
Title	Using e-portfolios to facilitate reflection: Insights from an activity theoretical analysis
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1 USING E-PORTFOLIOS TO FACILITATE REFLECTION: 2 INSIGHTS FROM AN ACTIVITY THEORETICAL ANALYSIS

3 4 **Introduction**

5 The use of portfolios in teacher education has attracted considerable attention in recent years.
6 Broadly speaking, portfolios constitute a collection of documents and evidence of a teacher's knowledge,
7 skills and experience (Wray, 2008). Portfolios present themselves in one of two main formats: paper or
8 electronic (Wray, 2007). Strudler and Wetzel (2005) argued that the differences between electronic and
9 paper-based portfolios were mainly technological and not conceptual (cf., Challis, 2005).

10 11 **The Nature and Purpose of Portfolios in Teacher Education**

12 Wray (2008) classified portfolios as used in teacher education into three broad categories, with
13 different purposes. First, learning or developmental portfolios enable student teachers to become aware
14 of and further develop their identity as teachers and learners, and promote an in-depth view about their
15 classroom practice (Snyder, Lippincott, & Bower, 1998; Wolf & Dietz, 1998). These types of portfolios
16 deliberately engage student teachers in critical reflection and inquiry into their knowledge and skills, while
17 encouraging documentation of their growth in teaching.

18 Second, credential or certification portfolios are for summative and accreditation purposes (Barrett
19 & Carney, 2005; Butler, 2006; Granberg, 2010; Zeichner & Wray, 2001). They serve to determine student
20 teachers' readiness to teach and their proficiency on a set of teaching standards (Snyder et al., 1998).
21 These portfolios might contain a combination of self-selected and prescribed evidence such as lesson plans,
22 statements of teaching philosophy and video or audiotapes of classroom interactions.

23 Third, employment or best practice portfolios (Montgomery, 1997; Wolf & Dietz, 1998) serve to
24 showcase and market a student teacher's experiences, abilities and qualifications to prospective employers
25 (Barrett & Carney, 2005; Butler, 2006; Granberg, 2010; Zeichner & Wray, 2001). They may contain course
26 transcripts and curriculum vitae, formal assessments and recommendations from university and school
27 supervisors. They might also contain self-selected evidence and documentation similar to those in a
28 certification portfolio.

29 Some teacher education programs have attempted to combine different purposes within a single
30 teaching portfolio, while others have required separate portfolios for different purposes (see Snyder et al.,
31 1998). As a result, many variations in portfolios have emerged. Oftentimes, e-portfolios represent a blend
32 of two or more of the above genres depending on the needs and pedagogical designs of their institutions
33 (Granberg, 2010).

34 35 **E-portfolios and Reflective Practice**

36 The practice of using portfolios is not new to teacher education. But the surge in commercially
37 developed and free open source applications in Information and Communications Technology (ICT) has
38 resulted in a concomitant interest in migrating from hard copy to electronic platforms and an increase in the
39 development and use of e-portfolios by those in the field of teacher education (Strudler & Wetzel, 2005;
40 Yancey, 2001). E-portfolios further hold particular interest for teacher educators due to its potential to
41 support reflective practice (Kidwai, Johnson, Hsieh, & Hu, 2010).

42 The concept of reflection has defied a single and agreed upon definition. The notion has its roots
43 in the work of John Dewey (e.g., Dewey, 1933), who conceptualised reflective practice as a rigorous,
44 methodical, and disciplined, collective process of making-meaning, and which requires attitudes that attach
45 significance to personal and intellectual growth. We understand reflectivity and the parallel term of
46 reflection to be “a purposeful activity fostered over time that requires awareness of self and self-perception,
47 is developmental and occurs in stages, and is based in experience that connects to other meaningful
48 experiences” (Quinn, Pultorak, Young, & McCarthy, 2010, p. 28).

49 Reflection on one’s own perceptions, beliefs, experiences and practices is core activity for all
50 teachers including those in initial teacher education (Walkington, 2005). Reflection enables student
51 teachers to restructure their prior conceptions and to refine their thinking about pedagogy (Calandra,
52 Gurvitch, & Lund, 2008; Schön, 1987). Teachers who are reflective practitioners are able to evaluate their
53 teaching and modify it in accordance to contextual requirements (Oakley, Pegrum, & Johnston, 2014).

54 Researchers agree that one of the greatest value in portfolio development is in promoting reflection
55 and thoughtful practice (Oakley et al., 2014; Pelliccione & Raison, 2009). Tzeng and Chen (2012, p. 166)
56 **asserted** that reflection is “explicitly expected and fundamental to the purpose of e-portfolios. Ahn (2004)
57 **went** as far as to refer to e-portfolios as being the most effective and efficient mechanism for encouraging
58 students to reflect on their own learning processes. In a review of perspectives on e-portfolios, Hallam and
59 Creagh (2010) similarly **concluded** e-portfolios’ potential to help students become reflective learners;
60 learners who are aware of their personal and professional strengths and weaknesses.

61 Reflection occurs in two ways: in the selection of artefacts and development of the e-portfolio, in
62 the documentation of learning and in the statements of reflection embedded with the artefacts and examples
63 of learning (Retallick, 2000; Stansberry & Kymes, 2007). The effectiveness of e-portfolios lies in how they
64 encourage student teachers to engage in critical reflection and to consider connections between subject-
65 matter content, theory, research and practice (Oakley et al., 2014). These benefits derive from the process
66 of portfolio construction, the mentoring and collaboration during this process and the feedback provided.
67 Furthermore, e-portfolios encourage self-evaluation by enabling learners to examine their development, as
68 well as their strengths and weaknesses (Barbera, 2009; Corbett-Perez & Dorman, 1999; Hallman, 2007;
69 Wolf, 1994).

70 The potential benefits offered by e-portfolios from a theoretical or institutional perspective have
71 been heavily emphasized in the literature. The utility of the e-portfolio as a reflection tool while widely
72 endorsed in theory, has yielded conflicting results when examined from student teachers’ perspectives
73 (cf.,Berg & Lind, 2003; Pelliccione & Raison, 2009). With the widespread use of the e-portfolio, faculty and
74 administrators need to understand student teachers’ perspectives on the ability of this tool to meet their
75 needs (Parker, Ndoeye, & Ritzhaupt, 2012; Tzeng & Chen, 2012). The inability to fully recognize the benefits
76 of technological tools to them as learners potentially hinders their widespread use (Beresford & Cobham,
77 2010; Gay & Hembrooke, 2004). Conversely, understanding their perspectives can lead to improvements
78 in e-portfolio implementation, further the teacher education program’s mission for cultivating reflective
79 practitioners and ultimately benefit all stakeholders (cf.,Parker et al., 2012; Tosh, Light, Fleming, &
80 Haywood, 2005).

81 Although student perceptions do not represent actual behaviours, the link between perception and
82 behaviour is well-established. Evidence shows that this link is generalizable across various contexts
83 (Dijksterhuis & van Knippenberg, 1998; Reibstein, Lovelock, & Dobson, 1980). For example, Dijksterhuis
84 and van Knippenberg (1998) **concluded** that “perception has a direct and pervasive impact on overt
85 behaviour” (p. 865). Similarly, the way student teachers perceive the purpose of e-portfolios substantially
86 influences how they use, and create the content of their e-portfolios (Barrett & Carney, 2005). For this
87 reason, we consider that perceptions of student teachers may ultimately impact upon whether and how
88 they use e-portfolios for reflections.

89 A plethora of research conducted to date focuses on student perceptions of the value of the e-
90 portfolio (e.g.,Niikko, 2002; Rhodes, Chen, Watson, & Garrison, 2014; Rossi, Magnoler, & Giannandrea,

91 2008; Yao, Aldrich, Foster, & Pecina, 2009). Few if any, of the existing research studies attempt to measure
92 student teachers' perceptions of the e-portfolio with reference to the context of its integration. Yet, the way
93 in which e-portfolios is integrated into the fabric of the educational context will influence student teachers'
94 perceptions of the initiative (Ritzhaupt, Parker, & Ndoye, 2012). Consequently, Ritzhaupt and colleagues
95 (2012) **called** for more research on student teachers' perceptions on the use of e-portfolios in teacher
96 education, in different integration contexts or programs.

97 If current research on e-portfolios needs to better integrate context and student teachers'
98 perceptions, then it needs a systematic coherent theoretical framework that supports this integration. We
99 suggest that CHAT allows one to identify, understand and target specific problem areas from a systematic
100 and holistic lens; with considerations for the social, historical and contextual structures present in an
101 environment. It offers a set of conceptual tools and common vocabulary that allows for complex
102 conversations in a manageable and meaningful manner (e.g., Yamagata-Lynch, 2010). These are aspects
103 considered to be necessary preconditions for e-portfolio research (e.g., Jaworski, Robinson, Matthews, &
104 Croft, 2013; Zeichner & Wray, 2001). The theoretical framework and language of CHAT provides
105 researchers with a perspective for organizing and communicating data about e-portfolios that other
106 methodologies do not necessarily address (cf., Yamagata-Lynch, 2010).

107 Along similar lines, researchers such as Hardman (2005), Jaworski and colleagues (2013), and
108 Mwalongo (2016) **presented** their case for the utility of CHAT as a framework for analyzing and
109 understanding differential perceptions of the use of technological tools in the context of education. These
110 researchers **acknowledged** the usefulness of CHAT in enabling researchers to make sense of complex
111 real-world data sets in a manageable and meaningful manner, capture complexity in its wholeness, as well
112 as to examine specific elements and their contribution to the whole. CHAT, it is suggested, enables student
113 teacher perceptions of the use of technological tools to be analysed and understood with reference to its
114 context.

115

116 **Understanding the Role of E-Portfolios in Facilitating Reflection: A Cultural-Historical Activity** 117 **Theoretical (CHAT) Perspective**

118 Cultural-Historical Activity Theory (CHAT) investigates human activity as being embedded in a
119 specific social context, that has a history and future that is constantly in flux (Worthen, 2008). CHAT utilises
120 the activity system, defined as "object oriented, collective, and culturally mediated human activity"
121 (Engeström & Miettinen, 1999, p. 19) as the unit of analysis. The entire activity system includes the subject,
122 the person engaged in the activity who, motivated towards an outcome, acts on an object using mediating
123 artefacts. Action is constrained by social elements of the system which include the tacit and explicit rules
124 or norms that govern the activity; the community within and for which the activity occurs; and the division
125 of labour – both the horizontal division of tasks and the vertical division of power or status (Engeström,
126 1999). Additionally, three higher-order processes describe the relationships within the system. The
127 relationship between the subject and object is one of *production* of an outcome by the subject, and the
128 *consumption* of that outcome by other subjects in the community. The relationship between the subject and
129 others in the community can be described as being one of *exchange* while the relationship between the
130 object and community is one involving the *distribution* of the outcomes (Roth & Lee, 2007). The activity
131 system is typically represented using the 'activity triangle' (Engeström, 1987, 1993) (see Figure 1).

132 CHAT further exposes contradictions or tensions, within the activity system. Contradictions have
133 been described as "a misfit within elements, between them, between different activities, or between different
134 developmental phases of a single activity" (Kuutti, 1996, p. 34). Contradictions emerge as disturbances,
135 which are visible manifestations of contradictions (Engeström & Sannino, 2010). They are "problems,
136 ruptures, breakdowns, clashes" in activities (Kuutti, 1996, p. 34).

137 Contradictions may appear as (a) primary contradictions within each and any of the nodes of the
138 activity system; (b) secondary contradictions between two or more nodes. They may also appear as (c)
139 tertiary contradictions between a newly established mode of activity and remnants of the previous mode or

140 when activity participants face situations in which they have to use an advanced method to achieve an
141 objective; or as (d) external contradictions between the newly reorganized activity and its neighbouring
142 activity systems (Engeström & Sannino, 2010). An analysis of contradictions reveals why outcomes were
143 not achieved (Divaharan & Lim, 2010), although in some instances, outcomes may be attained due to
144 resolution of the tensions via the creation of expansive solutions (Engeström & Sannino, 2010). In these
145 instances, contradictions act as sources of change and development (Gedera, 2016).

146

147 _____

148 INSERT FIGURE 1 HERE

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150

151 CHAT is a framework or descriptive tool (Nardi, 1996) that allows a move away from a techno-
152 centric perspective to understanding technology as being a part of a larger scope of human activities
153 (Kaptelinin & Nardi, 2006). It enables the gaining of insights into the dynamics of the activity system of a
154 programme, rather than study its components in isolation (e.g., Barab, Barnett, Yamagata-Lynch, Squire, &
155 Keating, 2004). “No tool is good or bad in itself; its effectiveness results from and contributes to the whole
156 configuration of events, activities, contents, and interpersonal processes taking place in the context of which
157 it is being used” (Salomon, 1993, p. 189). Therefore, an examination of the role of e-portfolios and reflective
158 practice in teacher education cannot be viewed apart from the sociocultural contexts within which it is
159 situated.

160 CHAT affords the identification of contradictions in an activity system that helps practitioners and
161 administrators to focus their efforts on the root causes of problems. Such collaborative analysis and
162 modelling is a crucial precondition for the creation of a shared vision for the expansive solution of the
163 contradictions (Engeström, 2000). This is especially important in teacher education, given that the aim of
164 education is usable knowledge or knowledge that is responsive to the current and emerging needs of
165 practitioners and users and ultimately to the solution of professional problems (Richey, 1998).

166 In this paper, we analyze the data to illustrate the enhanced understandings that may arise from
167 employing CHAT. We present a case study of the e-portfolio in its early stages of implementation at Excel
168 (a pseudonym), and a CHAT analysis of the tensions and contradictions that affected student teachers’ use
169 of e-portfolios for reflections. Specifically, this paper seeks to answer the following research questions:

- 170 1. How do student teachers at Excel perceive the use of e-portfolios for reflections?
- 171 2. What are the contradictions that affect student teachers’ use of e-portfolios for reflections at Excel?

172

173 **Methodology**

174 *Participants*

175 28 student teachers enrolled in the Postgraduate Diploma in Education (Junior College) (PGDE-
176 JC) program at Excel, from 2011-2013, participated in the study. The PGDE (JC) is a nine-month program
177 that seeks to prepare graduates to teach at the Junior College level. Prior to the enrolment in the program,
178 all student teachers had obtained at least a Bachelor degree while some had Master degrees. The
179 academic specialization of these student teachers differed depending on which subject they were preparing
180 to teach in Junior Colleges. After their enrolment, all student teachers would go through coursework
181 subjects as well as a field placement called their teaching practicum.

182 *Procedures for Ethical Clearance*

183 Ethical clearance was obtained from the University's Institutional Review Board prior to the conduct
184 of the study. All student teachers enrolled in the PGDE-JC program from 2011-2013 were told about the
185 research study and invited to participate. Written consent from each agreeable participant was sought.

186 *Data Collection Methods*

187 One-to-one and focus-group interviews were conducted with the 28 student teachers. The
188 interviews focused on understanding how and why the student teachers did or did not use the e-portfolio
189 for reflection; as well as whether and how the e-portfolios facilitated the reflective process.

190 Policy papers and documents, presentation slides in task force meetings, minutes of meetings,
191 were referred to, in order to provide contextual information for decisions pertaining to the e-portfolio
192 implementation process.

193 The participants were invited to grant the research team access to their e-portfolios, although not
194 all did so. These student teachers created e-portfolios where possible, to verify contextual information
195 provided in the interviews, and to understand and verify student teachers and the community's engagement
196 in the e-portfolios.

197 *Role of the Researchers*

198 Faculty members of the research team functioned as complete participants throughout the study in
199 their various roles and capacities as members of the implementation committee for the e-portfolio at Excel,
200 as tutors of the student teachers, and as supervisors of the student teachers during their teaching practicum.
201 This provided us with insiders' perspective to the institutional and faculty standpoints on the use of the e-
202 portfolio.

203 *Methods for Maintaining Trustworthiness*

204 Members of the research team vetted the data analyses to ensure trustworthiness. Student
205 teachers' comments were triangulated with informal conversations with the school mentors when the
206 opportunity arose. Perspectives and understandings of the faculty members of the research team were
207 also used to triangulate the student teachers' comments. Methodological triangulation was carried out
208 where possible. Student teachers' perspectives were triangulated with the documents and with their actual
209 e-portfolio activity and artefacts where the data was available.

210 *Data Analysis*

211 The interview data was analysed according to the research questions and utilizing the constant
212 comparative method (Glaser & Strauss, 1967), generally following the procedures for activity systems
213 analysis outlined by Yamagata-Lynch (2010). The data was first transcribed onto Microsoft Excel
214 spreadsheets. The researchers read the interview transcripts to obtain a general sense of the data. Open
215 coding was carried out manually as a form of preliminary analysis. The codes were examined sorted
216 according to similarities and differences. Relationships with other codes, broader categories of codes and
217 sub-categories of codes were identified. Activity system models were drafted by identifying codes and
218 themes that fit into the subject, tool, object, rules, community, and division of labour elements and then
219 taken as the unit of analysis.

220 Larger themes were sought as were their interrelationships with other themes. Connections were
221 made to elements in the systems and analysed for how they inter-relate with or contradict each other.
222 Checks were made to ensure that codes and themes were buttressed by strong evidence from the data set.
223 In this paper, we focus on findings pertaining to student teachers as subjects, engaging in e-portfolio
224 mediated activities in order to attain the object of being a reflective practitioner.

225

226 **Using E-portfolios to Facilitate Reflection: The Case of Excel**

227 Excel is an institution providing initial teacher education in [country – removed for blind review].
228 One of the key objectives of Excel is to cultivate reflective practitioners. At Excel, student teachers go
229 through a rigorous program that equips them with an understanding of general and domain-related
230 pedagogies, as well as the relevant classroom management and teaching skills, but some of them
231 experience difficulties in bridging the theory-practice link. Cultivating their reflective abilities would address
232 this issue to some extent. Furthermore, until recently, there was no means of capturing the extent to which
233 student teachers were able to integrate their learning from the various courses offered, and of gathering
234 evidence for the attainment of their teaching competencies. Finally, there was a need to provide a common
235 channel of communication and sharing for both staff and students within the institution. To address these
236 issues, the e-portfolio was introduced into Excel.

237 An e-portfolio, conceptualized to be developmental in nature, was designed. One of the aims of e-
238 portfolios at Excel was to chart the learning and personal growth of the student teacher through his/her
239 experiences at Excel. It was meant to constitute an electronic collection of authentic and diverse evidence
240 of a student teacher's learning and achievement over time, on which he/she has reflected and designed for
241 personal development, as well as for presentation to audiences for specific purposes. The e-portfolio was
242 referred to as a 'Learning and Teaching Portfolio', to make salient the continuum in its role in charting the
243 development of a student teacher at Excel through to his/her eventual professional development as a skilful
244 teacher and reflective practitioner. Google Sites was adopted as the free open source application-as a
245 platform to host student teachers' portfolios (Authors, 2011 –removed for blind review). A broad framework
246 was given to student teachers to anchor the content of their e-portfolios. Student teachers were given some
247 autonomy in the design of their e-portfolios albeit within the broad framework, and to determine the content
248 to be selected for placement in this platform. The student teachers were granted access to the platform for
249 the entire duration of their program, in the course of which, they were provided with the relevant support
250 and guidance on the use of the e-portfolio and various reflection strategies.

251 The e-portfolio was not formally assessed due to its developmental ideals. The implementation
252 committee felt that the e-portfolio should not be an additional burden on the student teachers. As such, the
253 e-portfolio was conceived to be mainly a tool which supported existing program requirements. Nevertheless,
254 a number of strategies were implemented to ensure the successful integration of e-portfolios into the
255 teacher education program. Tutors were asked to support the integration of the e-portfolio by tying in
256 assignments with the use of the e-portfolio. For instance, they could request that student teachers upload
257 all course assignments onto the e-portfolio. Tutors were also encouraged to comment on the assignments
258 via the e-portfolio. On their part, student teachers were encouraged to upload their learning artefacts onto
259 the e-portfolio and to share them with their peers and their tutors to invite comment. These activities were
260 meant to capitalise on the learning and developmental aspects of the e-portfolio. Nonetheless, it was the
261 student teachers who ultimately had full control over who had access to their e-portfolios and which parts
262 of the e-portfolios were shared.

263 A number of milestone checks were also put in place. To ensure the use of the e-portfolio, student
264 teachers were required to share their e-portfolios with key personnel from both Excel, and in the school
265 where they completed their field placement at two points: before and after the teaching practicum. Before
266 the commencement of the teaching practicum, student teachers were to introduce themselves to their
267 practicum supervisors, school leaders and key personnel, share their teaching philosophies, and what they
268 learned in Excel using their portfolios. After completion of their teaching practicum, student teachers were
269 also required to conduct a formalised sharing session about their practicum experience and what they
270 learned. For the student teachers at Excel, the e-portfolio had to be used for different purposes depending
271 on which stage of the journey they were in and the milestones that they had to meet. Accordingly, their e-
272 portfolios evolved for different purposes beginning from a learning portfolio, to a showcasing portfolio and
273 culminating as an informal certification portfolio.

274 CHAT is used specifically to examine the activity system of using e-portfolios as a tool to mediate
275 the development of reflective thinking capacities in Excel. We conceptualise this activity as involving the
276 individual pre-service teacher engaged in using and uploading various teaching and learning artefacts onto
277 the Google Sites platform as they navigate the e-portfolio implemented at Excel. This process does not
278 occur in isolation but is situated within the sociocultural context of Excel's teacher education programme
279 with norms for participating in the Excel community and expectations and rules for how the student teacher
280 is to use the e-portfolio. A horizontal division of labour depicts how individuals manage the different tasks
281 of using the e-portfolio, as well as tasks involving the co-participation of their peers, tutors, practicum
282 supervisors as well as school leaders and mentors. A vertical division of labour characterizes the power
283 and status differentials inherent in the community between student teachers and their tutors, supervisors,
284 school mentors and school leaders. The activity system of a student teacher using Excel's e-portfolio for
285 reflection is depicted in Figure 2.

286 _____

287 INSERT FIGURE 2 HERE

288 _____

289

290 **Results**

291 **Student Teachers' Perceptions of the Use of E-Portfolios for Reflections in Excel**

292 The student teachers at Excel found the e-portfolios to be potentially useful for mediating and
293 supporting the reflective process. However, primary, secondary and external contradictions were inherent
294 in the e-portfolio activity system and these prevented the full potential of e-portfolios from being realized.
295 These tensions included primary contradictions which existed within (i) the tools of the activity system; (ii)
296 the objects of the activity system; (iii) the rules and (iv) the division of labour. Secondary contradictions
297 were found between (i) the subject and object; (ii) the tool and object; and (iii) rules and object of the activity
298 system. External contradictions between Excel's activity system and those of the national schools and the
299 larger educational context were also identified.

300 To address the first research question, student teachers were interviewed with regard to their
301 perceptions of how the e-portfolios supported or constrained their reflections. Data analyses showed that
302 many of the student teachers perceived the e-portfolio to be useful for reflective thinking. For instance,
303 this was encapsulated in TPS's statement:

304 [The e-portfolio] "...taught me to be reflective... When doing the eP, that one came to me
305 very strong, all the time I need to be reflective. That's the greatest benefit. And it is helpful."

306 Student TSH presented a similar view:

307 "...this allows me to reflect my learning in Excel... It helps me to reflect on my teaching
308 practices..."

309 The student teachers explained how they felt reflection occurred. Firstly, the process of e-portfolio
310 construction provided an impetus for them to sit down and reflect. They explained that it was
311 through the process of construction and looking back at their e-portfolios that reflection was
312 facilitated. The process of selecting artefacts for uploading and thinking about what they wanted
313 to communicate through the e-portfolio was highlighted in particular:

314

315 LT describes it as such:

316 “...to sit down and reflect what is useful to put in and what you think you are trying to tell
317 people. And then is it necessary to write a short explanation to the things to put up? And
318 also to really sit down and think of what you are trying to show through e-portfolios. Is it to
319 show that you have been very professional, knowledgeable and competent about
320 teaching?... So you look back what you have uploaded before, and also it helps you to
321 reflect to think how should I use this artefact in the class. I play like recall, reflecting, recall
322 and reflecting. It actually integrates what you have learned in Excel into actual class.”

323 The responses of TPS, TSH and LT suggest that e-portfolios functioned as a tool that mediated
324 their reflective thinking capacities.

325

326 **Primary Contradictions**

327 In spite of this, there were several contradictions inherent in Excel’s activity system that negated
328 the potential of the e-portfolios. These pertained to (i) tensions among different tools; (ii) tensions among
329 multiple objects; and (iii) and conflicting expectations and roles within the activity system.

330

331 **Tensions among Different Tools for Mediating Reflections**

332 The student teachers recognized that e-portfolios could support reflections by acting as a “platform”,
333 a “space” for penning down and consolidating their thoughts. Nevertheless, some of them questioned the
334 e-portfolio as a useful tool for reflection and suggested that oral reflections with their mentors and even just
335 the plain informal process of thinking privately were equally effective tools for reflections. Another student
336 teacher mentioned that like a diary, she preferred the paper to the electronic format for reasons such as
337 privacy. In comparison to the other modalities, the e-portfolio presented additional steps and tasks. To the
338 student teachers, reflections could technically occur anywhere and the objectives could be fulfilled with or
339 without the e-portfolio.

340 In the focus group discussions, student teachers B and Bb described how the reflective process
341 was more innate for them. Drawing on their practicum experiences, they described how although they
342 reflected after each lesson, it was an “innate process”, and so “in that respect, the e-portfolio was side lined.”

343 These responses highlight the primary contradictions between e-portfolios and the more primitive
344 forms of reflections by pen and paper, oral reflections and informal reflections which were more traditionally
345 accepted and required less effort. The process of reflection could be mediated by any of these tools and
346 not necessarily that of the e-portfolio. These alternative tools acted as a form of competition with the e-
347 portfolios.

348

349 **Tensions among Multiple Objects**

350 The data further alluded to contradictions amongst the objects of the activity system. Student
351 teachers questioned the main intent of the e-portfolios and highlighted the inherent incompatibility between
352 the multiple purposes of the e-portfolio adopted at Excel. They made specific references to incompatibilities
353 between the reflective intent of e-portfolios and that of archiving and aggregating their learning. Depending
354 on how they interpreted the use of the e-portfolio, the student teachers either “uploaded everything” –
355 treating the e-portfolio as a “dumping ground for assignments” or they “selected some” artefacts and
356 accompanied these with carefully considered rationales for selection. As AXS describes it:

357 “...I feel that just uploading the assignments, it’s like showcasing something. It’s like that
358 since you have done something, then you just put it up. That’s what some people were
359 doing. Some people would just dump assignments up there. It is not a thought process
360 whereby you think through the modules...”

361 At the same time, student teachers also felt that the aim of showcasing was in tension with the
362 notion of reflecting with e-portfolios. The aims seemed fundamentally incompatible because to the student
363 teachers, reflections were meant to be authentic; whereas using the e-portfolio for showcasing purposes
364 required purposeful choosing of what they wanted to showcase, customized for a “target audience”. For
365 student teachers at Excel, the target audience included school leaders and other mentors who would be
366 their future employers and seniors. Consequently, student teachers viewed the use of the e-portfolio for
367 showcasing purposes as a “boasting process”.

368 Those who uploaded authentic reflections and all their artefacts were not willing to share because
369 “people [would] make assumptions which may or may not be true”. After all, the e-portfolio was “official
370 [and] not personal”. True and authentic reflections the student teachers believed, “occur[red] in the context
371 of discussion, in the context of trust” and occurred better in the context of discussion with more
372 knowledgeable others like their school mentors, as opposed to using the e-portfolio. This need for trust
373 lends support to Xu’s (2003) findings that an environment of trust is essential for student teachers to use e-
374 portfolios for reflections.

375

376 **Conflicting Expectations and Roles**

377 Conflicting rules and divisions of labour were found to exist within Excel’s e-portfolio community.
378 There were differences in expectations between the teacher educators at Excel, the supervisors of the
379 teaching practicum, and staff members of the student teachers’ practicum school. While it was “a
380 requirement” for successful completion of teacher training at Excel, the mentors and school leaders of the
381 practicum school did not make it compulsory. In fact, in many cases, it was not required.

382 Contradictions were found between the roles played by the different parties in Excel’s e-portfolio
383 activity system. At Excel, student teachers were asked to upload their learning artefacts and to then share
384 them with peers and tutors to invite comment. Tutors were encouraged to play the corresponding role of
385 tying in assignments with the e-portfolio and then commenting on the assignments.

386 As part of the milestone checks implemented to ensure the integration of e-portfolios into the pre-
387 service teacher education program, student teachers were required to introduce themselves to their
388 practicum supervisors, school leaders, key personnel and mentors within the school. They were to also
389 share their teaching philosophies, and what they learned using their e-portfolio before the commencement
390 of the teaching practicum. After completion of their teaching practicum and before the completion of the
391 entire pre-service training program, student teachers were also required to conduct a formalised sharing
392 session about their practicum experience.

393 Supervisors of the teaching practicum met with student teachers before they were posted out to
394 schools. During this meeting, student teachers were required to grant access to and present their
395 completed e-portfolios to their supervisors. Most supervisors, with a few exceptions, required the student
396 teachers to do this.

397 The plan was that student teachers would similarly share their e-portfolios with the school leaders,
398 key personnel and mentors, subsequent to being posted to schools. But in reality, this was hardly ever
399 necessary. When sharing and presentations were initiated in schools, it was either in the form of
400 PowerPoints or informal oral sharing. The student teachers generally felt that school members were “not
401 interested” in the specifics of the e-portfolio and “did not ask for it”. In the context of the schools, the e-
402 portfolio was a “good to have. Whether you have it or not they will not check” (student teacher AC). Schools

403 were more interested in the practical aspects of teaching, whether the student teachers were able to deliver
404 the lesson, and thus the student teachers perceived the e-portfolios to be lacking utility in schools. As two
405 student teachers expressed it, “the people in school are not interested”, “as for the school’s requirement,
406 the e-portfolio is basically nothing”.

407 AC explained why although she did reflect, she did not use the e-portfolio as a tool for reflection
408 during practicum:

409 AC: Because a lot depends on the requirement by your [practicum] supervisor and
410 school. From the school I was in, we didn’t exactly do reflection on the e-portfolio. It was
411 not the requirement. So what we do we have our own reflection, after the lesson plan, we
412 have a page for reflection. And that is where we do our reflections. So the e-portfolio is
413 totally not in the picture.

414 From a CHAT perspective, tensions within the rules and division of labour in the activity system
415 negated the attainment of the object of reflection mediated by the e-portfolio. The leaders, key personnel,
416 and mentor were seldom actively involved in the e-portfolio process.

417

418 **Secondary Contradictions**

419 Data analyses further revealed secondary contradictions in Excel’s activity system. Specifically,
420 contradictions and tensions between (i) the subjects’ motives and the object of the activity system; (ii) the
421 nature of the tool and object; and (iii) rules and object of the activity system.

422

423 **Tensions among Subjects’ Motives and the Object**

424 Although one of the main purposes of introducing the e-portfolio at Excel was to act as a tool for
425 facilitating reflection, not all student teachers adopted the same objective. For the student teachers, their
426 main objective was to get their e-portfolio done so as to clear this module. Their motive was to complete
427 the e-portfolio as quickly as possible, particularly since the e-portfolios were not graded. As a result, student
428 teachers did the e-portfolio for the sake of doing it. When all the assignments were due at the same time
429 nearing the end of the semester, the student teachers made the practical decision to focus on their graded
430 assignments. Although the e-portfolios were intended to foster reflections and the student teachers were
431 encouraged to think about what they learned, many of them “didn’t touch [their] e-portfolios” till the very end
432 and finished all their reflections in a day or a few days. Some student teachers only started before they
433 were to go out to schools for practicum. For these student teachers, they “didn’t touch their e-portfolios”
434 while undergoing initial teacher training at Excel. Contradictions between the motive of the subject and the
435 object of the activity system were thus evident.

436 AC: So all of us just do the minimal and just submit the e-portfolio...we just don’t have
437 time...on top of assignments. This was always the least priority...

438

439 **Tensions between the Nature of the Tool and the Object**

440 The student teachers alluded to secondary contradictions between the tool and the object of the
441 activity system at Excel. They indicated that they were wary about using the e-portfolio for reflective
442 purposes. LWX stated how he would not upload artefacts nor reflections on the e-portfolio and even if he
443 did, he would keep it private. “I don’t want everyone to read personal posts”. Similarly, AXS mentions that,
444 “whatever I put in here are the things that I feel comfortable with my colleagues.” In fact, one student

445 teacher mentioned, that like a diary she preferred the paper format not the electronic. “I prefer the diary
446 format, rather than the blog format.” The e-portfolio was a platform open on the World Wide Web and the
447 student teachers were worried about the “scary leak of information”. They described the online world as
448 “dodgy”. The student teachers perceived tensions between the personal and closed nature of their
449 reflections as opposed to the open nature of the e-portfolio on the online world.

450

451 **Tensions among the Rules and the Object**

452 Student teacher, AXS, alluded to contradictions between the rules and the object of the activity
453 system which was to foster reflections. AXS talked about the requirement for them to upload their
454 assignments in every module. From an institutional perspective, this requirement for the student teachers
455 to upload their assignments, stemmed from the fact that the e-portfolio at Excel was meant to be a tool that
456 supported existing program requirements rather than act as an additional burden. Therefore, tutors were
457 asked to support the integration of the e-portfolio into the course by having student teachers upload
458 completed course assignments onto the e-portfolio.

459

460 However, AXS felt this mere uploading, was antithetical to reflection.

461 AXS: “I believe [the e-portfolio] can be a good platform which serves a good purpose of
462 reflection...it actually helped me to consolidate my thoughts, helps to remind me why I am
463 becoming a teacher...But I don’t think this should be used as just a site for storage of
464 assignments. Because I feel that in every module they just ask you to upload your
465 assignments. And if generally I just upload my assignments, it serves no purposes. It’s
466 like I am just giving you a link to my assignments. So if e-portfolio is used for that purpose,
467 then I don’t think it is useful...

468

469 **External Contradictions**

470 Responses from the student teachers alluded to external contradictions between Excel’s activity
471 system and those of the national schools and the larger educational context.

472 The student teachers observed that schools in the nation, used a “different platform” for their e-
473 portfolios instead of Google Sites, while still others were using hardcopy portfolios. A few student teachers
474 described how their mentors were using hard copy portfolios and kept their own portfolios in a thick ring
475 bound folder. As such, they wondered about the continuity and usability of the e-portfolio they had created
476 while at Excel. Although Excel’s learning and teaching portfolio was meant to be one that the student
477 teachers could take into their teaching careers, the context of the schools did not support the e-portfolios
478 nor student teachers’ reflections with it.

479 This contradiction between the tool situated in the activity system of Excel differed from the tool of
480 the school’s activity system and is mentioned by M:

481 M: I still believe e-portfolio is too standalone... Haven’t seen the real incorporation
482 into the school’s IT website or system...

483 Although at Excel, there were considerations of and plans for future integration with the platforms used in
484 schools, this had not yet materialized. Different tools were used in the different activity systems within
485 which the student teachers functioned without a sense of continuity.

486 See Figure 3 for Contradictions in the E-Portfolio System at Excel.

487

488 _____

489 Insert Figure 3 here

490 _____

491

492 **Discussion**

493 The present study examined student teachers' perspectives on the role of the e-portfolio in
494 developing reflective thinking abilities at Excel, using the CHAT framework. It showed that student teachers
495 perceived the e-portfolio to have potential in developing reflection. Consistent with the literature, student
496 teachers felt that the process of constructing the e-portfolio provided implicit opportunities for them to
497 engage in reflective thinking as they selected their artefacts, rationalised the selection process and decided
498 upon the artefacts to include and for what purposes. Explicit opportunities for reflection also took place from
499 the reflective pieces that they had to write and include in their e-portfolios (e.g., Barrett, 2007; Bartlett, 2008;
500 Loughran & Corrigan, 1995; Retallick, 2000; Seldin & Associates, 1993; Stansberry & Kymes, 2007).

501 Despite the potentials and possibilities offered by the e-portfolio, the CHAT perspective uncovered
502 contradictions inherent in Excel's e-portfolio activity system that negated student teachers' use of the e-
503 portfolios for reflection. The study found contradictions existing on three major levels: primary, secondary
504 and external.

505 Inherent primary contradictions were found between the tools that mediated reflections.
506 Specifically, there were tensions between e-portfolios as a mediating tool for reflection and the more
507 traditional tools of reflection, such as pen and paper, oral discourse, metacognitive processes and private
508 speech which were considered less effortful and more spontaneous. The student teachers felt that
509 reflection could be mediated by any of these tools and was not necessarily limited to that of the e-portfolio.
510 By instituting the e-portfolio as a tool for reflection, the student teachers felt compelled to reflect with it. The
511 literature that discusses the nature and consequences of using e-portfolios as opposed to traditional paper
512 and pen portfolios is currently scant and ambiguous (Zeichner & Wray, 2001). CHAT suggests that this is
513 an important line of research to explore as tools that are more primitive may compete with more advanced
514 tools in the e-portfolio activity system. Research should also make comparisons between reflecting with
515 different modalities including the oral and metacognitive, the formal and the informal, so that the most
516 effective and efficient form may be utilised.

517 Primary contradictions were found between the multiple objects of the activity system. The student
518 teachers questioned the main intent of the e-portfolios at Excel and highlighted the incompatibility between
519 the different purposes of e-portfolios at Excel. Namely, its functions of reflection versus aggregating and
520 archiving, and reflection versus that of showcasing. The perceived incompatibility and tension between the
521 various objects of the activity system is an issue commonly raised in the existing literature. Oakley, Pegrum,
522 and Johnston (2014) for instance, [noted](#) that despite efforts to make it clear to them, student teachers found
523 it difficult to grasp the idea that the e-portfolios had multiple purposes and that these would change over
524 time. Numerous other studies have discussed the conflicting nature of multipurpose e-portfolios, since they

525 simultaneously served as tools for learner reflection and growth, for evaluation and assessment, and/or for
526 marketing and employment (e.g., Hallman, 2007; Oakley et al., 2014; Snyder et al., 1998; Strudler & Wetzel,
527 2011; Tzeng & Chen, 2012; Wray, 2008). Researchers **differed** in how best to address this issue. While
528 some **were** in favor of using separate portfolios for different purposes (Oakley et al., 2014; Zeichner & Wray,
529 2001), others **suggested** that student teachers should be explicitly prepared to be shape-shifters. Student
530 teachers should be taught to tap on the affordance of technologies and tailor their electronic portfolios for
531 multiple views and audiences (Strudler & Wetzel, 2011).

532 Contradictions within the rules and division of labour in Excel's activity system negated the
533 attainment of the object of reflection mediated by the e-portfolio. There was unequal involvement of the
534 various stakeholders in the e-portfolio process. While milestone checks were implemented at Excel, and
535 most of the tutors and practicum supervisors from Excel were involved in using the e-portfolio, there was
536 little follow up of the e-portfolio initiative from school leaders, key personnel and mentors. Consequently,
537 the student teachers did not consistently use the e-portfolio when in schools. The findings suggest that in
538 addition to stakeholders in teacher education institutions, the buy-in and a culture supporting e-portfolios in
539 schools is equally necessary. The situation further warrants a model of practicum and supervision tightly
540 integrated with the e-portfolio and closely aligned to its intent (e.g., Xu, 2003; Zeichner & Wray, 2001).

541 Although the intent was for the e-portfolio to facilitate reflections, not all student teachers at Excel
542 adopted the same objective. For the student teachers, their main aim was to complete the e-portfolio as
543 quickly as possible, since it was not graded. This situation was especially pronounced when the student
544 teachers had to juggle many other graded assignments. Many of them only worked on their e-portfolios at
545 the end and completed them in a matter of a day or a few days, rather than reflecting on what they had
546 learned in a progressive manner. Secondary contradictions were thus found between the object and
547 subject of the system.

548 The experiences raised by the student teachers here reflect the struggles faced by teacher
549 educators who struggle with getting student teachers to work on their portfolios over time rather than
550 engaging in the common practice of putting it all together at the last minute (Zeichner & Wray, 2001). One
551 way to deal with this is to ensure that there is buy-in from students, and that the e-portfolio is not too
552 overwhelming (Strudler & Wetzel, 2011). Furthermore, according to these respondents, the ungraded e-
553 portfolio was competing with the other numerous graded assignments. In a cost-benefit analysis therefore,
554 the e-portfolio must emerge as worthwhile for the student teachers to embark upon. Another way to deal
555 with this problem is to establish multiple checkpoints from the beginning to the end, and have student
556 teachers present various pieces of the portfolio either to a seminar or class group or to a teacher educator
557 in an individual conference (e.g., Dollase, 1996).

558 A common issue found in the e-portfolio literature is the personal-revelation dilemma (Parker et al.,
559 2012) faced by student teachers and related concerns of access, security and privacy over the Internet
560 (Lorenzo & Ittelson, 2005). Student teachers may not be comfortable with revealing personal issues widely.
561 Furthermore, e-portfolios exploit the Internet, multimedia and the linking capabilities of electronic
562 environments. The student teachers from Excel experienced the same predicament. They raised concerns
563 about uploading personal material or reflections onto the e-portfolio that was hosted on a vulnerable online
564 environment. These findings further support Xu's (2003) observation that for student teachers to use e-
565 portfolios for reflections, an environment of trust is essential. In the digital context, it is important for student
566 teachers to understand who should be accorded access to their e-portfolios, which segments should be
567 made visible and shared, and why. This creates a sense of trust in the student teachers and gives them
568 an assurance of confidentiality which would encourage open and honest entries instead of censored ones
569 (cf., Fawns & McKenzie, 2010; Gannon, Draper, Watson, Proctor, & Norman, 2001). Student teachers
570 should also feel that their personal data, artefacts, and entries are safe, and that they have control over the
571 privacy of their information (cf., Beetham, 2005)

572 Student teachers at Excel alluded to contradictions between the rules and the object of the e-
573 portfolio activity system. At Excel, there was a requirement for them to upload their assignments in every

574 module. The reason for this was that the e-portfolio was intended to support and complement existing
575 program assignments. It was not meant to create additional work. But student teachers found this process
576 of mere uploading to be antithetical to reflection. The present study reinforces current findings on e-
577 portfolios in teacher education namely that the e-portfolios by themselves are merely storage spaces. It is
578 only when they are specifically designed to support reflective thinking that they have real pedagogical
579 benefits (Riedinger, 2006). There is thus a need to pay attention to creating and deploying key learning
580 activities that use e-portfolios effectively (Doig, Illsley, McLuckie, & Parsons, 2006). Blakely (2016)
581 suggested that, for the e-portfolio to fully realise its potential in bringing about reflective thinking, we need
582 to encourage students to meaningfully and deliberately view learning as a developing process and their
583 reflections as depictions of these processes. “The e-portfolio can provide the space and occasion for such
584 an understanding when it functions as more than merely a storage space and when accompanying curricula
585 and pedagogy invite students to become self-aware learners through the powerful potential of their
586 reflective work” (p. 139).

587 Excel’s e-portfolio was perceived to be too isolated from the activity system of national schools,
588 thus highlighting external contradictions between Excel’s activity system and those of the national schools
589 and the larger educational context. Student teachers reported that the schools to which they were posted,
590 either used different platforms or hard copy portfolios. Despite the goal of having the student teachers take
591 their e-portfolios into their teaching careers, the student teachers reported a sense of discontinuity between
592 what was happening in Excel and in schools. This finding highlights Xu’s (2003) point about the need to
593 build up the momentum triggered in pre-service teacher education and continue to promote reflective
594 practice and professional growth using the e-portfolio even as they become accredited teachers. In addition,
595 the results of this study suggest that the data on the e-portfolio platform should be easily portable and the
596 structure of the platform should remain essentially the same. Research should examine the range of
597 conditions supporting the transfer of e-portfolios from teacher education to the school context, and how
598 best to make it work.

599

600 **Implications and Conclusions**

601 CHAT provides us with the parameters for consideration and a compass as to how to better situate
602 e-portfolios within the activity system of Excel specifically, and teacher education more broadly, so as to
603 better develop reflectivity. The data from this study suggests that good practices for the implementation of
604 e-portfolios in teacher education could be described by the following principles:

- 605 (i) The technology used to support e-portfolios should be user friendly, collaborative, secure, and
606 ensure that e-portfolio data be easily transferred across platforms. Users should be made
607 aware of these features and assured of confidentiality.
- 608 (ii) E-portfolio platforms should be compatible with mobile technologies. E-portfolio platforms
609 should be compatible with applications for photo-taking, voice-recordings and allow for easy
610 direct uploads. In this way, oral reflections can occur on the fly with one’s phone recorder and
611 then easily uploaded onto the e-portfolio. This would minimise tensions between reflecting
612 informally and orally versus reflecting using written forms in the e-portfolio.
- 613 (iii) The e-portfolio should minimise repetitive work and enable student teachers to use it for
614 multiple purposes separately and for different audiences without have to deal with tensions.
615 For instance, the e-portfolio platform could be synced with assignment submission courseware
616 which reduces student having to upload the same assignments and artefacts separately onto
617 multiple platforms. At the same time, it should allow student teachers to customise the content
618 for various audiences, while maintaining the main database backend.

- 619 (iv) Student teachers should be informed as to who should have access, which segments should
- 620 be made available and the rationale. Student teachers should have some prerogative to decide
- 621 which aspects of the e-portfolio are shown to who and when.
- 622 (v) Staff must fully integrate e-portfolios into their curriculum, pedagogy and assessment and not
- 623 just use it as an add-on.
- 624 (vi) E-portfolios must be deemed as worthwhile as graded assignments.
- 625 (vii) Expectations and roles between teacher educators and educators in school should be aligned
- 626 with regard to the e-portfolio. Buy in from all parties involved, including student teachers, and
- 627 a strong supportive culture for e-portfolio use.
- 628 (viii) The e-portfolio platform used in teacher education should be compatible with those used in
- 629 schools and in professional development programs. There should be an overall culture of e-
- 630 portfolio use in the field of education.

631 The above considerations are not all new, and mirror what researchers have been separately
 632 advocating in the literature (e.g., Barrett & Knezek, 2003; Challis, 2005; Jimoyiannis, 2012; Klenowski,
 633 Askew, & Carnell, 2006). But they enable us to speculate on what could be possible expansive solutions
 634 to current issues that have yet to be satisfactorily resolved. In a White Paper on “Reinventing ePortfolio
 635 Technology and Practice”, Serge Ravet (2016) [proposed](#) exploring the use of the blockchain, a public,
 636 distributed ledger, as a candidate for the next generation of e-portfolio technologies. Ravet [made](#) the case
 637 that the emergence of the blockchain technology and its attendant ledger-based e-portfolio, is a great
 638 opportunity to address many of the challenges that are currently being faced.

639 According to Ravet (2016), as compared with current e-portfolios, ledger-based e-portfolios:

- 640 (i) Provides a single entry point to all services and parties and offers a unified view of one’s
- 641 universal repository
- 642 (ii) Provides a repository from which the owner can customise a range of e-portfolios for various
- 643 purposes
- 644 (iii) Offers seamless interactions between individual, collective and institutional e-portfolios and are
- 645 distributed under the full control of their owner
- 646 (iv) Offers interoperability between different e-portfolio platforms, personal learning spaces,
- 647 institutional systems and the rest of the world thus facilitating the building of a community of
- 648 learners and a community of practice (see also Albion, 2008)
- 649 (v) Facilitates the authoring of powerful reflection through in-built technological scaffolds
- 650 (vi) Removes tedium by making e-portfolio authoring pleasurable and creative though automated,
- 651 in-built applications and services
- 652 (vii) Offers privacy and anonymity

653 It seems that this new open and distributed architecture could be an expansive and transformative solution
 654 to the contradictions and tensions encountered in the integration of e-portfolios into Excel and elsewhere,
 655 and should be tried and tested.

656 A CHAT analysis of the use of e-portfolios rejects the view that e-portfolios can be studied in
 657 isolation. Instead, CHAT advocates the view that it must be studied within the learning environment and
 658 the broader social cultural context in which it is situated. CHAT suggests that we need to target the activity
 659 system in its entirety.

660 A more holistic and integrated approach towards the study of e-portfolios is offered by CHAT which
 661 utilizes the activity system as a unit of analysis and offers the notion of contradictions to understand
 662 disjunctures. Contradictions and tensions within the e-portfolio activity system need to be identified and
 663 resolved before e-portfolios can be effectively used to achieve its aim of developing reflective thinking.

664 By identifying these contradictions, the field of vision for researchers is enlarged. Instead of
665 studying only the outcomes, it enables attention to be accorded to the roots and origins of problems, which
666 enable further understanding of why certain initiatives cannot be fully brought fruition (Bonneau, 2013). It
667 suggests that the framework allows us to study and document both the successful and tension-based areas
668 of e-portfolio adoption in teacher education which arises from the wider social context. From these
669 discussions, a systematic research agenda and holistic comprehensive intervention can then be generated
670 for policy and practice in the educational community both nationally and internationally. The contradictions
671 and challenges found in this study, we believe, will not only apply to our sample student teachers, but also
672 be relevant to teacher education as a whole. Such a study will inform policy makers, school administrators,
673 teachers and teacher educators about how to take up the affordances and address the limitations of e-
674 portfolios, how to successfully integrate and implement e-portfolios in teacher education, and how to provide
675 tailored demonstrations and trainings to institutions of teacher education around the globe. It also provides
676 a roadmap for the exploration of expansive solutions in the future. A CHAT perspective to e-portfolios
677 should therefore be further explored.

678 The current study is limited by its primary reliance on self-reported, perception data. Future
679 research should seek to mine the data from e-portfolio artefacts for actual levels of reflection. Links between
680 the process of e-portfolio construction and its relation to reflection levels should be explicitly examined
681 (Cáceres, Chamoso, & Azcárate, 2010; Orland-Barak, 2005). This is in keeping with Zeichner and Wray's
682 (2001) recommendation that, we need to learn more about the actual nature and quality of reflection that
683 emerges under different conditions of portfolio use.

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