Emotions and Networked Learning

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Abstract
Emotions in networked learning have been underresearched despite their importance. The present research is one of the first few attempts to better understand adult learners' emotional experiences in a specific networked learning context—an online doctoral programme designed and organised based on networked learning principles. This paper takes the initial step of unpacking the intricate interplay between emotions and networked learning experiences, utilising a longitudinal, mixed methods research approach to demonstrate the diversity and complexity of emotions experienced in networked learning situations. Online doctoral students (n=48) completed a questionnaire four times during the first six months of their PhD program, with an interval of five to six weeks. This is the most critical period for students to develop multiple connections promoting networked learning both within and outside the programme. They connected to new people, ideas, and resources, becoming an integral part of learning networks. The questionnaire quantitatively measured the intensity of 36 different emotions felt by each student, respectively, about their networked learning experiences and general life experiences. Participants also qualitatively reflected on the most intense emotions and wrote "why" they felt such ways. Based on quantitative data, a principal component analysis extracted five meaningful clusters of emotions and repeated-measures ANOVAs further showed meaningful patterns and changes in those emotions. The qualitative data was analysed using a constant comparative method to identify dominant themes to provide deeper insights into student emotions. Findings suggest that emotions are in a constant state of flux, reflecting the multifaceted nature of networked learning experiences, through which learners juggle multiple responsibilities and connections across different times and spaces. Two distinct categories of emotions emerged: positive and negative. Despite the challenges and complexities of online doctoral studies, positive emotions remained resilient, underscoring networked learning as a source of inspiration—with the heightened 'Intrigued' component at specific learning milestones. Negative emotions are nuanced, with negative cognitive emotions, associated with networked learning experiences, intensifying initially and decreasing as students adapt; while negative gut reactions are more prevalent in general life. However, a notable release of negative cognitive emotions in general life suggests the interplay between emotions arising from networked learning and their influence on students' broader experiences. Surprisingly, the study challenges assumptions about isolation in online learning, revealing a consistent sense of social inclusion and support within the learning network. Overall, this study provides a comprehensive understanding of emotions in networked learning, offering valuable insights for supporting adult learners.

Keywords
Emotions; networked learning experiences; mixed-methods; online doctoral programme; isolation

Introduction

Learning is, and should be, an essential part of adult lives in today's society, facing complex global challenges that require professionals to continuously acquire new knowledge, skills, and perspectives. Networked learning in flexible formats is often the only way adult professionals can legitimately and securely participate in learning and develop themselves (Littlejohn et al., 2019). Networked learning is experienced through engaging with multi-layered connections "between people, between sites of learning and action, between ideas, resources and solutions, across time, space and media" (NLEC, 2021). The process of networked learning, in which individual learners actively participate as living elements within dynamic and fluid connections, constantly shaping and reshaping these connections, can lead to both positive and negative experiences. Higher education institutions have been called upon to transform and function as networks themselves to better accommodate the needs and circumstances of adult learners engaged in networked professional learning (Nørgård et al., 2019). Nevertheless, no matter how flexible and accommodating educational institutions are, adult learners (and teachers alike) who need to navigate diverse responsibilities and complex relationships entailed in those responsibilities feel a range of different emotions while engaging with networked learning practices. Those emotions, in turn, significantly affect the quality of their networked learning experiences and shape their perspectives on themselves and others.
Therefore, this article conceptualises networked learning as an emotional and fundamentally ontological process in which individuals belong to certain connections (and often intentionally, not belonging to the other connections).

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Considering the inclusivity of entities that constitute connections in networked learning, it's crucial to acknowledge that all adult learning is inherently networked and, ultimately, emotional. In the general field of education, there has been a long-standing separation between emotion and cognition. This separation has often prioritised 'thinking' over 'feeling'. Traditionally, learning was perceived as a cognitive process that primarily (if not exclusively) involved learner cognition, reasoning, and brain functions, while emotion was oppositionally considered irrational, erratic, and irrelevant to learning; thus, emotion needed to be controlled and removed from learning situations (O'Regan, 2003). Consequently, the critical roles of emotions in learning experiences and outcomes have largely been neglected (Cleveland-Innes & Campbell, 2012).

Networked learning scholars have already shed light on the inseparability between social-material-digital realms of today's educational landscapes, as all learning experiences, whether online or offline, are physically situated in learners' everyday lives (NLEC, 2021). Some have rightly brought the bodily embodied and lived learner experiences in networked learning environments to the forefront of academic conversions in the field of networked learning (Dohn et al., 2020; Fawns, 2019; Gourlay & Oliver, 2018). Embracing the physicality of learner experiences beyond the mind-body binary inevitably questions the neglect of emotions in educational research. Despite the increased awareness of the physical nature of networked learning, networked learning researchers, like other educational researchers, have more frequently focused on the cognitive aspects of learning. Even the researchers interested in the relational aspects of networked learning experiences have mainly investigated learners' perceptions rather than emotions. Such observation can be validated by the fact that networked learners' emotions have not been featured as a main subject in networked learning literature, with a couple of exceptions. Maree Stenglin (2016), in her chapter entitled *Building bridges: Design, emotion, and museum learning*, has explored museums as place-based spaces for networked learning, focusing on the entanglement of people and things and discussing the role of mobile technologies in reshaping museum spaces and learner experiences. The chapter points out that Carvalho and Goodyear's (2014) architectural framework, albeit comprehensively explains "what learners actually do—both "mentally and physically" (p. 132), does not include "emotion and the impact of emotion on learning and learning design" (Stenglin, 2016, p. 132). It may be because "emotions" were commonly perceived as inaccessible and impractical as a subject of academic inquiry due to their subjective and private nature.

Acknowledging Stenglin's earlier attempt both to problematise a lack of emotional considerations in networked learning scholarship and to observe emotional relationships between learners and (museum) spaces when connected through mobile tools, the present authors also delve into the profound importance of emotions within networked learning environments. This paper takes the initial step of unpacking the intricate interplay between learners' affective states and learning experiences, significantly influencing the quality of learning outcomes. It aims to demonstrate the diversity of emotions experienced by adult learners in networked learning situations. The authors' exploration has been situated in the first author's own pedagogical context, an online doctoral programme, which has been designed and organised by a team of networked learning researchers and advocates (see Lee & Bligh, 2023). Over the past decade, there has been a rapid increase in the number of online doctoral programmes established to accommodate the growing demand for doctoral studies among adult learners worldwide, many of whom have additional professional and social responsibilities (Berry, 2017; Kumar & Dawson, 2018; Rockinson-Szapkiw et al., 2019). While the physical distance from their university of study (and often, the country of study) allows adult learners to pursue PhDs without sacrificing other aspects of their lives, it also poses additional and unique challenges to students struggling to juggle multiple responsibilities (Lee, 2020a). The specific doctoral programme under investigation in this article is carefully designed to assist learners in navigating these challenges— by promoting and facilitating the creation of strong and explicit connections, including those between "one learner and other learners, between learners and tutors; between a learning community and its learning resources" (Goodyear, Hodgson, & Steeples, 1998, p. 2).

Considering that adult learners' emotions are volatile, continuously and frequently changing throughout their networked learning processes, the present research applies a longitudinal perspective, measuring learners' emotions four times across six months. As we embark on this exploration of the heart of networked learning, it is imperative to emphasise that emotions are not ancillary to the learning process but rather integral to its very fabric. Understanding and harnessing the emotional undercurrents within networked learning holds the key to unlocking its full potential, ensuring that learners not only acquire knowledge and skills but enact and contribute to the emancipatory agendas of networked learning (NLEC, 2021).

Three research questions have guided this study as follows:

- What are the emotions experienced by a group of adult students during the first six months of their online PhD programme, fostering and facilitating connections for networked learning?
- How have the emotions experienced by the group shifted, changed, or remained the same during the six months of the programme?
- How are the emotions experienced by the group while engaging with networked learning experiences different from their emotions in general?

Literature Review

In the networked learning community, discussions about emotions have been noticeably scarce. This review aims to shed light on the emotional experiences of doctoral students engaged in networked learning. Although no empirical investigation has yet explicitly delved into the emotions arising during online doctoral studies, insights can be gleaned from the existing literature on emotions in traditional campus-based doctoral studies—to reiterate the authors' belief here, under the broad conceptualisation of connections, any learning is fundamentally networked. Undertaking a doctorate has been likened to 'riding the emotional rollercoaster' (Morrison-Saunders et al., 2010). This illustrates the shared understanding of the pivotal role emotions play in the success of doctoral experiences. Doctoral students, regardless of their learning context, navigate a complex tapestry of positive and negative emotions (Prieto et al., 2022). These emotions are multi-faceted and ever-evolving, mirroring the complex challenges inherent in doctoral studies (Anttila et al., 2021; Usher & McCorma, 2021; Weise et al., 2020). While confronting the unique challenges at different stages of their studies, doctoral students engage in significant 'emotion work' to manage and cope.

Studies such as Batty et al. (2020) have explored various learning hurdles faced by doctoral students, their emotional responses (reporting over 30 emotions), and the coping strategies employed for each challenge. They conceptualise their findings as a physical and emotional doctoral journey map. Similarly, Weise et al. (2020) have identified six types of significant events within the academic community context: research process, research communication, resources, opportunities and limitations, personal agency, and personal life. These events elicit three main types of affective responses: positive activation (e.g., joy, enjoyment, hopefulness, delight, and peace of mind), negative activation (e.g., anger, fear, frustration, overwhelming sensations, anxiety, anguish, helplessness, and confusion), and deactivation (e.g., boredom, loneliness, sadness, disappointment, and despair). Anttila et al. (2021) conducted international comparative research involving 272 doctoral students and identified six positive emotions (self-efficacy, enthusiasm, gratitude, satisfaction, belonging, and relief) and ten negative emotions (frustration, anxiety, insecurity, shame, sadness, disappointment, inefficacy, exhaustion, lack of interest, loneliness). Their research highlights the complexity of emotional responses in doctoral studies; not all negative emotions have deactivating effects, and not all positive emotions activate learning motivation and engagement. For example, some negative emotions, like frustration and insecurity, can stimulate and enhance learning motivation, whereas relief can have the opposite effect.

Morrison-Saunders et al. (2010) provide a comprehensive overview of the common emotions experienced by doctoral students at various stages of their studies. At the outset (upon acceptance into the PhD program), students typically experience elation and enthusiasm, although mature students may also grapple with fears related to returning to academic life. The commencement of a research project and the establishment of supervisory relationships can trigger negative emotions such as bewilderment, confusion, and anxiety. Nonetheless, during this early phase, both positive and negative emotions contribute positively to doctoral studies. During the middle phase, negative emotions become more prevalent, driven by diverse challenges encountered while collecting data and reviewing the literature, often perceived as repetitive and isolating. A lack of deadlines and academic routines post-coursework completion, often compounded by additional work or teaching commitments, exacerbates negative emotions such as frustration, boredom, guilt, and loneliness. In contrast to earlier stages, negative emotions are more detrimental in the middle phase of doctoral studies. Finally, the end or writing-up phase intensifies both negative emotions (e.g., fear, frustration, anxiety, boredom, and panic) and positive emotions (e.g., elation and satisfaction). Although students may experience intense satisfaction, relief, and pride upon completing each draft chapter and, ultimately, the entire thesis, multiple factors contribute to intense negative emotions. These factors encompass the fear of failure in the PhD examination, frustration and tension in the relationship with the supervisor and their feedback practice, financial concerns, and challenges in maintaining supportive relationships with non-academic circles.

Other studies have honed in on specific facets of doctoral experiences, including conducting doctoral research, the structure of doctoral studies, available resources, supervision activities, scholarly community engagement, and scholarly development (cf. Anttila et al., 2021). Geng and Yu (2022) examined students' emotional responses to feedback on their academic writing, identifying negative emotions such as anxiety, confusion, and frustration, along with positive emotions like satisfaction, inspiration, and gratitude. Velardo and Elliott (2021) undertook qualitative research with vulnerable populations of doctoral students, revealing emotional responses such as guilt, sadness, empathy, compassion, helplessness, and frustration. In response to these emotions and other overarching pressures (e.g., stress, doubt, heavy workloads, time constraints, poor work/life balance, uncertainty), doctoral students often find themselves compromising either their research or their well-being. Mura and Wijesingh (2022) have observed that doctoral students experience negative emotions like fear and anxiety within today's neoliberal academic context, marked by increased academic competition and individual accountability, leading to stress and depression.

Research has also been conducted into the emotional experiences of less conventional doctoral student groups. For instance, several studies have reported that emotions among mature doctoral students are more intricate and unpredictable than those of their younger counterparts, often influenced by incidents occurring outside their study programmes and hours, such as family relationships (Aitchison & Mowbray, 2013), romantic relationships (Ng, 2017), and work-related burnout (Evans et al., 2021). International doctoral students studying abroad tend to experience distinct emotions, including heightened career aspirations (Sakurai et al., 2017) and fatigue due to international relocation and cultural and linguistic adaptation (Prabawati, 2020). During the recent Covid-19 pandemic, international doctoral students' negative emotions have been notably exacerbated, leading to a sense of displacement (loss of belonging), nostalgia, and guilt due to 'in-mobility' challenges imposed by social distancing measures (Phan, 2022a; 2022b). Kennedy and Gray (2016) provide a rare insight into the emotions of online doctoral students, suggesting that a sense of progression, community interaction, and feedback on assignments are three critical aspects of online doctoral studies that trigger complex, fluctuating emotions. These findings are particularly relevant to the subject of the current study: adult learners in networked learning situations. Although previous studies on the emotions of less conventional doctoral students, there must be unique differences in those in online doctoral programmes designed to facilitate networked learning, which is worth investigating using a more focused approach.

Research Methods

Participants

This study was conducted in the first module of an online PhD programme offered at a UK university. The module runs from January to June each year, with an international cohort of 25-30 new PhD students working collaboratively online. All students are mature adults, most with full-time jobs and families, and about half are international students studying outside the UK. Between 2018 and 2022, a total of 124 doctoral students enrolled in the module; among them, 68 (54%) voluntarily participated in the study. The student participants completed an online questionnaire four times during the module period at an interval of 5-6 weeks. However, only 48 participants (70.5%) fully completed all four surveys.

Thirty-two female and 16 male students participated in the study, representing the gender distribution among the entire student body in the programme. The vast majority of students were between 40-49 years old, followed by 30-39 years old and 50-59 years old. Only one student was between 20-29 years old, and one student was 60 or older, representing the age distribution of the population. Most students had full-time jobs (n = 41), only seven worked part-time, and none were unemployed. Forty students reported having a partner, and eight were single. Finally, more than half of the students had dependents living with them, mostly children (n = 25). These reported outcomes align with the general characteristics commonly shared by online doctoral students in social sciences.

It is important to note that the study period was interrupted by the recent Covid-19 outbreak. Nevertheless, given that the programme had already been designed and operated online in 2018 and 2019, the changes in the module and learning activities were minimal during the Covid-19 pandemic (between 2020 and 2022). However, to improve the validity of the study, we divided the research participants into the pre-Covid cohorts and post-Covid cohorts; the results do not suggest significant differences between the two groups.

Data Collection and Analysis

There was no questionnaire previously developed and readily applicable to our context; thus, we have developed a new one. Having six basic emotions identified by Ekman (1999) as our starting point (i.e., anger, fear, sadness, happiness, disgust, surprise), we included as many emotions as we could find from the literature on doctoral studies to be inclusive. Twenty-three emotional responses expressed by students in online courses (cf. Cleveland-Innes & Campbell, 2012) were additionally reviewed to see if any emotions distinctively experienced by online learners were worth including. As a result, we initially had a list of 52 emotions. However, some of the very similar, or arguably the same, emotions (e.g., fear/afraid and proud/pride) were merged by choosing the one that is likely more relevant to online doctoral studies over the other (i.e., "afraid" over "fear" and "proud" over "pride"). Thirty-six emotions were eventually included in the online survey set up in Qualtrics.

The first part of the main survey asked participants to think about their emotions about their "general lives". Thirty-six emotions were listed with a guiding question: "How intensely, on average, would you say you have experienced each of the following emotions over the past four weeks?". Each emotion was rated by participants on a 7-point Likert scale: 1 = Not at all, 4 = Moderately, and 7 = Extremely. All emotions were presented on the same page using forced responses. The second part of the main survey asked participants to specifically think about their emotions regarding their "networked learning", followed by the same question, 36 emotions, and rating scales as in part 1. In this way, we hoped students could separate the emotions they specifically experienced about learning from other aspects of their lives. After the two rating tasks, two open-ended questions were asked: "If there are any other emotions you have felt when working on your doctoral studies over the past four weeks, then

please specify them here:" and "If you have felt any of the emotions listed/added above very strongly, please explain why". The questionnaire was piloted with the 2017 cohort; as a result, the order (and wording) of some questions were revised before being used in 2018.

A principal component analysis (PCA) was conducted using SPSS Statistics software to extract independent components to reduce the number of dependent variables (DV) from 36 different emotions to a few meaningful clusters of emotions. To address our research question, we separately ran repeated-measures ANOVAs for each DV with independent variables Time (4 levels) and Context (2 levels: emotions about general lives and networked learning) to explore whether the extracted emotion components changed across the six months (four times) and differed between the contexts. At time 1, students were first introduced to the programme, tutor team, cohort members, online learning environment (i.e., Moodle), and learning content. At time 2, students engaged in networked learning activities: online reading and discussions about different elements of qualitative research, while at time 3, students conducted an independent research project with a minimum level of interaction with others. At time 4, students wrote their research report and reviewed each other's draft assignment, sharing feedback. The qualitative data was analysed using a constant comparative method to identify dominant themes to provide deeper insights into the emotional characteristics of networked learning experiences.

Results

Principal component analysis (PCA)

Five independent components were extracted through orthogonal (varimax) rotation, with 62.65% of the total variance explained. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was superb (.93, $\chi^2(630)= 10597.66$, $p < .001$; see Sofroniou & Hutcheson, 1999), showing that factor analysis is appropriate for these data. The table of anti-image correlations showed very high correlations in the diagonal elements (all > .8 when the minimum acceptable should be > .5). However, in the table of commonalities, the lowest amount of variance explained after extraction by the factors was 40% for the emotion 'surprised'. In addition, the table of reproduced correlations (i.e., correlations between observed scores and scores produced by the model) showed all diagonal elements to be > .5 except three: 'surprised' .40, 'entertained' .49, and 'guilty' .42. Therefore, these three emotions were excluded, and the PCA was run again with 33 DVs instead of 36.

Again, five independent components were extracted, with 65.08% of the total variance explained after rotation. KMO was again superb (.94, $\chi^2(528)= 9885.17$, $p < .001$). The diagonal elements in the anti-image correlation matrix were all > .8, and the reproduced correlations were all > .5. The rotation converged in 7 iterations. The first component extracted explained 27.87% of the variance after rotation. The emotions loading on this component were all positive emotions with large loadings of positive sign (all > .62) with specific emotions such as 'encouraged', 'hopeful', 'excited', 'proud', 'satisfied', 'inspired', 'reassured', and 'supported' (see Table 4). Therefore, this factor was labelled *Positive emotions*.

The second component explained an additional 17.29% of the variance after rotation, with negative emotions having large loadings of positive sign (> .59) with specific emotions including 'uncertain', 'anxious', 'uncomfortable', 'incompetent', 'intimidated', 'afraid', 'overwhelmed', 'confused', and 'discouraged'. Additionally, smaller loadings were observed for 'isolated' .43, and the positive emotion 'confident', loading with a negative sign -.44; this latter emotion also loaded on the first component with a larger loading of .66. This second component was labelled *Negative cognitive emotions* given that these emotions have mostly to do with the cognitive appraisal of a situation, rather than instinctive reactions to the given situations. The third component extracted explained 12.02% of additional variance after rotation, with a range of negative, more instinctive emotions (labelled *Negative gut reactions*) showing large positive loadings (all > .52); the specific emotions included 'offended', 'angry', 'disgusted', 'annoyed', 'disappointed', 'sad' and 'neglected'. Additionally, 'discouraged' loaded .43, which also featured on the second component .59.

The fourth component included 'isolated', with a larger loading of .70 than its loading on the second component (.43) and 'neglected', with a loading of .57, in addition to its loading on the third component (.53). This fourth component was labelled I*solation*. Finally, the fifth component featured only one emotion, 'intrigued', with a negative loading of -.45; this emotion also featured in the first component with a larger loading (.62), apparently making an additional independent contribution on this last component labelled *Intrigued*.

Table 1: Component matrix before rotation (left) and rotated component matrix (right)

Component matrix						Rotated Component matrix					
	Components						Components				
	1	2	3	4	5		1	2	3	4	5
Satisfied	0.78					Encouraged	0.84				
Hopeful	0.73					Hopeful	0.82				
Encouraged	0.73	0.44				Excited	0.82				
Happy	0.72					Proud	0.80				
Comfortable	0.70					Satisfied	0.80				
Excited	0.69	0.45				Valued	0.79				
Inspired	0.69					Happy	0.77				
Proud	0.68	0.40				Inspired	0.76				
Motivated	0.68					Reassured	0.73				
Confident	0.68		0.43			Thankful	0.73				
Reassured	0.68					Supported	0.72				
Valued	0.67	0.43				Morivated	0.72				
Supported	0.67					Comfortable	0.70				
Discouraged	-0.66	0.46				Competent	0.67				
Competent	0.61		0.48			Confident	0.66	-0.44			
Thankful	0.59	0.42				Intrigued	0.62				-0.45
Incompetent	-0.54	0.43	-0.41			Uncertain		0.78			
Annoyed	-0.50	0.48	0.42			Anxious		0.74			
Sad	-0.48	0.45				Uncomfortable		0.73			
Afraid		0.61				Incompetent		0.73			
Uncomfortable	-0.52	0.58				Intimidated		0.72			
Uncertain	-0.52	0.56				Afraid		0.71			
Anxious	-0.43	0.54				Overwhelmed		0.70			
Overwhelmed	-0.42	0.52				Confused		0.69			
Intrigued	0.42	0.49				Discouraged		0.59	0.43		
Confused		0.48	-0.41			Offended			0.81		
Disappointed	-0.44	0.46				Angry			0.77		
Intimidated	-0.44	0.45	-0.45			Disgusted			0.74		
Angry	-0.49	0.42	0.54			Annoyed			0.70		
Offended		0.43	0.51	-0.41		Disappointed			0.65		
Disgusted			0.41			Sad			0.52		
Isolated	-0.42				0.53	Isolated		0.43		0.70	
Neglected	-0.49	0.42			0.50	Neglected			0.53	0.57	

Pricipal component analysis: Varimax rotation with Kaiser normalization. Rotation converged in 7 iterations.

First component: Positive emotions

The repeated-measures ANOVA conducted on the first component, Positive emotions, revealed a significant effect of Context only, whereby reported positive emotions were significantly higher when engaging with networked learning, M = 0.19, SEM = 0.12, compared to in general, M = -0.02, SEM = 0.11; $F(1,47) = 4.74$, $p < .05$, $p\eta^2 = .09$, power = .57. No main effect of Time, $F(2.60,122.02) = 1.87$, ns, or interaction between Context and Time, $F(3, 141) = 1.01$, ns, were found.

Second component: Negative cognitive emotions

A highly significant main effect of Context was found, whereby negative cognitive emotions were higher when engaging with networked learning, M = 0.25, SEM = 0.12, compared to in general, M = -0.10, SEM = 0.11; $F(1,47) = 12.16$, $p = .001$, $p\eta^2 = .21$, power = .93. A significant main effect of Time was also found, $F(3,141) = 2.86$, $p < .05$, $p\eta^2 = .06$, power = .67, with descriptive statistics showing that negative cognitive emotions increased at times 2 and 3 and then dropped at time 4 to a lower level than time 1 (Figure 1). To explore time differences further, two post-hoc comparisons were run: a Helmert comparison to compare time 4 to all other times together and a pairwise comparison between times 4 and 3. Bonferroni correction for two comparisons led to $p = .025$. Both comparisons survived correction, showing significantly lower negative cognitive emotions at time 4 than all other times, $F(1,47) = 7.59$, $p = .008$, $p\eta^2 = .14$, power = .77, and at time 4 than time 3, $F(1,47) = 7.24$, $p = .01$, $p\eta^2 = .13$, power = .75.

In addition, a significant interaction of Context by Time, $F(3,141) = 2.95$, $p < .05$, $p\eta^2 = .06$, power = .69, further qualified these main effects (see Figure 2). The same post-hoc comparisons previously defined for Time were tested within each context separately; Bonferroni correction for four comparisons in total led to $p = .013$. While

engaging with networked learning, negative cognitive emotions dropped at time 4. They were significantly lower than all previous times $F(1,47) = 6.98$, $p = .011$, $p\eta^2 = .13$, and also significantly lower at time 4 than time 3, mean difference = -0.35, $p = .013$. Instead, when asked about their emotions "in general", students showed no difference in negative cognitive emotion between time 4 and all other times, $F(1,47) = 1.17$, ns, nor between times 4 and 3, mean difference = -0.29, ns. Thus, even though the main effect of Time suggested this trend to be independent of Context, the interaction and post-hoc tests showed a clear-cut effect of Time while when engaging with networked learning, and no differences in general. Certainly, the release at time 4 could have been felt more generally in everyday life as well.

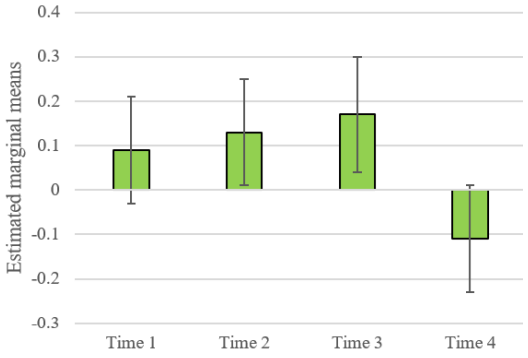

Figure 1. Means for negative cognitive emotions over Time.

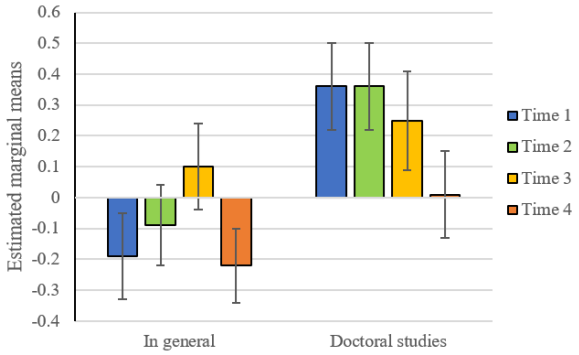

Figure 2. Means for negative cognitive emotions

Third component: Negative gut reactions

A highly significant main effect of Context was found, whereby negative gut reactions were significantly higher in general, M = 0.60, SEM = 0.13, compared to when engaging with networked learning, M = -0.40, SEM = 0.07; $F(1,47) = 98.61$, $p < .001$, $p\eta^2 = .68$, power = 1. No main effect of Time, $F(3,141) = 0.96$, ns, or interaction between Context and Time, $F(2.50, 117.56) = 1.46$, ns, were found.

Fourth component: Isolation

The ANOVA investigating Context by Time showed a significant main effect of Context, whereby feelings of isolation were experienced significantly more strongly in general, M = 0.14, SEM = 0.12, compared to while engaging with networked learning, M = -0.12, SEM = 0.10 $F(1, 47)= 5.29$, $p < .05$, $p\eta^2 = .10$, power = .62. This effect was confirmed in the ANOVA with the additional independent variable Pre/Post-Covid, $F(1, 46) = 4.82$, $p < .05$, $p\eta^2 = .10$, power = .58; in general M = 0.15, SEM = 0.12; while engaging with networked learning M = -0.11, SEM = 0.10. No other main effects or interactions were significant in either model.

Fifth component: Intrigued

Because the Intrigued component has a negative factor loading, lower or negative values of this component mean students are more intrigued. A highly significant main effect of Context was found, whereby students felt significantly more intrigued when engaging with networked learning, M = -0.25, SEM = 0.08, compared to in general, M = 0.42, SEM = 0.12; $F(1,47) = 38.77$, $p < .001$, $p\eta^2 = .45$, power = 1. In addition, a significant main effect of Time, $F(3,141) = 3.33$, $p = .02$, $p\eta^2 = .07$, power = .75, showed that students felt fairly intrigued at time 1, less and less intrigued at times 2 and 3, and then more intrigued again at time 4. To explore time differences further, 3 post-hoc comparisons were run to compare time 1 to each of the other times. Bonferroni correction for three multiple comparisons led to $p = .017$. The corrected comparisons revealed that students were significantly more intrigued at time 1 than time 3, with mean difference = -0.33, $p = .01$; no other comparisons were significant. No interaction between Context and Time was found, $F(3,141) = 0.28$, ns.

Discussion

This mixed-methods research shed light on the diversity of emotions experienced by adult learners engaged in networked learning within the context of an online PhD programme. The above results provide several valuable insights into the dynamic nature of emotions during the six-month-long networked learning journey, challenging the notion of learning as a cognitive process. Those will be discussed here with student voices collected as qualitative data in this study.

Most importantly, the study suggests the tangible impact of networked learning on participants' emotional states, emphasising that these experiences do not occur in isolation but are intertwined with the complexities of their personal and professional lives. B88 wrote, "I am completely uncertain about what might happen to my job and life as a result of Brexit… I wonder as a school that depends on EU students (and money!) whether the job can stick whatever Brexit may bring!" and M58 shared: "I worry about my son's education. We live in a country that I did not grow up in so I am not familiar with the education system or the language. I worry a lot that my deficiencies will hold him back." Obviously, in 2020, many including A18 wrote about the pandemic: "General anxiety about the coronavirus. This has impacted my personal life significantly. General worry about if shops will run out of food, if we will get sick and the travel bans. I've also had to cancel my summer holiday." Although we have measured the intensity of emotions associated with general lives separately from the ones associated with networked learning experiences, it is difficult to doubt that the above mentioned emotions about other aspects of participant lives influence on their networked learning experiences and emotions.

Regarding positive emotions, the study reveals a consistent thread of positivity that runs throughout the networked learning process. Participants reported feeling encouraged, hopeful, excited, and motivated, suggesting that networked learning can be a source of inspiration and fulfilment within their academic pursuits. In particular, the emergence of the "Intrigued" component suggests that students experience heightened curiosity, particularly at the inception and conclusion of modules, signifying pivotal moments of engagement within the learning network. One of the participants wrote about their emotions about networked learning at time 1, "[I am] inspired by the academic setting; excited and hopeful about the present and future; valued by tutors and coursemates; proud of myself so far; anxious by nature; integrally and instrumentally motivated." (B26) Another mentioned at the same time, "I've felt a lot of the positive emotions strongly. I felt anxious prior to the course but now I feel happy. A few years ago, I was starting to move more into academia but illness forced me to leave my job and that country and I've felt a bit lost since. Starting this course has reignited that sense of purpose and achievement, with regard to learning, that has been absent." (G54) Participants are again intrigued at the stage of writing up their research project with some new findings and insights: "My project represented the culmination of my work on this module. I'm very pleased with it as a piece of work and excited to see where it will lead." (J69) and "Conducting my [research], reading other research articles and [a book title]. I can't stop reading and learning. Discussing with some peers and researchers I met during the seminars made me even eager to learn more." (A62)

Despite the presence of positive emotions, the study also acknowledges the existence of negative emotions. However, it distinguishes between negative cognitive emotions, linked to cognitive appraisal during networked learning processes, and negative gut reactions, more prevalent in general life. The initial stages of networked learning appear to elicit more negative cognitive emotions, gradually diminishing as students accustomed to the new learning environment, ultimately culminating in a notable decline when final assignments are submitted. This underscores the need for robust pedagogical and emotional support during the initial stages of networked learning. Surprisingly, a notable release of negative cognitive emotions was also reported in general life at time 4, indicating a potential interplay between emotions arising from networked learning and their influence on students' broader life experiences. This interconnectivity emphasises the significant role that networked learning play in students' lives, especially when the learning and living are closely interconnected.

Moreover, the study offers intriguing insights into the perceptions of "Isolation", challenging conventional assumptions associated with online learning. Contrary to the expectation of increased isolation in online learning environments, participants in this online doctoral programme reported feeling less isolated within their learning network and more isolated in their general lives. This sense of social inclusion and support within the learning network remained consistent throughout the study, unaffected by the COVID-19 pandemic. This unexpected finding highlights the transformative potential of strong connections and well-established learning networks, dispelling the notion that online learning (and distance education) inherently leads to isolation. One participant from 2020 who badly hit by the outbreak of COVID-19 shared: "This might be the same as "thankful" but I am especially thankful for the constant conversation and support of my peers in WhatsApp. It never feels like I'm alone and everyone is so helpful. This probably sounds bad, but it's helpful to know that others are going through the same emotions at the same time as I am. And I love how we all help, encourage, and push each other!" (R35) Of course, R35 was not alone in finding the cohort community essential during the pandemic.

Conclusion

The article provides valuable insights into the emotional experiences of adult learners, highlighting the impact of time and context on various emotional components. Its longitudinal design and the use of both quantitative and qualitative methods contribute to a comprehensive understanding of how emotions evolve during networked learning processes. In conclusion, this study not only advances our understanding of emotions in networked learning but also challenges prevailing stereotypes about online education. It reveals the multifaceted nature of emotions in educational contexts, emphasising the importance of tailored support mechanisms for learners

navigating the multiple connections in networked learning and beyond. The findings also provide valuable insights for educational institutions seeking to foster a sense of belonging and togetherness within their online learning communities, ultimately redefining the narrative surrounding emotions in online education (cf. Lee, 2018; 2020b). Further research in this area could explore the intricate interplay between the emotional learners' affective states and learning experiences, looking into their impact on learning outcomes.

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