the type of relation(s) in Model
 400 2, seniority in management role remained the primary predictor, followed by whether (or not) a
 401 network contact was a partner. Although only 32% of PD participants indicated to discuss their
 402 teaching practice with their partner, if they did they mostly discussed their practice frequently. Finally,
 403 in Model 3 we added whether location of the connectors influenced frequency, whereby in addition to
 404 seniority in management role and partner dummy external links were significantly negatively
 405 predicting frequency of contact.

406 Table 2 Regression model of strength of external connector contact (i.e., frequency)

	Model 1	Model 2	Model 3
Gender	-.036	-.039	-.036
Seniority in Management role	-.291***	-.259***	-.275***
Colleague		.200	.147
Friend		-.035	-.014
Supervisor		.137	.111
Partner		.251**	.299**
Family		.076	.106
Same department			-.064
Same discipline			.000
External link			-.228*
R-Sq adj.	.073	.093	.107

407 n = 235 * p < .05, ** p < .01, *** p < .001

408

409

410 **5 Discussion**

411 As highlighted in both transition research ([Jindal-Snape and Ingram, 2013](#);[Jindal-Snape, 2016](#)) as well
412 as social network theories ([Borgatti and Cross, 2003](#);[Thomas et al., 2020a](#);[Author A, 2020a](#)), many
413 people go through multiple complex transitions when starting a new role. In this innovative study, we
414 set out to explore the external social learning relationships of 114 early-career academics (ECAs)
415 within a professional development (PD) programme using an innovative combination of social network
416 analysis with web crawling of external connectors' websites. Our research indicates that our ECAs
417 discussed and shared their teaching practice with 238 external connectors, including their colleagues,
418 friends and their partner. However, these ECAs made only limited usage of senior management
419 networks and expertise for their PD and their teaching practice in particular.

420 In line with principles of proximity and homophily ([Coleman, 1988](#);[Bresman, 2010](#);[Daly et al.,](#)
421 [2010](#);[Author A, 2014a](#)) and Research Question 2b, the PD participants shared their practice most
422 widely with their colleagues both within and outside their departments/disciplines and suggest that
423 these PD participants had a high level of connectedness with them. In line with principles of proximity
424 and homophily ([Coleman, 1988](#);[Bresman, 2010](#);[Daly et al., 2010](#);[Author A, 2014a](#)) and Research
425 Question 2b, the PD participants shared their practice most widely with their colleagues both within
426 and outside their departments/disciplines and suggest that these PD participants had a high level of
427 connectedness with them. A negative correlation was found between gender and hierarchical roles,
428 whereby male academics were more often present in senior management positions than female
429 academics. Although similar results were found as [Bevelander and Page \(2011\)](#) and [Kalyani et al.](#)
430 [\(2015\)](#) with regards to male staff being central to participant's networks, this may be a reflection of the
431 male to female staff ratio where the study took place rather than female participants being less likely
432 to form social networks. Further, the information flow reported by participants in the PD programme
433 seemed to be hierarchically flat, that is, based upon the web crawl participants primarily shared
434 information with people who they had a common identity ([Daly and Finnigan, 2010](#);[Daly et al.,](#)
435 [2010](#);[Rehm et al., 2014](#)).

436 However, most ECAs had weak ties with respect to sharing practice with senior management and
437 persons within their discipline/department (that is, no or negative correlations in the frequency of
438 contact), participants may not then be able to act as brokers of these information flows to persons in
439 their own department/discipline. This suggests that the value of PD training to a department may be
440 lost as the sharing of new practices or ideas may have slow uptake. A consequence of this is that senior
441 management may become distanced from the training that is provided and may make decisions based
442 on the training they think their personnel are receiving. In line with recommendations of [Lane and](#)
443 [Down \(2010\)](#), departments and senior management in particular may need to "create a safe space for
444 others to have their voice to harvest the wisdom of different and contrary perspectives to better
445 anticipate what is unforeseen". In other words, a joint effort is needed to allow participants to discuss
446 and share their practice beyond the PD classroom to staff from all levels.

447 In line with recent studies on cross-boundary management ([Bresman, 2010](#);[Akkerman and Bakker,](#)
448 [2011](#);[Thomas et al., 2020b](#)), this study also found the sharing of practice extends beyond the
449 organisation and included persons in similar organisations (external links). The number of external
450 links was small and there were weak ties with them which suggest that organisational learning between
451 institutions is also insular. This makes intuitive sense, as connectors who were not working in the same
452 location (e.g., a different university) will be less easy to contact than those colleagues who worked in
453 the same building or on the same campus. Nonetheless, in line with [Burt \(1992\)](#) and [Jindal-Snape and](#)
454 [Ingram \(2013\)](#) these external links may be important for potential new information or a trusted

455 perspective of how teaching practices at their institute might be slightly different, therefore providing
456 a potential benchmark for discussion. Indeed, this insularity may be appropriate for organisations with
457 highly valuable information, however in other organisations such as charities and universities with very
458 similar roles, an openness to sharing practice can minimise the time and money spent on the duplication
459 of methods and encourage innovations and optimisation of practice. There is also a possibility as these
460 were ECAs; they were still maintaining weak ties with their old institutions until they were able to
461 establish strong ties at their new institution.

462 A final, important but mostly ignored finding in the social network literature, but this is more
463 acknowledged in the transition literature ([Jindal-Snape, 2016](#)), is the role of participants' partners for
464 support in PD. Notably, several participants had strong ties with their partners with respect to sharing
465 their teaching and learning practice. This is perhaps not surprising as they probably have strong
466 bonding social capital and partners are able to provide emotional support to PD participants as well as
467 professional support if the partner works in a similar organisation. However, the organisational learning
468 or sharing of information are extended beyond that of the organisation and is being shaped by the
469 employee's partner rather than through the collective knowledge of the organisation. The strength of
470 the tie may suggest that there is a lack of mentors at a middle or senior management level to help with
471 this offloading of emotion. As organisations are unlikely to "prohibit" participants' sharing with their
472 partners and external connectors, it may be worthwhile that organisations to take a wider holistic
473 perspective in being a social enterprise ([Lane and Down, 2010](#)). By recognising the importance of
474 external social network formation of its employees, in particular the role of partners and colleagues at
475 lower hierarchical levels in providing academic, professional and emotional support, senior
476 management needs to recognise that management support and measuring the impact of PD may be
477 more complex.

478 **5.1 Limitations**

479 A crucial limitation of our findings is that both closed and open social network analyses of learning
480 and teaching networks were self-survey instruments, whereby socially desirable behaviour might
481 influence the results. However, a large body of research ([Borgatti and Cross, 2003](#); [Daly and Finnigan,
482 2010](#); [Daly et al., 2010](#)) has found that SNA techniques provide a robust predictor for actual social
483 networks and PD programmes, in particular given the high response rates (88%) and similar findings
484 across two consecutive implementations of this PD programme. However, a large body of research
485 ([Daly and Finnigan, 2010](#); [Daly et al., 2010](#); [Thomas et al., 2020a](#)) has found that SNA techniques
486 provide a robust predictor for actual social networks and PD programmes, in particular given the high
487 response rates (88%) and similar findings across two consecutive implementations of this PD
488 programme. Nonetheless, the framing of the SNA question (focussed on teaching and learning) might
489 have restricted respondents' recall of their network, in particular with senior management.

490 A second limitation is the accuracy of the data gathering process of job roles and hierarchical positions
491 of external connectors using publicly available websites. Not all professionals keep their job
492 information 100% up to date on their website or LinkedIn profile, although with increased competition
493 amongst academics for scarce (funding) resources ([Adcroft et al., 2010](#)) almost requires academics to
494 maintain a public web presence, which might mitigate some of these concerns. A third limitation is
495 that we did not follow-up with the external connectors what kind of information and advice they were
496 sharing with PD participants. Due to recall issues of social network interactions ([Neal, 2008](#)), perhaps
497 the intensity of contact and types of information and support exchanged might be different than
498 reported by PD participants. Future research is needed to determine whether reported informal network
499 links by PD participants indeed provide the academic, professional and emotional support.

500 A third and perhaps most important limitation was the lack of qualitative data to understand the
501 complex longitudinal transition experiences, such as for example done by [Thomas et al. \(2020b\)](#) who
502 followed beginning teachers for a year and conducted a range of interviews over time with ECAs and
503 more experienced academics. We also recognise that ECAs are not a monotonous group and their
504 transition journeys from the PD would not be similar and may be dependent on their own unique
505 circumstances and attributes such as their age, gender, race, nationality and discipline. However, this
506 analysis was beyond the scope of our paper. Although we conducted previous qualitative focus group
507 discussions ([Author A, 2015a](#)), which highlighted that ECAs used the PD and external networks
508 primarily for academic, professional, and emotional support, further longitudinal research would be
509 needed to explore the long-term impacts of external connectors on ECA transitions based on their own
510 unique characteristics. However, our quantitative analyses do indicate a (perceived) importance of
511 those external connectors for allowing ECAs to transition in their new role.

512 **6 Conclusion**

513 Higher Education Institutions use specialised PD training to up-skill their ECAs to ensure they are
514 competitive. The strength, number and type of external connections that these ECAs have can
515 determine the extent and level that new knowledge from PD training is shared within the organisation.
516 As there is limited research in exploring these external connectors, this study examined with whom
517 and to what extent that ECAs shared their PD experiences outside the training room. The results suggest
518 that ECAs shared their knowledge quite widely but mainly with people they had a common identity,
519 for example colleagues at a similar stage in career. The results also indicate that these ties tended to be
520 male colleagues. Further, the intensity of knowledge sharing was positively related to sharing of
521 knowledge with their partners and negatively related to senior management personnel. Further research
522 should look at the social networks of mid-career employees, whether they are more likely to maintain
523 ties from their early-career PD training, as well as, from their previous institutions.

524 **7 Conflict of Interest**

525 *The authors declare that the research was conducted in the absence of any commercial or financial*
526 *relationships that could be construed as a potential conflict of interest.*

527 **8 Author Contributions**

528 The first author collected and analysed all the initial SNA data and web crawling data. The second
529 author double coded and independently verified the web crawling data. Both authors contributed to
530 the writing of this manuscript.

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538 Author A 2013b ([Rienties et al., 2013](#))

539 Author A 2014a ([Rienties and Kinchin, 2014](#))

540 Author A 2015a ([Rienties and Hosein, 2015](#))

541 Author A 2016a ([Jones et al., 2017](#))

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543

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