"I DON'T REALLY 'DO' COMPUTERS!" -- GEOGRAPHY STUDENTS' VIEWS OF THEIR OWN DIGITAL LITERACY

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Abstract

Understanding the interplay between self-efficacy and digital skills can open our eyes to the ways in which students view their own abilities to cope with the range of software and hardware that they might experience inside and outside of education. It may help us understand how better to ensure our students are prepared for gainful employment. This paper suggests that, by applying Q methodology, we can more fully appreciate the various aspects of digital literacy and self-efficacy for a set of students. It follows that such knowledge can yield more specific ideas about where and how to make students more confident in their digital practice and this is discussed in relation to teaching Geographical Information Systems.

Introduction

Students, perhaps more than ever, now need to be "work ready" as they graduate (Lammy, as cited by CBI, 2009), and, for most, a key component of this readiness is the panoply of digital skills and familiarities that we might term *digital literacy* (DL). However, the ongoing debate about what determines and defines digital literacy has led to a seemingly daunting array of viewpoints and interpretations (Helsper & Eynon, 2013). When working with students, such complexity may be a barrier to developmental discussions or graduate reflection upon digital achievements. In response to this, the UK's Joint Information Services Committee (JISC) has been working with the higher education (HE) sector, establishing various ways of influencing and developing digital literacies for both university students and staff (Payton, 2012). The results of these studies have been to create a series of interventions that center on a range of different issues. For example, the PriDE project at the University of Bath (2012) has worked to define digital literacy, giving these definitions a contextual edge. Meanwhile, the WORDLE team at Worcester College of Technology (2014) has developed tools to identify various digital skills, whilst the focus has been upon developmental conversations within Plymouth University's SEEDPoD project (2013).

White and Le Cornu's (2011) study into *Visitors and Residents* (V&R) explains that digital literacies, both those of staff and students, are based upon us engaging in a continuum of practices which place us somewhere between a *digital visitor* (who dips into the digital world, using tools for specific goals, and where value is defined by these outcomes) and a digital resident (who sees the digital world as a place where relationships and identities are forged and maintained and thinking is done online, and expresses its value in these terms). As White and Le Cornu pointed out, this is not a model of binary opposites,

perhaps unlike the date-influenced world of *Natives and Immigrants* (Prensky, 2001). It reflects a range of attitudes, practices and standpoints that we may all adapt from time to time. In other words, it is, perhaps, less useful to see our digital literacy as a characteristic, but more as a strategy or approach that is adopted in a given situation. If this is the case, there are a range of factors that might influence how, and how successfully, we move between these two ends of the V&R continuum, and gaining a view of how our students currently understand these strategies could give us a window into both their present positions *vis-à-vis* their digital practice and a better understanding of how these positions might shift.

Digital or technology (or even, sometimes, computer) self-efficacy has been established as a term that defines the users' perceived ability in using technology in a given way or context. Stemming from work within the realms of psychology (Bandura, 1997), researchers have used this measure to correlate with a range of other traits, characteristics and contexts; age (Helsper, 2007 [as cited by Eynon & Helsper, 2011]), amount of use and/or training (Eastin & LaRose, 2000), gender (Durndell & Haag, 2002) to name but a few. Many studies have emphasised the statistical relationships between these characteristics and self-efficacy, by showing a significant impact of one or more of these characteristics upon self-efficacy, or the role of self-efficacy in promoting further developments in technology use or educational achievement through its use (Malliari, Korobili, & Togia, 2012). However, these studies give us few clues as to how students really view all aspects of digital literacy, nor do they show where the multi-faceted worlds of self-efficacy and digital literacy resonate or jar, in this more complex world of digital visitors and residents.

With these issues in mind, this paper first presents four particular viewpoints, determined using Q methodology, of how students view their areas of confidence around the varied definitions of digital literacy. It then suggests how learning this information about students' perceived abilities might help educators enhance digital literacy within students.

Methodology
Q methodology follows a series of relatively distinct phases, arriving at a set of factors that are judged to represent a variety of participant viewpoints. The reader is referred to primers and texts such as Van Exel and de Graff (2005) and Watts and Stenner (2012) for details of developing a Q study. Q methodology provides the researcher with an opportunity to investigate the variety of accounts people construct around a research question, and is particularly good at identifying the complex interplay between these constructs. Here, the focus is upon the constructions (the viewpoints) rather than the constructors, i.e., the participants (Stainton-Rogers, 1995). It is an approach that has been used and championed for creating and understanding a range of stakeholder dialogues (Wolf, Brown, Cuppen, Ockwell, & Watts, 2011).

The concourse is, by definition, large, as it contains statements that try to embrace the full communicability of the subject under study (Watts & Stenner,

2012); it may contain formal definitions, opinions and points of views, even urban myths. The provenance of the statements can come from all walks of life: scholarly articles, blogs, face-to-face interviews, direct questions, and personal opinion. All of these avenues were looked into during the generation of the concourse for this study, with particular note being made to the literature emergent from studies such as those supported by JISC. Learning Technology colleagues were also extremely helpful during this period, both in generating putative statements, but also in vetting the final statement set (Q set) for coherence and adequacy. Finally, a university-wide digital literacy workshop generated further ideas for statements.

These statements were then sorted and thematically grouped. Statements appeared to split into three categories; *Being, Doing*, and *Having*. By *being*, the statements refer to digital literacy as promoting certain characteristics in students, e.g., a reflective capacity. For *doing*, statements focussed upon digital literacy as the acquisition or practice of skills. Finally, for *having*, statements pointed to digital literacy as being able to access a range of resources. At the same time, these groups could be subdivided into 4 dimensions; Resources, Tasks, Working Together and Helping. The rationale for statements appearing in each Category/Dimension intersection is briefly described in Table 1.

Table 1

Explanatory Table Defining Statements for Each Aspect of Digital Literacy Found Within This Study's Concourse

| | | Categories | | |
		Being	Doing	Having
Dimensions	Resources	DL as having a range of resources to be as reflective and innovative as possible	DL as just being able to use a range of in and out-of-house resources	DL as having access to appropriate hard and software
	Tasks	DL as being efficient and effective with technology	DL as specific skills, often contextually important	DL as having access to specific resources for specific tasks
	Working Together	DL as using technology to become team orientated	DL as being collaborative online	DL is orientated around social media
	Helping	DL as helping building communities that are accountable and professional	DL as being able to access and give help, guidance and development	DL as having access to a wide range of in and out-of-house support

Once these statements had been sifted into a range of themes, and final edits made, a set of statements was arrived at (the Q set) that reflected a balanced view of the entire concourse. The Q set was then shared with three colleagues, two unrelated to the project, to check for clarity and conciseness, and to identify any potential themes that been omitted. A final Q set of 48 statements was arrived at, expressing the various ways in which students may define digital literacy. The final set of statements, plus their final factor scores, can be found at: http://bit.ly/ReV2Qc.

The Participant set (P set) for this study was a group of 23 final year Geography students at Southampton Solent University. These students came from a range of educational and social backgrounds; 11 were female and 12 were male. All were aged between 20 and 22 years old at the time of sorting.

Geography students represent a specific position within the digital literacy spectrum in as much as whilst they are not expected to be conversant with significant technological issues of software and hardware, they should be more adept than just using technology for plug and play gaming and communication. This is because they are required to use technology for a range of data processing exercises, particularly through the use of spreadsheets and Geographic Information System (GIS) software. At the same time, like all university students, they should be relatively proficient at using university systems for accessing information and completing assignments.

Participants were asked to sort the 48-statement Q set according to the extent to which the statements most aligned with the condition of instruction. This was, "Identify how confident you are that this statement applies to yourself." The statements were sorted onto a quasi-normal distribution, with the distribution ranging from integers of +4 ("most confident this applies to me") to -4 ("most unconfident this applies to me"). Some duplication of choice was allowed under each of these choices, but the important issue here is that each participant made sure that each statement referred to her/his own views on confidence, yet also rank ordered this statement alongside all others in the Q set. A short post-sort questionnaire was conducted to establish some qualitative data regarding the reasons behind positioning statements at the two extremes of the distribution.

Analysis of the data was performed using PQMethod (Schmolck & Atkinson, 2002), the software widely recommended and used by other Q practitioners. Once the scores against each statement were entered, on a participant-by-participant basis, correlations were calculated between sorts. Factors were then extracted from this correlation matrix using Principal Components Analysis (PCA) and rotated using the VARIMAX rotation approach. PCA is a mathematical procedure that reduces the dimensionality in data by summarising the variation within a correlated multivariable data set into a smaller set of uncorrelated components (Shaw, 2003). Each component represents a particular combination of the original variables, and, therefore, describes underlying structures within the original data. In Q, these structures are seen as subjective viewpoints. VARIMAX rotation is a mathematical procedure that attempts to maximise the difference of each variable within

components, leading to components that are more readily identifiable with a single component. This, it is claimed, should aid interpretation (Watts & Stenner, 2012). Keeping in mind the criteria of simplicity, clarity, distinctness and stability (i.e., the same participants loading to the same factor, or the same discourses coming from factors irrespective of the solution chosen) developed by Webler, Danielson, & Tuler, (2009), a range of solutions were tested. The chosen solution yielded four components (here referred to as factors) that accounted for 51% of the study variance, and 18 of the 23 participants significantly load to these factors. In the interpretation of factors that follows, the holistic nature of factor interpretation has been purposely shortened for brevity, but can be accessed in full at http://bit.ly/1jX5KmD. The nomenclature used refers to the statement number and its associated factor score (i.e., statement number: factor score).

Results

Factor One
This factor accounts for 12% of the study variance, with two respondents significantly loading to it. This is a factor that describes relative confidence in the basics; the material they have been trained and taught in. There is a strong sense of confidently knowing how to use computers to access and manipulate digital information in order to facilitate the work process in particular. However, whilst there is evidence to suggest a much clearer sense of confidence in all things digital, computers are by no means the only media through which information is collected and organised. Overall, this factor indicates claims of the highest levels of confidence in digital practice amongst the P set. Table 2 illustrates some of their thoughts.

However, another look reveals that this factor expresses significant reservations about moving outside of that narrow focus; there is a sense that this confidence seems to come from familiarity. Multitudinous offerings in terms of different social media streams and enabling technologies are approached less assuredly than other factors, meaning that this viewpoint appears to be more comfortable within one fixed frame of reference. This is echoed where the discourse focuses upon feeling less comfortable when the context changes. Thus, participants who more strongly relate to this view express less confidence in claiming a panoply of skills and do not feel comfortable in adopting the skills and tools by themselves. It is possible that this voice is partly governed around issues of access, both to technology and supporting systems.

If access is a particular issue for this narrative, this may help to explain a strong sense of not being able to *think outside the box*; to experiment and practice. Thus, the less confident aspects of this discourse are expressed in terms of enabling technology to take away routine and solve un-thought-of problems, both technically and by preventing those that share this view from expressing real confidence in using technology to promoting their own independent learning. This issue seems to be acknowledged as a pressure to keep up with the digital world, and reticence to sometimes recognise themselves as truly digitally literate. This narrative of becoming uncertain as

complexity increases is also reflected in this factor's lower confidence in accessing support in areas beyond basic IT support.

Table 2

Selected Qualitative Comments From Participants Who Significantly Load to Factor One

"I am technologically competent in that I can use technologies that are necessary." Participant 11	"I am quite set in my ways…often against learning anything different if my current methods are working effectively." Participant 18

Factor Two

This factor accounts for 12% of the study variance, with six respondents significantly loading to it. This factor suggests that the major area of digital confidence is in the area of communication, particularly through a range of social media and platforms. In terms of these communication channels, this factor expresses the most confidence in areas of breadth of identities, products, and skills. This confidence is allied to having full access to technology that *joins* with the rest of world. Moreover, this viewpoint is acutely aware of the need to conduct one's online activities ethically and professionally, although there is uncertainty about tone and appropriate forms of language. There is a clear sense that this factor expresses, in relation to the rest of the data set, the greatest confidence in facing and developing new challenges. However, in terms of overall confidence in digital practice, the factor array suggests some equivocation with scores of and around zero. Table 3 illustrates some of the thoughts associated with students who significantly load to Factor Two.

Table 3

Selected Qualitative Comments from Participants Who Significantly Load to Factor Two

"I rarely try out new technology…but I regularly communicate with friends via twitter, Facebook and whatsapp." Participant 4	"Sometimes I find it more reliable and easier to collect information with pen, paper and to read books." Participant 10

Whilst this may seem like a factor that expresses a multitude of skills and experiences, they are just many means to one end. Outside of communication, when the context changes to work, this factor describes a significant lack of digital confidence. Aware of the developments in the digital world, this factor suggests that participating in these developments is less crucial, perhaps because they may not always align to the goal of communication with people.

This is exemplified where less confidence around technology as a work tool is expressed, particularly in regard to academic work. The factor expresses little

confidence overall, particularly around proficient and easy use of technology around issues of learning, data management and exploitation, assessment, reflection and research. That being said, this factor still expresses confidence in the use of systems where useful material might be stored. This clear distinction, that compartmentalises technology as a communication tool rather than a real facilitator of work, is highlighted by this view expressing less confidence about accessing support that is specifically about IT practice, as opposed to being confident about using IT to access academic support, i.e., communicating with tutors and sharing specific technological support with others. This means that this factor describes a struggle to appreciate how digital practice can inform new and different situations.

Factor Three
This factor accounts for 13% of the study variance, with five respondents significantly loading to it. Table 4 illustrates some of the thoughts associated with students who significantly load to Factor Three. This view appears to separate out the understanding around digital literacy, and what its benefits are, from the skills of being digitally literate themselves. There is a narrative of understanding where to access a range of things, and why this may be important. At its heart, this factor expresses the greatest degree of confidence around issues of access, be this to systems, platforms, resources or academic support, with only some misgivings about online assessment tools. This widespread access means that the factor describes a confidence in understanding how technology facilitates working flexibly in time and space. However, there is a significant counterpoint to this view that suggests that such understanding does not necessarily promote or secure action and the development of digital practice. First, in looking at appropriateness, this factor expresses relatively less confidence in knowing what to use, when, and how to use technology safely and professionally, although there is less worry about using different *digital identities* in different contexts. When it comes to claiming a degree of competence and comfort with technology, this factor is least confident than any in the data set, and there is a sense of pressure to know all that is new in the digital world. This factor also expresses relative discomfort about developing solutions to new problems, and passing this learning on to others. In fact, whilst confidence in access is clear in this factor, confidence in the use of technology in a range of fields is missing. This lack of confidence in use extends beyond the familiar, and there is something of an inability to work in new scenarios being expressed. This view of not feeling comfortable thinking laterally is exacerbated by a lack of confidence as to where to seek specific IT guidance. This dissonance may be predicated upon a view that the digital world is not, as yet, the be all and end all to student life.

Table 4

Selected Qualitative Comments from Participants Who Significantly Load to Factor Three

"I prefer not to really explore with technology unless I need to."	"I would much rather read a book or write my ideas down."
Participant 13	Participant 14

Factor Four
This factor accounts for 14% of the study variance, with five respondents significantly loading to it. Table 5 illustrates some of their thoughts.

Table 5

Selected Qualitative Comments from Participants Who Significantly Load to Factor Four

"I have a smartphone….I watch YouTube, keep up with news, mainly the football scores."	"I use social and communication media often…but I can't solve technical problems and do not adapt to digital skills easily."
Participant 12	Participant 7

This factor describes an attitude of broad confidence with a wide range of familiar technologies, and as for Factor Two, this discourse appears to center on a confident sense of using different types of technology to liaise with peers. There is a clearer sense of being at ease with technology in a variety of formats, in a variety of contexts. This even feeds through to relative confidence in solving quite technical issues on one's own, or via support. Such confidence means that there is an assuredness that being at the forefront of change is not important; the factor suggests that this form of regular updating does not happen. This may mean that strong associations with this factor miss the broader picture of technology, in all its forms, being an enabler in many different ways.

However, it does claim a less than confident stance when that technology shifts its focus to the university campus. This factor expresses a lower level of confidence, lower than anywhere else in the data set, when it comes to working with and gaining access to university resources and systems. This reticence also feeds through into thinking about using technology in specific areas of academic work, such as developing resources, managing data, and, more generally, in the broader aspects of lifelong learning. Given the confidence expressed by this factor, it still appears to be predicated upon learning what needs to be learned; there is little sense of being at the *cutting edge* or engaging with technology in terms of skills and attributes that can be carried around to be applied to different sets of challenges. There is little sense, in the factor, of collaboration and sharing; digital literacy seems a rather private affair.

Discussion

Probably the first thing to note from this analysis is the need for action. If digital self-efficacy is related to positive digital outcomes, as has been previously suggested, then when a declaration of digital mastery, such as in Statement 8 ("I am technically competent and reliable; I can hold my own in the digital world!"), scores relatively low for all factors (see Table 2), there is an indication that these students do not class themselves as digitally native. In White and Le Cornu's (2011) world, these viewpoints indicate a stronger association with the conception of being digital visitors, and, in order to enhance digital literacy, we need to work to make students more comfortable with 'visiting' more regularly and with greater confidence.

Second, the factors reveal how educators might act to further develop crucial skills in students' digital literacy. Moreover, understanding areas of confidence like this also allows us to not only see gaps to fill, but also to view potential strategies to use and avoid. The unfortunate outcome of this study is that a *one-size fits all* approach is probably going to be unsuccessful. The following short discussion outlines what some of these approaches might look like within the context of teaching GIS.

It appears that those who more readily associate with Factor One can gain a quiet confidence in things with which they are familiar, yet seem less inclined to dabble in unfamiliar technologies. It might be suggested, then, that developmental strategies should not just focus upon online, self-directed learning and training, at least not in the first instance. Such an approach would seem counterintuitive here. Instead, helping develop students who more readily associate with Factor One needs an approach to be, perhaps, personal, careful, and allow students to practice many times in many contexts. One strategy might focus on providing students with hardware, which is extensively used within as many learning contexts as possible, such as happened in projects at the University of Manchester (Dexter, 2012). It might also suggest the use of easily accessible software, which, given the context of GIS, might point to open source solutions rather than licensed packages.

Accommodating a view that confidence in digital skills is most marked in areas of collaboration and communication (Factor Two) may suggest that these are areas educators can exploit to develop other digital skills. Such interventions might include designing collaborative GIS projects, where students have to document a team approach to solving a thorny research problem through the medium of social media tools. They might also focus on the growing social dimension in georeferenced data, afforded through applications such as FourSquare and Flickr or more specialist apps such as ViewRanger.

Convincing students who more readily associate with Factor Three is perhaps, the most challenging task. Conceptually, it appears that they understand and are confident in the knowledge of how useful digital literacy is, and how to access digital resources. Developmental activities here may have to focus less just on the *doing,* but more on the real advantages of doing, alongside a carefully scaffolded learning experience that allows them to experience the real benefits of improving digital practice – improvements that go beyond the instrumental use of resources for assessment purposes. So, instead of teaching GIS as a stand-alone unit, perhaps, for these students, it may be better to show how GIS is an analytical tool in the arsenal of geographers and environmental scientists, integrating GIS practice with the wider skills of data collection and interpretation.

Finally, addressing those who hold more firmly to Factor Four, we may have to embrace the fact that greater self-efficacy comes from students practicing digital skills in their own way, regardless of what systems and packages the university decides is relevant. In some areas, where certain software is considered *industry standard* this may raise some concerns. However, there is

latitude here to develop students' confidence first and foremost through concentrating on letting them use their own technology and find their own solutions. If improved digital self-efficacy is related to students' ability to extend their digital practice (as seen, for example, in Kuo, Tseng, Lin, & Tang, 2013), then maybe educators should not be so worried that a nascent understanding of specialist software is so important. Thus, understanding GIS becomes more important than understanding a specific GIS package. Such development might be facilitated by developing programmes of Bring Your Own Device, as well as investigating the potential of using packages across a range of platforms. Interaction with university systems might only focus upon crucial points of the learning experience, such as sourcing information and submitting assignments. If this were pursued, development of tutors is likely to be almost as crucial as that of students.

Conclusion

The enhancement of digital literacy appears to be becoming increasing important in terms of enhancing the employability of students. Research would suggest that this enhancement is positively linked to students' views of their own abilities, or a measure of their digital self-efficacy. Recent data focuses either upon the social construction of such views, or the statistical relationships between self-efficacy and a range of personal characteristics and academic outcomes. Little of this research suggests we understand how the students themselves construct their own ideas around their abilities.

With this is mind, this study used Q methodology to establish four viewpoints which express ways in which students view their own claims to being digitally literate. Within these viewpoints are aspects of repetitive use and familiarity, the growing influence of social media, the need to still win hearts and minds over developing digital practice, and the need to allow students to express their own digital practice through their chosen technology.

It is suggested that by carefully developing learning experiences that tap into these multiple expressions of digital self-efficacy, a more digitally literate student body may emerge.

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