

Part-time higher education students' interactions with a virtual learning environment as an exploration of theories of connectivism

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Abstract

This article uses data from an action research project (ARP) conducted with part-time higher education (HE) students as a means of exploring the recent thinking about learning characterised by theories of connectivism. Both quantitative and qualitative data are presented to assess the extent to which connectivist theory might explain – and indeed develop – the use of a virtual learning environment (VLE) on a part-time Education degree in the United Kingdom (UK), particularly for students from non-traditional backgrounds. The article concludes by discussing what both the data themselves and connectivist perspectives on those data might have to say about VLE use in an age in which such learning platforms are but one means of accessing learning.

Keywords: connectivism, virtual learning environment, non-traditional students, higher education

1. Introduction

George Siemens' (2005 and 2008) work on the theory of connectivism poses important questions for educators and academics who are interested in the way that learning is transformed by technology. In this paper, we present data collected from an action research project (ARP) that examined the use of a virtual learning environment (VLE) by non-traditional, part-time students on an undergraduate education degree. Informed by these data, we explore Siemens' and Downes' (2019) ideas about connectivism and how they challenge traditional ideas about learning. Consequently, this paper has three distinct aims: first, to present the data from the ARP to help us consider how Siemens' principles of connectivism (2005) are illuminated or problematised; second, to explore how the ideas of Siemens and Downes might be used to develop interaction with VLEs for non-traditional students; and, finally, to consider why the principles of connectivism may currently be under-utilised in pedagogic practice in the context of UK higher education and how this might be addressed.

1.1 Literature review

Though much of the extensive literature on HE VLEs concerns their positive potential (Burgess, 2008; Higgs, 2012; Busher *et al.*, 2015) especially for non-traditional students, Graham and Halverson (2019) have argued that further research into the relationship between usage/usability and the benefits is essential to gain a proper understanding of how VLEs influence learning. This study looks at student engagement with the VLE to explore Siemens' ideas about connectivism and considering how VLE usability and take-up might be improved. As such, it is helpful to consider the literature in three broad areas: data analytics as an indicator of VLE useability; the use of VLEs in HE settings, particularly for distance learners and non-traditional students; and explanations of VLE use in terms of theories of learning that pre-dated connectivist theories.

Studies which have used data analytics to examine how much time students spend using a VLE largely suggest that there is no definable correspondence between individual students' VLE activity and their ability to achieve a particular outcome on a course. Some years ago, Malikowski *et al.* (2007) proposed a way of thinking about categories of VLE activity which might be recorded and analysed, a model that this study considers as a means of identifying the potential benefits. The categories include: transmitting course content; evaluating students; evaluating courses and instructors; creating class discussions; and creating computer-based instruction (*op.cit.*, p.156). To assess the level of engagement with the VLE, subsequent studies in this area have used data analytics relating to, for example, login frequency, number of interactions with other students and staff and types and frequency of materials accessed. Notable among these are Agudo-Peregrina *et al.*, (2014) and Chaka and Nhobo (2019), who attempt to examine the correlation between data analytics and student outcomes. Similarly, Beer (2010) and Caruso (2006) bring together the analytics from across institutions to measure both performance and engagement. Though there is some evidence for the correlation between analytics (login data) and student engagement, this cannot be taken as a predictor of success (Henrie *et al.*, 2018) and so more qualitative analysis is required, as much analytics research confirms.

Consequently, wider qualitative analysis of the use of VLEs in HE, particularly by distance and non-traditional learners, can be useful here. Though some of the literature deals with both these groups separately, they have many issues in common, these often characterised as 'barriers to learning' imposed by circumstance (distance, financial difficulties) and background (no prior or current university attendance by any family member; personal family commitments precluding full-time, face-to-face study). McGivney (1993) describes these in terms of the personal, situational

or dispositional; so, a dispositional barrier might be an individual's self-perception as being 'too old to learn', while a situational barrier might be insufficient money to undertake a course of study. These descriptions match the concerns of many students on the course being undertaken in this study. Burton, Golding Lloyd and Griffiths (2011) suggest that such barriers can be overcome through both early and sustained contact with the students and flexible course design, of which VLEs form a part. With this in mind, and for reasons of space, both types of learners mentioned above are treated here as a single group.

Several studies indicate that VLEs and online learning more generally can have benefits for non-traditional and distance learners. Higgs (2012) explains how non-traditional students on a social work course found the online sphere to be particularly helpful for discussing ethical problems because, in that context, they felt more confident in coming forward to help others and to be helped. Similar positive effects are also reported in other subjects (Burgess, 2008) with teachers noting that students can become more autonomous and successful (Martzoukou and Kemp, 2016). However, it has also been argued that VLEs can present problems for these learners. These include: the difficulty of supporting students with the development of necessary information communication technology (ICT) skills (Safford and Stinton, 2016); a lack of pedagogical expertise or clear role for the teacher (Allan *et al.*, 2012); and a recognition that to deploy such technologies does not solve the wider educational or circumstantial issues that impact on students' learning (Holley and Oliver, 2009). In the light of this, we wanted to explore whether looking at VLE use through the lens of connectivism might suggest how best to ensure that non-traditional students will benefit from the advantages of the VLE while also addressing the challenges.

1.2 Theoretical framework

George Siemens proposes eight "*principles of connectivism*" which are presented below. (NB: The 'CN' numbers in brackets here are our own addition and refer to the coding system that we use to identify the way the data gathered relate to each principle.)

- Learning and knowledge rests in diversity of opinions; (CN1)
- Learning is a process of connecting specialized nodes or information sources; (CN2)
- Learning may reside in non-human appliances; (CN3)
- Capacity to know more is more critical than what is currently known; (CN4)
- Nurturing and maintaining connections is needed to facilitate continual learning; (CN5)
- Ability to see connections between fields, ideas, and concepts is a core skill; (CN6)

- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities; (CN7)
- Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision. (CN8)

(Siemens, 2005)

These principles have been reinforced by an epistemological framework employed by Downes (2008) to outline a theory of distributed knowledge in which connectivist knowledge involves knowing both the connection and the information provided by the connection. Despite criticisms of this view (Kerr, 2006), we argue that connectivism provides an ideal way of thinking about the data generated by the current project, because in addition to asking how students learn to handle the technology, it also asks about their relationship with that technology. Through a connectivist lens, we seek to examine how students engage with VLEs and how VLEs might be used more effectively, particularly for non-traditional students. We accept that there is some scepticism about connectivism as a learning theory (Kop and Hill, 2008; Verhagen, 2006) and that any conclusions drawn from this kind of investigation need to be tempered by the observation that connectivism has not yet been fully established within undergraduate education courses.

It is important to note that much of Siemens' and Downes' work on connectivism arises out of their development of massive open online courses (MOOCs). A MOOC is an online learning platform which presents learning materials that anybody can use and take part in. MOOCs are usually free and are designed to accommodate very large numbers of people. While MOOCs and VLEs have some similarities, their differences (not least the question of what is or isn't being paid for) raise some important questions about the ability of connectivism as a learning theory to encompass all aspects of educational processes in HE; for example, the role of pedagogy in the learning process and the nature of knowledge or perhaps the skills and competencies required of the student. With this in mind, it is perhaps wise to see the discussion of data that follows later in the paper not only as a critique of these students' use of the VLE viewed through a connectivist lens, but also as an implicit critique of connectivism itself, given that Siemens and Downes developed the theory from a specific type of learning environment.

Finally, as bridge to the theoretical framework of connectivism, it is worth pausing to consider literature that has sought to explore VLE use by relating that activity to other theories of learning. Perhaps unsurprisingly, given the collaborative and collective way that VLEs are utilised by

educators, there have been attempts to characterise them in terms of Wenger's notion of a "community of practice" (Ellaway, Dewhurst and McLeod, 2004). The authors explain how VLEs might be used to support pre-existing communities of practice, taking Wenger's "Learning Architecture Framework" and using this theoretical idea to evaluate how effective such online communities are. Keller (2005) on the other hand, draws on implementation research to examine how different learning theories, including Compeau *et al.* (1999), explain how cognitive aspects of learning to use a VLE can helpfully influence instructional design and subsequent pedagogy. Exploration of this connection is a well-trodden path in educational research (Sweller, 2016) and perhaps provides a more empiricist view of VLE use than many, which tend to be influenced by more constructivist and constructionist approaches (Barker, 2012). It is therefore useful to site connectivist theory in relation to these other theories of learning that articulate Siemens' belief that it sits outside more established cognitivist, constructivist and behaviourist theories of learning. Though not all thinkers about technology and learning see themselves as connectivists (Kop and Hill, 2008), there is a broad view that twenty-first century technology does require us to think differently and more innovatively about learning and it is this that we attempt to engage with here.

With these issues raised by the literature in mind, we devised four initial research questions:

1. How do these students use and engage with the VLE?
2. How do students perceive the VLE and the way that it is meant to be used as a part of their studies?
3. How does the teaching team perceive student use of VLE across the course?
4. What improvements can we make, as a teaching team, to the way that we use VLE to deliver the course these students are on?

2. Method

2.1 Project context

The project was originally designed as an ARP, intended to develop ways of improving students' interaction with a VLE in the context of a four-year, part-time, undergraduate Education degree, designed for people already working in schools in England. Students complete their degree through a weekly four-hour taught face-to-face session and use of the VLE for a range of tasks and for accessing a variety of learning materials.

2.2 Participants

Staff and students from the programme formed a purposive sample (figure 1). Students tended to be mature, many were employed as teaching assistants and had often experienced what

McGivney (1993) describes as personal, situational or dispositional barriers to learning, discussed earlier. Staff who deliver this course are experienced at working with this type of student, having had at least five years of so doing.

1. Student questionnaire: Level 6 class of 16 students. Questionnaire response 16/16.
2. Staff questionnaire: 5 core staff team members. At the time there were 7 core team members, but two were the researchers. Questionnaire response 5/5.
3. Unit grades for first Level 6 30 credit unit from cohort of 82 students across four campuses and VLE interaction data (hours online).

Figure 1: Data collection methods

2.3 Materials and procedure

Two questionnaires were administered – one to students and one to staff. The staff questionnaire was delivered via an online survey, which remained open to participants for four weeks, and asked nine questions in a combination of open, closed and scaled formats. Staff were asked to rate the usefulness of various functions of the VLE (such as making announcements, assessment and feedback or guided learning) on a scale of one to five, while open questions asked them to identify positives and negatives of students' working with the VLE. The mean average completion time for the staff questionnaire was eleven minutes and eighteen seconds.

The student questionnaire was administered on paper in the students' weekly teaching session. Again, this consisted of nine questions in a combination of open, closed and scaled formats. Here, closed questions asked students to identify specific times of the day when they accessed the VLE and how often they did so, while again, to parallel the staff questionnaire, they answered a scaled question about usefulness. Open questions asked students about their access to the VLE and whether they had used any materials from it in their classroom practice. Average completion times for this questionnaire were not recorded, but the researchers felt that nine questions would be as many as could be completed easily in a small part of a teaching session.

The questionnaire data, combined with unit grades for the first level 6 thirty-credit unit from a cohort of eighty-two students across four campuses and VLE interaction data (i.e. hours online) formed the basis for the analytical discussion.

There were some ethical risks to the project, most notably in relation to respondents' feeling coerced into answering questions in a research project being run by two people who were either their colleagues or their lecturers. This risk was mitigated through a combination of informed

consent and anonymity; no participants were identifiable at any point in the study and all were offered the right to withdraw from it. Ethical approval for project was given by the ethics panel of the Institute for Research in Education at the University of Bedfordshire.

Though the project began as an ARP which was attempting to develop students' use of the VLE, it did not stay in this form entirely. After the data had been collected, we began to think that there were some issues at play bigger than just the students' use (or non-use) of the VLE in their studies. The questionnaire responses suggested issues around the relationship between technology and learning that we had not really considered at the start of the project. As such, the project became more of a critical action research (Kemmis, McTaggart and Nixon, 2015) endeavour as it went on.

3. Results

3.1 Quantitative data

To examine data analytics from the VLE, student grades for the first level 6 unit were banded in the A to F category (A, A-, B+ F), spanning the range of grades achieved for the unit. Time spent on the VLE was categorised in two-hour bands from the least time online (less than two hours – twenty-two students) to the most (thirty-plus hours – one student). We compared these two measures, using Spearman's rho correlation coefficient. A weak positive correlation between time and final grade outcome was identified (figure 2).

This data provided us with limited information related to the students' use of the VLE, other than confirming outcomes similar to those found by Malikowski (2007), Agudo-Peregrina *et al.*, (2014) and Chaka and Nhobo (2019), who also found weak correlations between the amount of time spent logged on to a VLE and final grade outcomes. In terms of how much time was spent on the VLE over the course of a thirty-credit, 300-hour unit, over half of the students spent less than six hours on the VLE site (figure 3), but, as we were not able to identify exactly what the students were doing when online, they could have been logged on without any interaction.

Correlations				
			Grade	Time on VLE
Spearman's rho	Grade	Correlation Coefficient	1.000	.218*
		Sig. (2-tailed)	.	.049
		N	82	82
	Time on VLE	Correlation Coefficient	.218*	1.000
		Sig. (2-tailed)	.049	.
		N	82	82

*. Correlation is significant at the 0.05 level (2-tailed).

Figure 2. Correlation between time spent on the VLE and final grade outcome

Time spent on VLE	Frequency	Percentage	Cumulative percentage
0 ≥ 6 hours	48	58.5	58.5
6 ≥ 12 hours	17	20.7	79.3
12 ≥ 24 hours	10	12.2	91.5
More than 24 hours	7	8.5	100.0
Totals	82	100	

Figure 3. Breakdown of time spent on the VLE during one thirty-credit teaching unit

The student questionnaires were helpful in providing greater insight into what they did when logged on to the VLE. Figure 4 shows both students' use – and staff perceptions of student use – of different elements of the VLE. Students went online mainly to gain information, whether in connection to the teaching sessions and/or assignments or to access literature and did not really see it as a medium for interacting with tutors. Staff perceptions of student use mirrored these findings.

Students and staff were asked to rank the different elements of the VLE in order of most to least useful (1 being most and 7 being least useful). Both staff and students identified the information-related sections as most useful and those related to interaction as least useful (figure 5). This highlights that the organisation of the VLE (designated by the institution at the time) provided a useful structure for information-related sections, illustrating Siemens' (2005) connectivist principles of learning as connecting specialist nodes or information sources (CN2) and currency (CN7). However, as we suggest below, in many ways the connections at work here seem incomplete, as the students used the VLE infrequently for pedagogic interactions. There are clearly other influencing factors at work here, relating to how students use the platform, which will need to be explored in further research.

Burton, Golding Lloyd and Griffiths (2011) identify that barriers for non-traditional learners can be overcome through flexible course design – and the VLE has the potential to form a part of that. Flexibility of access meant that the students identified that they accessed the VLE at times to suit them – in this case during evening hours (12/16 students) and at weekends (13/16 students) being the most common periods of time for access. This leads us to consider links between the quantitative and qualitative data. For example, measures of interaction tallied with the staff views of student access to the VLE, perhaps unsurprising as many of the students work full time; however, it is the qualitative data explored in the next section which allows a deeper exploration of these links between the staff and student views.

To summarise the findings of the quantitative data, it is apparent that the students used the VLE for gaining information related to their course and accessed it at a time convenient to them. If we reconsider the categories of use identified by Malowski *et al.* (2007), for these students the VLE appears to sit primarily within the 'transmission of course content' category. However, it is the qualitative data that really helps to give us a

Articles

deeper insight how the VLE was mainly used (or not) and some of the reasons behind this.

	Yes		No		Sometimes	
	Students	Staff	Students	Staff	Students	Staff
To download information related to teaching sessions	11	2	2	0	2	3
To access the unit handbook	4	1	7	0	4	4
To access information about assignments	14	3	1	0	0	2
To interact with the electronic reading list	13	4	0	1	3	0
To access literature	14	4	1	1	1	0
To interact with the tutor	2	0	6	1	5	3
To interact with other students	0	0	10	4	2	0
To upload assignments	16	5	0	0	0	0

Figure 4. Student and staff perceptions of the main uses of the VLE

VLE Section	Content	Student Ranking	Staff Ranking
Announcements	Information (continuing)	5	4
Unit Information	Information (unit overview)	3	4
Guided learning	Information (session content)	2	2
Assessment and Feedback	Information (assessment, submission and feedback)	1	1
Reading list	Information (electronic access to the reading list)	3	3
The teaching team	Information (tutors teaching the unit)	6	7
Discussion boards	Interaction (between students/tutors/both)	7	6

Figure 5. Staff and students 'usefulness' ranking

3.2 Qualitative data

As we set out to explore the role of a VLE from a constructivist perspective, we considered the qualitative findings using the principles of connectivism (Siemens, 2005), coded earlier. This led to the identification of some key themes related to the use of the VLE and helped us to explore the following:

- Which connectivist principles are highlighted by students using the VLE to support their learning?
- Which connectivist principles are not evident in the students' use of the VLE and could the development of these support students to make even better use of it?

3.2.1 Theme 1: Why use a VLE?

Students' reasons for using the VLE mirrored those in the quantitative questions. Of the comments provided, all identified that they accessed the library resources, such as reading lists,

and information relating to assignments. Gaining information related to the teaching sessions and the running of the unit was the third element in this strand, identified by three quarters of the students (11/16). All but one student identified gaining more than one strand of information through their interactions with the VLE; for example, this student response:

To access: books via the library catalogue; to use Discover to find journals; slides from sessions; submit assignments; my results for assignments; download feedback on assignments; reading list for assignments.

Staff also identified the VLE as a place where students could access information. They themselves used it for contacting the students via online announcements or providing them with the resources needed for the unit. They felt that the platform enabled students to access relevant information within one place. Downes' (2008) suggestion that knowledge involves knowing both the connection (the VLE platform) and information provided by the connection (the content on the VLE) appears evident here. Alongside this, if we compare these findings to the principles of connectivism (Siemens, 2005), there is clear evidence of the students' accessing their learning via non-human appliances (CN3). The multi-modal use of the different aspects of the VLE also suggests that the students may also be seeing connections between difference fields (CN6), identifying links between elements such as reading lists and assessments. As the VLE provided access to weekly session information, we could consider that the students and staff have also identified the need for currency in relation to their learning (CN7).

Students' reasons for not using the VLE were limited, but, of the four students who chose to comment, all their responses related to the inaccessibility of aspects of the environment. For example:

I find it overcomplicated and it takes too much time; It is not hugely accessible on a mobile phone; I do not have a great understanding of its potential.

Staff mirrored these views in that they felt the students perceived the VLE as overcomplicated and hard to locate information. For these students, there may be a limitation in being able to see connections between different specialised nodes and information sources (CN2) as well as having difficulty in seeing connections between difference fields, ideas and concepts (CN6). We would argue that in many ways, the VLE constitutes just one such specialised node and, at the time of the data collection, there was, for example, no integrated, parallel phone app for the desktop version of the VLE. Further research might be necessary to see if the integration of these two

different nodes (desktop and app versions of the VLE) would support the 'connection-making' process between different fields and ideas.

3.2.2 Theme 2: Exploring opinions

Siemens' (2005) first principle identifies that learning and knowledge is related to a range of opinions (CN1) and it was evident from the discussion in theme 1 that students were accessing the VLE to explore reading lists and library materials, suggesting that they were accessing a range of opinions. This mirrored the quantitative data, where accessing reading lists was identified by both staff and students as the third most popular use of the VLE (figure 4). However, if we accept that learning and knowledge is related to a range of opinions, consideration also needs to be given to how these opinions might be shared between and accessed by students and tutors and whether the VLE is a platform that could enable this. According to the data, none used the VLE for interaction; when the students wanted to communicate with each other, all of them identified a public platform (WhatsApp Messenger) as their mode of interaction with others. Students' use of this platform fell into three categories:

- Support for each other, such as asking each other questions about the assignment and clarifying their understanding, or as a community for friendship and advice;
- Speed of response, in that social media was much faster than using the VLE;
- Access to social media was easier than to the VLE.

Staff mirrored these views, in that students saw the use of social media as enabling a community environment, providing mutual support. Staff also said that their discussions were private and not visible on the University forum; however, one member of staff expressed concern that one student turned off notifications, feeling they were having a detrimental effect. A point to note here is that tutors do not use public social media forums as this is not a recognised sanctioned university tool for communication between tutors and students. As much of Siemens' work with connectivism is based on his experience with MOOCs, a more open structure that probably integrates well with social media platforms, this may explain why there is more infrequent consideration of connectivist perspectives in the research into technology use in UK HE, particularly as VLE learning environments are more restrictive, only open to students on a particular course.

On initial examination of the data, although it appears that these students recognised that their development included the opinion of others (CN1), it is apparent that the VLE was not perhaps providing a mode of interaction that they saw as relevant to them, for they chose a public form of social media to interact with each other. However, as university tutors are not able to engage

within the social media platform, students are potentially missing out on accessing a key person who might be able to guide and support and help them maintain connections between different aspects of knowledge (CN6). Although there is a discussion board forum available within the VLE, students identified that it might be better used if it were possible to use it anonymously.

3.2.3 Theme 3: Accessibility

There were elements related to the VLE that were identified for improvement:

- Useability: Students and staff alike commented that the platform was not always user-friendly, in that at times it was over-complicated and daunting and could be difficult to navigate, with pages 'timing out';
- Connectivity: Though the VLE was seen as a forum to provide links to other areas such as reading lists, the library and e-mail, often these connections were very slow or did not work;
- Knowledge: Though students saw that the VLE provided links to a range of areas, they did not always know what to do when they reached them. For example, one student considered Discover (a search engine for literature) a hard tool for finding relevant journals and a member of staff suggested that it could be daunting for students to understand the platform and 'know what to do'.

Returning to Siemens' (2005) work, perhaps this highlights the need for developing a smoother transition between information sources (CN2). If the idea of connectivism is to support the development of connections, the nurturing and maintenance of connections (CN4) is perhaps a key consideration. What is fascinating is that students do maintain such connections virtually (as well as in the face-to-face environment of the classroom) but not via the VLE itself. Instead, they choose social media to trade knowledge and information, nurturing an 'unofficial' set of connections rather than an official one.

4. Analysis and Implications

Perhaps one way of thinking about the implications of these themes in the data is to consider what *isn't* happening for these students in connectivist terms. For example, some of the complaints about both useability and connectivity point towards the idea that students have less agency and autonomy than suggested by Siemens' original work (Kop, 2011). For Victor Pando (2018), such a lack of agency could lead to connectivism's becoming a kind of digital behaviourism, in which students are conditioned into learning in certain ways because technology either does or does not work for them. In some senses, though the ability to access learning materials at a time and place of the students' choosing seems to offer a good deal of autonomy,

this decision-making is hampered by a VLE which does not behave in way that supports such autonomy.

Similarly, we might question the extent to which the students see a connection between the learning that they do in a face-to-face class and the learning that happens within the VLE. Students who found Discover – the VLE tool for conducting literature searches – difficult to use might not be drawing a parallel between using such a tool and sitting in the library looking for books or journals. This connection-making, or perhaps lack of it, might be a pedagogical issue, highlighting the need to make analogies between face-to-face and online learning activities to establish and reinforce this learning connection. This tension suggests, then, that there is a need to teach explicitly about the connections between these different learning activities before the student necessarily makes the connection personally. Perhaps this is one of the missing pieces in the connectivist puzzle; for Downes, (2019) the MOOC has been the optimal expression of connectivist pedagogy. However, perhaps there is also some role here for old-fashioned pedagogical explanation for connectivist principles to achieve their fullest realisation.

Indeed, this uncertainty about where the teacher sits in the connectivist account of learning may offer some explanation for the absence of research or theorisation about such thinking in UK HE currently. The ideas of Siemens and Downes are in some ways, incompatible with traditional ways of thinking about HE; the view expressed by Siemens in 2005 (p.1), that “[i]nformal learning is a significant aspect of our learning experience. Formal education no longer comprises the majority of our learning.” If one accepts this view, then HE, which has traditionally seen formal teaching and learning as its substantive purpose, may need to consider its modes of delivery. While the data collected in this study was collected prior to the COVID-19 pandemic, it is worth considering the importance of connectivist ideas in the arena of post-pandemic HE. The mass move to online teaching and learning means that, to some extent, educators in universities across the world will need to consider the extent they are nurturing and maintaining such connections.

5. Conclusions

When considering the original questions that the ARP set out to answer, the questions about perception were reasonably easy to answer given the discussions above. Questions about use are much harder to grasp: while connectivist theory gives us a way of thinking about the relationship between student and VLE, there is limited evidence here to suggest that the VLE has improved learning in and of itself. However, there is some suggestion of the challenges faced by non-traditional learners in their use of the VLE and, in trying to address these challenges, a

connectivist lens can help us to see more clearly both the positives and negatives of learning online. These students do need a VLE in order to access the online aspects of their course and the materials associated with it, evident in the quantitative data collected regarding what they used the VLE for. However, there is also the sense that the qualitative data echoes the finding of Allan *et al.* (2012), that this use will still, to some extent, rely upon very clear direction by the lecturer leading the class. Similarly, the less-than-user-friendly nature of the interface may become another barrier for a group of students who might already have many barriers in their way. In connectivist terms, these problems mean that connections are not being nurtured, specialised nodes cannot be linked together and decision-making is hampered. There is the potential for really good VLE platforms, with intuitive interfaces and multi-device compatibility to give non-traditional students a powerful sense of agency. However, this agency will still need to be facilitated by a teacher or lecturer who can help make the connections between the VLE and learning explicitly clear.

Connectivism provides us, both as researchers and teachers, with a useful theoretical set of principles through which we might reflect on the way that we use and develop pedagogies around VLEs. Like any theory of learning, it will not tell us *how* to teach using a VLE or *what* we should be teaching. However, it does have the potential to make us think about these things in innovative ways. For example, if the VLE is primarily a set of connections by which students access information and it performs this function well, perhaps the focus of its future development should be to consolidate this role, rather than thinking about how it might transform pedagogy. If on the other hand, its aim is to develop more frequent and better interaction between student, teacher and knowledge, then connectivism might require us to rethink our relationship with knowledge. This is because, in the account given by Siemens and Downes, knowledge is no longer a fixed phenomenon that can be parcelled up and presented in traditional pedagogical ways. Rather, it is more like a place to be navigated with the teacher as guide.

From the data in this study, we can conclude that connectivist principles lead us to think about what students' – in this case, non-traditional students' – learning interactions with the VLE are really like. We suggest that this thinking can lead in the future to both better VLE design and better pedagogic use by HE teachers and, indeed, in some instances, making use of the technology that students already use (such as social media platforms) and building pedagogies around this. However, we also feel that there are number of clear 'next steps' for us, both as researchers and teachers. The first of these is to disseminate the findings of this research to our students and colleagues so that we can start an honest conversation about the potential of the VLE. This

conversation will involve discussing where, in teaching these kinds of student, the VLE both is and is not the most appropriate tool for aiding learning. The applicability of some connectivist principles to the data from this project highlights both the strengths and limitations of the VLE and further research, using connectivist thinking as a theoretical framework, might support both consolidation of strengths and also solutions to limitations.

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