If we build it will they come? Investigating the relationship between students' access to and use of ICTs for learning

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Abstract

Research from a survey of students in higher education institutions in the Western Cape has demonstrated that despite the difficulties being experienced in terms of access to Information and Communication Technologies (ICTs) in higher education, students report that they do indeed use computers for their learning.

In this paper we explore the relationship between access and use examining particularly the influence of context on use. We focus on those specific aspects of access where previous studies have highlighted a link between access and use, namely; home computer access, individuals' interest in and aptitude with using computers, and support within social networks.

Although the research findings do reveal quite obviously that students with poor access do make less use of ICTs for learning, this forms only part of the picture. High access does not guarantee high use: differentiation in use is noted amongst students from different socio-economic groups for example. There are also students with low access who exercise their agency in constraining conditions, and make frequent use of ICTs for learning, particularly in the business and engineering disciplines.

The findings reported in this paper suggest that the notion of the digital divide is simplistic and less useful than previously thought; rather indications are that amongst higher education students there is a usage divide, and digital differentiation is a more useful framing concept.

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INTRODUCTION

'If you build it they will come' is the dream in a context where access to computers is uneven, unequal and socially demarcated. More specifically, 'If its there will they use it?' Is this a realistic vision? Does improved access lead to more use? Does it lead to more use for all?

This paper first ascertains whether there is indeed a relationship between access and use. It examines limited access, considers whether use is also limited, and whether this is constant for different groupings. It also looks at situations of high access and explores whether there is concomitant high use. It further considers high access-high use situations with a view to ascertaining whether 'they *all* come'. It finally explores the relationship between access to specific resources – home computer access, personal agency, contextual access and access to digital content – and student use ICTs for learning. It does this to identify how access to ICTs enables or constrains use.

The study is framed by an understanding of access and use as inherently related, beyond being linked or cyclical. The assumptions are that access to multiple resources (including, obviously computers) is a requirement before use can be made, and that equally a purpose for use needs to be established before resources can be accessed. This can be imagined as kind of virtual Möbius strip, two sides of a concept forming a continuous closed connection. As access issues are resolved, use opens up more access issues: as use is explored, more and different kinds of access are needed . . . ad infinitum.

THE STUDY

Methodologically, the study was based on the findings of a survey responded to by 6 577 students and 515 academic staff five higher education institutions in the Western Cape in mid 2004. The survey was conducted both in a print and online format in order to maximize response rates. With the exception of one institution, the number of respondents represented 10 per cent of the overall staff and student population.[1]

Students and staff respondents from a range of faculties were represented with the majority being from business disciplines (28%) and the minority from health science disciplines (11%). The majority of students were at the undergraduate level (64%) and were in the first or second year of study (65%). Student respondents were evenly distributed in terms of gender. Most students were under 20 years old (57%). Their home language varied, with English being the most frequently spoken (39%) followed by Afrikaans (19%) and isiXhosa (14%). Most staff had worked at their institution for more than 5 years, and were at Lecturer level (42%) or below. The majority were male (59%) and older than 40 years (53%). Only 2 staff members spoke a home language other than English (56%) or Afrikaans (42%) (Czerniewicz and Brown 2006).

Analytically, the survey was framed by two connected models of access and use. Access to ICTs was understood as complex in that access and use are incessantly inter-

related, and that the resources to be accessed are multifaceted. In order to use computers, students and staff need access to four kinds of inter-related resources: technological resources (physical and practical), resources of personal agency, contextual resources, and digital content resources (Czerniewicz and Brown 2005). Laurillard's (Laurillard 2002) conversational framework provided a way of categorising the use of ICTs for teaching and learning in terms of five key events: acquisition, discovery, dialogue, practice and creation (Czerniewicz and Brown 2005).

When exploring the relationship between these two models and their sub-categories, it is of interest that we found correlations between the distinct categories for access (the resource groupings) and overall use. On the other hand, we found no correlations between overall access and specific use categories, that is, specific types of use are not directly influenced by having more or less access.

OVERALL RELATIONSHIP BETWEEN ACCESS AND USE

In order to determine if there was indeed a relationship between access and use we used correspondence analysis, a perceptual mapping technique that produces a graphical display of the relationship between different variables or indexes.[2] Figure 1 shows the relationship between infrequent, average and frequent use of ICTs (represented by the circles) for learning; and low, average and high overall access to ICTs (represented by the squares).

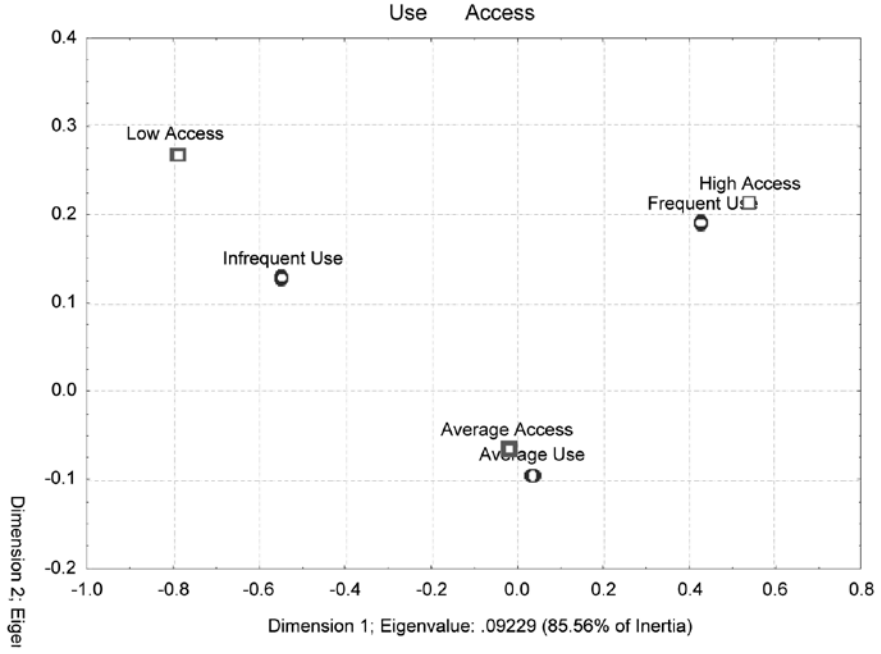

Figure 1: Relationship between access and use

Note that to read the graph it is important to look at where the shapes that represent one cluster (e.g. circles, which represent use) are found in relation to another cluster (e.g. squares, which represent access). These graphs should be read by looking at the proximity of the different clusters to each other. One needs to focus on either the horizontal or vertical axes that separate the graph into upper or lower quadrants. If two shapes are located in close proximity on the same side of the graph, this says there is a strong correlation between these two clusters.

The analysis shows a strong correlation between use of ICT for learning and level of access. High access and frequent use are clustered together in the top right quadrant, and low access and infrequent use in the top left quadrant of the graph.[3]

This analysis effectively shrinks the results to two dimensions or axes, each of which can be understood by closer examination. Dimension 1 (plotted on the x axis) is the most reliable indicator of the associations in the data as it accounts for 85 per cent of the variation in the data. It distinguishes between infrequent and frequent use AND low and high access, thus highlighting the differences between low access and infrequent use (which both fall on the negative side of the axis at a high level of magnitude), and high access and frequent use (which fall on the positive side of the axis, also to a high level of magnitude).

Dimension 2 (plotted on the x axis) only captures 14 per cent of the variation in this data. However, it does seem to be distinguishing between the extremes of access and use (high and low, and frequent and infrequent), and average access and use. However, average access and average use are located close to the point of origin and therefore do not account for much of the variation in the data.

RELATIONSHIP WITH USE IN LOW AND HIGH ACCESS CONTEXTS

When we explore this relationship more closely (Figure 2) we see that 73 per cent of students with low access also make low use of ICTs for learning, indicating that lack of access is a clear constraining factor for use. However the pattern is not mirrored when students have high access. Although 58 per cent of students with high access also make high use of ICTs we are interested that 44 per cent of students with high access are also low users. High access alone is not enough to result in high use.

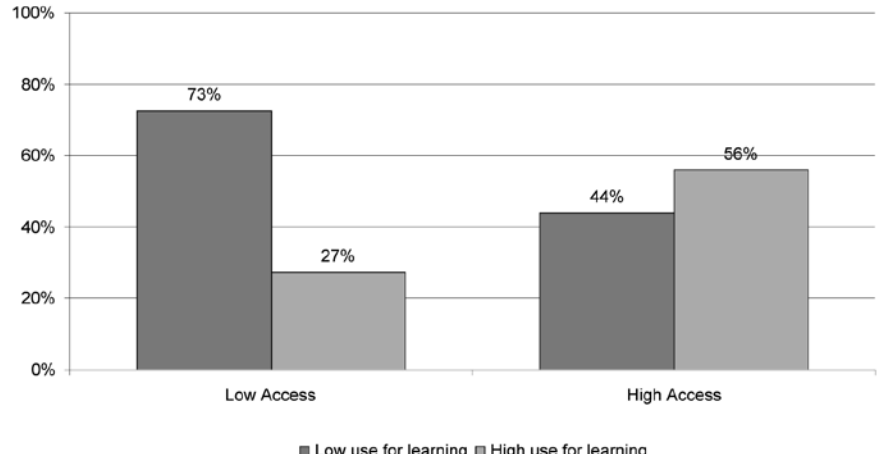

Figure 2: Relationship with use in low and high access contexts

Low access/infrequent use

In examining the differences in frequency of use amongst students with low access we found no demographic differences of gender and language, suggesting that in terms of these demographic factors, the digital divide is indeed disappearing.

However, we do observe some differences in use in terms of socio economic group (SEG) and age. Students from high SEG do have a slightly higher frequency of use of ICTs for learning (32% compared to 28%). Age is another aspect which appears to constrain use with older students (i.e. more than 30 years old) reporting a much lower frequency of use of ICTs for learning (15%) compared to younger students (27%) (Figure 3).

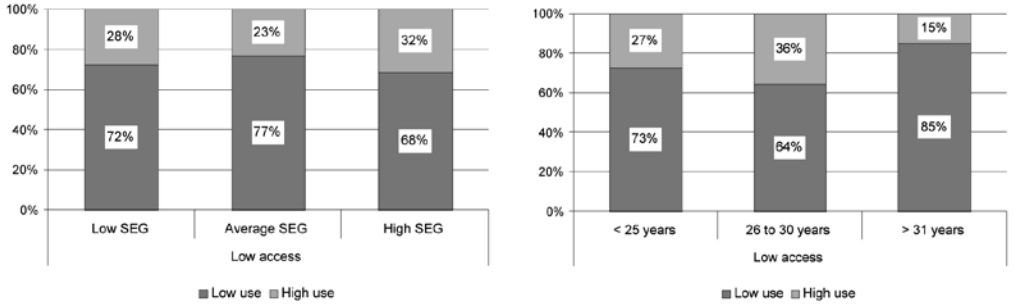

Figure 3: Examination of how SEG and age impact on frequency of use amongst students with low access

We also note a difference in frequency of use amongst students with low access across disciplines (Figure 4). For example students studying in the sciences have much lower frequency of use (82%) compared to students from Engineering (66%). This concurs with other reports (Brown and Czerniewicz 2007) where we noted that students in the applied disciplines of Business and Engineering also use ICTs more frequently compared to students from the pure disciplines of Science and Humanities. It seems that even with low access, use is likely to be more frequent in disciplinary groupings which encourage or require ICT use for learning. The use of ICTs for learning in these disciplines is quite specific. In engineering students are frequently required to use computers to build something, especially using specialized software (Brown and Czerniewicz 2007) and use a computer to undertake a simulation, role play or case studies (Baillie and Percoco 2001). In business disciplines students make frequent use of ICTs for communication and activities such as multiple choice quizzes (Brown and Czerniewicz 2007) teaching strategies favoured as a method of assessment in applied fields (Neumann 2001).

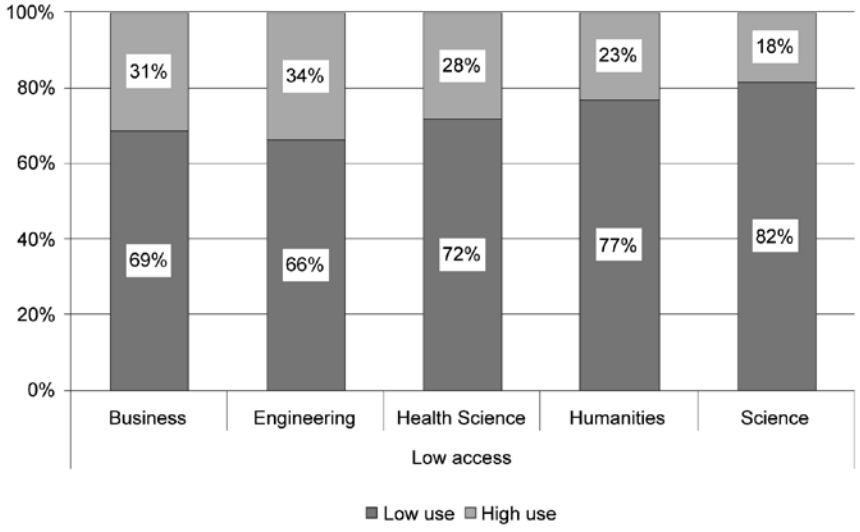

Figure 4: Examination of how discipline of study impacts on frequency of use amongst students with low access

Another factor that appears to particularly enable higher use even amongst students with low access is ease and adequacy of access on campus. Figure 5 shows that 60 per cent of students with low access and high use have good ease and adequacy of access to computers on campus. This demonstrates the importance of campus-based ICT infrastructure for facilitating use of ICTs for learning.

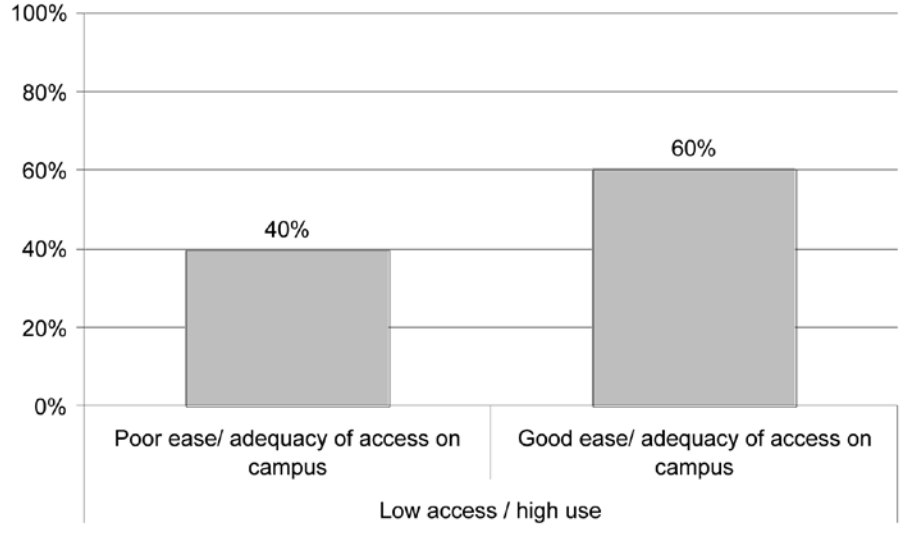

Figure 5: Examination of how ease and adequacy of on campus access impacts on frequency of use amongst students with low access

High access/infrequent use

An examination of the differences in frequency of use amongst students with high access revealed no demographic differences of terms of gender and language or age. However we did find differences between students from different socio economic groups (SEG's) with high access to be pronounced. When students have high access, students from a high SEG have a higher use of ICTs (61%) than their counterparts from average or low SEG's (53%). This suggests that when there is no digital divide apparent (as in the high access group where students all have reasonable access to ICTs) what we are seeing is a socially structured differentiation in use of ICTs.

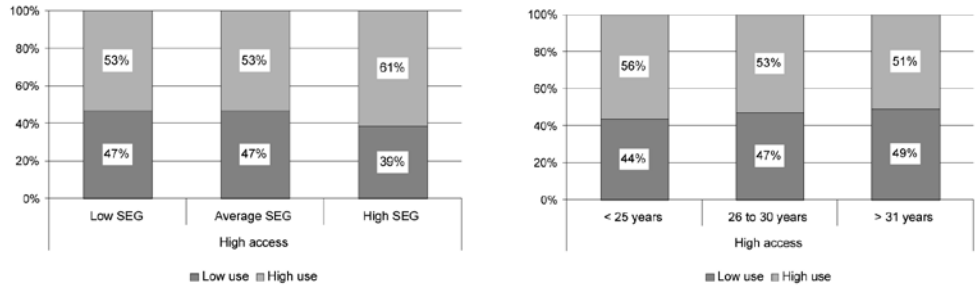

Figure 6: Examination of how SEG and age impact on frequency of use amongst students with high access

Our findings therefore concur with recent research which shows that despite the diminishing access gaps and advanced use of the internet difference in a developed country – the Netherlands – use differences continue to exist amongst adolescents from different socio-cultural groups (Van Dijk 2006). Diversity of use as a concept is replacing the focus on the divide, with various researchers (Bucy and Newhagen 2004; Peter and Valkenburg 2006; Van Dijk 2006) focusing on the 'usage gap' rather than the access gap. This approach highlights the substantial differences amongst people of different ages, gender and income groups in the type and range of activities for which people use ICTs. It is therefore of note that in this study, the students use appears to only be differentiated by socio-economic group. As Figure 6 demonstrates, use is not differentiated by age, nor by gender.

This indicates that studies may need to explore other factors which might be influencing differentiation of use. Such factors may include choice (students with high access can choose whether or not they want to use ICTs); purpose and relevance (it may not be desirable or necessary to use ICTs in certain disciplinary context for example); and proxies, (students may not be engaged in an ICT based activity themselves but may be drawing on other students who do use ICTs as resources).

RELATING ACCESS TO FREQUENCY AND VARIETY OF USE

Does more access results in broader or more varied use of ICTs for learning? At the start of the paper we mentioned that we grouped ICT activities according to various teaching and learning events. We found no correlation between overall access and specific kinds of events (i.e. types of use are not influenced by having more or less access.) But an analysis of variation and frequency was revealing.

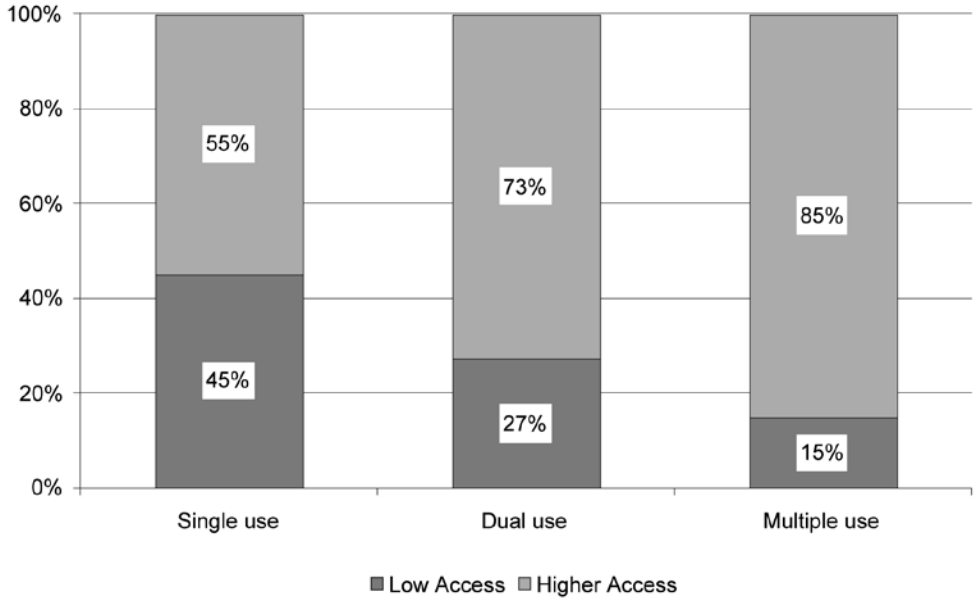

Figure 7: Comparison of students' variation of use and level of access

Figure 7 demonstrates that 85 per cent of students who make multiple use of ICTs for learning also have high access. Students with poor access have a more limited range of use of computers for learning, with only 45 per cent having a single use and 26 per cent a dual use. This shows that whilst high access does not equate with high use it is certainly strongly aligned with varied use. Our understanding of s of ICT use links linking media forms to teaching and learning events, and is based on Laurillard's conversational framework (Laurillard 2002). We support her view that effective teaching utilises a range of strategies and media forms for different purposes and to meet different objectives. Such flexibility and variety will enhance learning. Thus the finding that in high access situations use is more varied seems to indicate that high access enables enriched pedagogical practices.

Given the association between lack of access and lack of use, we are interested to see if we can discern which resources are constraining or enabling on use or whether lack of a variety of resources for access constrain use.

The relationship between home computer access and use

A number of studies have suggested a relationship between computers at home and frequency of use. A recent British report notes that the level and quality of ICT use in learning is influenced by a number of factors, one of which includes ready access to a Internet-connected computer at home (The Becta Review 2005). Another found that young people were more likely to make effective use of computers if three conditions were in place, one of which was that they had a computer at home (Facer 2002).

Figure 8 once again demonstrates that low access is more of a constraint on use then high access, with 60 per cent of students who do not have use of a computer at home being low users of ICTs for learning. This concurs with others studies which note a difference in level and quality of computer use when students have access to a home computer (The Becta Review 2005; Selwyn 1998).

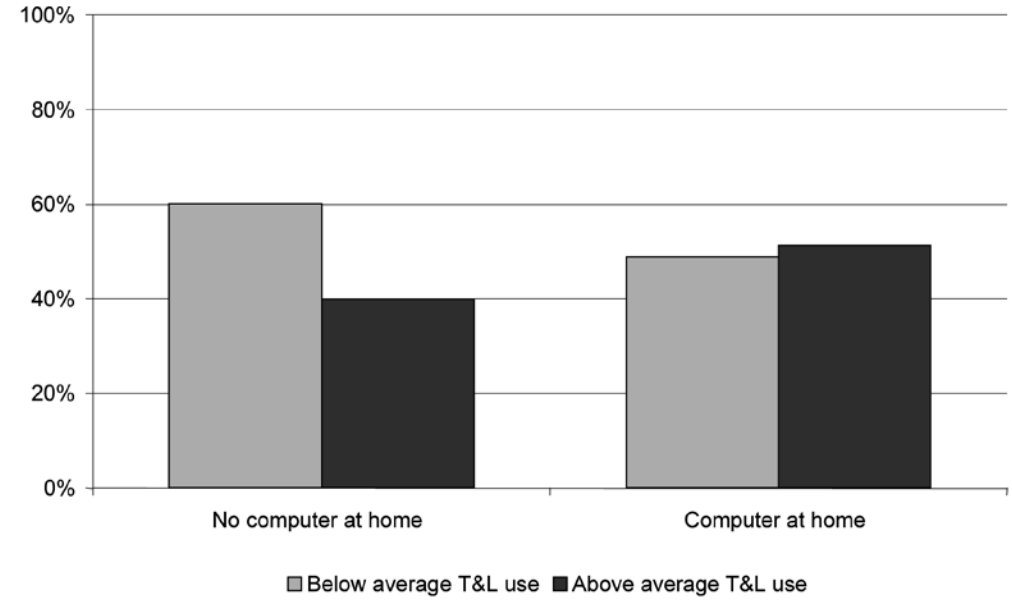

Figure 8: The relationship between home access to a computer and the use of it for learning

However considering home computer use alone may simplify the picture given that the way a home computer is used is related to socio economic group. Nakhaie and Pike (1998) note that students from a higher SEG use a wider variety of computer applications than those from lower SEGs.

Hassani (2006) also notes that whilst home computer access is a key factor in use, individuals who have many locations of use (e.g. home and work, or home and internet café or home and school etc.) take greater advantage of ICTs.

Lack of a home computer therefore appears to be a constraining factor for use, both internationally and in our findings. However, the converse is not true. Students who do

have access to a computer at home are comprised evenly of below- and above-average users. This finding concurs with at least one other: a relatively less recent study notes that students with a computer at home do not differ significantly in their overall use of technology in school or college from students without home access. However, students with home computers did use the school/college computers more frequently for Internet and email Selwyn (1998). It therefore seems that there is an argument having a computer at home may not increases the likelihood of students using a computer for learning.

In our study the difference in use patterns is not noticeable in terms of having access to the Internet at home, as is evident in (Selwyn 1998). Our findings contradict those from elsewhere. College students in the US were found to have a greater use of the Internet the longer a computer had been in the home. Students with no computer at home were found to have a low use of the Internet (Korgen, Odell and Schumacher 2001).[4]

While our findings are clear, the overall picture is contradictory, meriting further exploration and research.

The relationship between personal agency and frequent use

Many researchers have noted the importance of the linkage between personal agency and use. Broos and Roe (2006) for example note that psychological factors such as motivation and interest offer possible explanations for differential adoption and use of ICTs in their study of Flemish adolescents. Some researchers have specified that a lack of interest in and aptitude for using computers is a factor constraining use (Kvasny 2002; Selwyn 2006) while others have found student attitude to technology an enabling factor for use (Miltiadou and Savenye 2003).

We therefore examine the levels of use of students who differ in their disposition and aptitude regarding computers for learning.

Figure 9 shows that the majority of students with a low disposition also have below-average use (64%). While the difference in use amongst students with a high disposition is not as marked, a slight majority (56%) of students with a high disposition also have above-average use of computers for learning. Certainly more students with a low disposition also have a below average use of ICTs for learning and more students with a high disposition also have a high use of ICTs for learning.

The pattern is mirrored in terms of students' aptitude (which is a combination of their perceived self efficacy, length of experience and participation in some form of computer training).

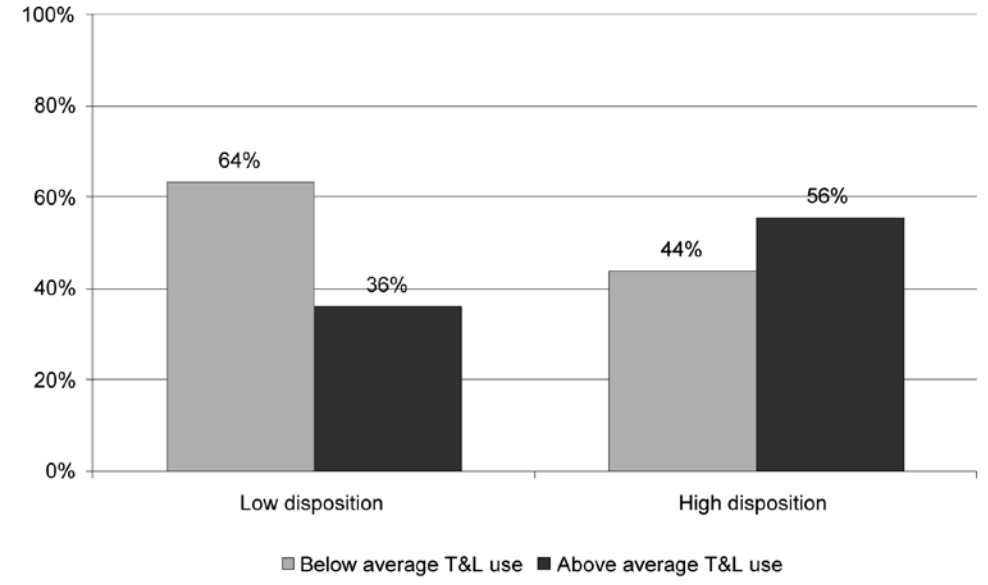

Figure 9: Relationship between disposition and use of a computer for learning

Figure 10 shows that 62 per cent of students with a low aptitude also have a low use of computer for learning. Students with an average aptitude have a slightly lower use of computers for learning (55%), whilst more students with a high aptitude also have an above-average use of computers for learning (56%).

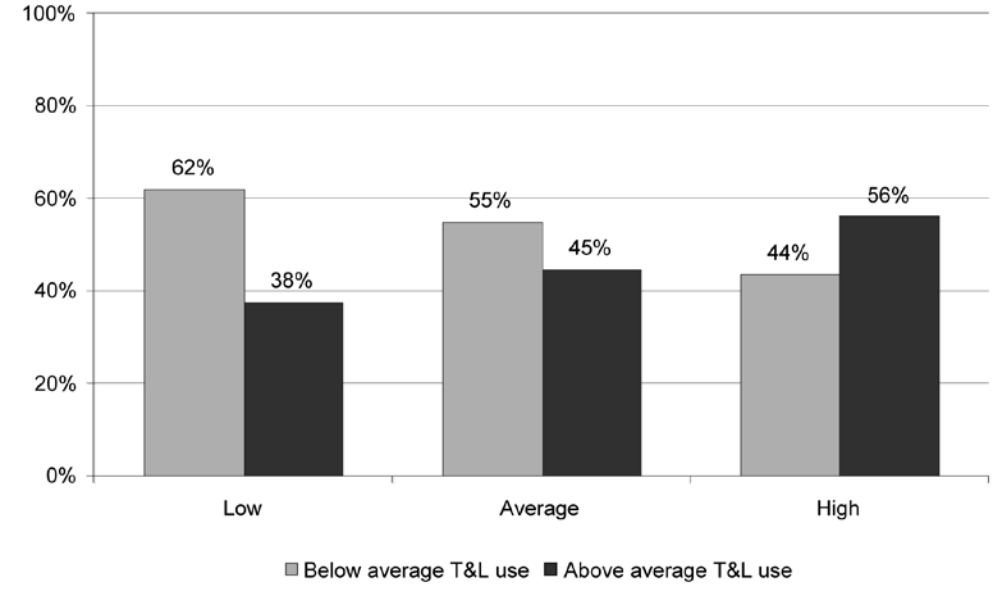

Figure 10: Relationship between aptitude and use of a computer for learning

Self efficacy has been found to be an important factor in ICT use as it influences motivation and behaviour and indeed some researchers have suggested that self efficacy is an important predictor of internet use (Broos and Roe 2006).

The relationship between contextual access and frequency of use

The enabling power of supportive contexts has been noted in the literature, with arguments being made that that strong social networks encourage use (Kvasny 2002). Conversely, lack of social support is observed to constrain use of technology (Warschauer 2003a; 2003b; 2003c). Given that contextual resources seem particularly relevant for students, we were keen to explore this relationship.

Our findings reveal that students with little access to contextual resources in the form of support from families and friends (60%) have below average use of computers for learning.

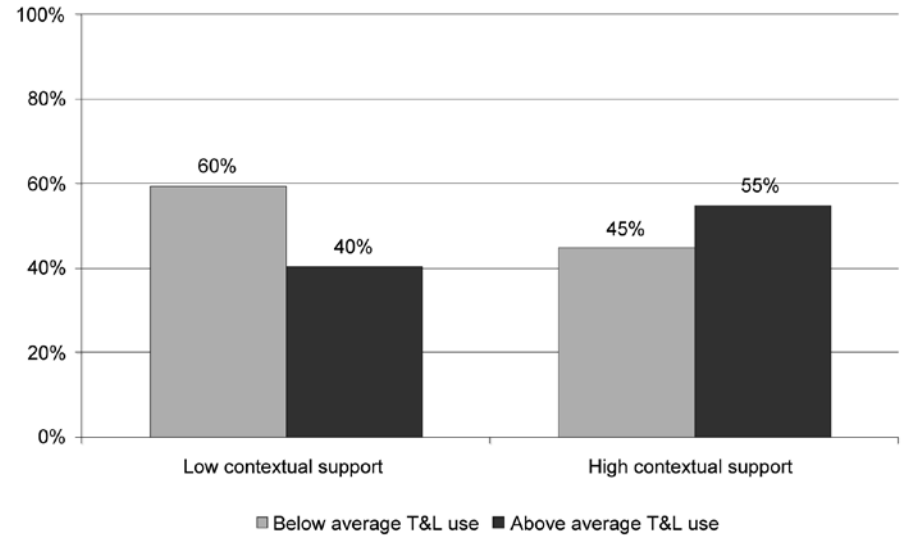

Figure 11: Relationship between contextual support and the use of a computer for learning

The difference in use was not as marked for students with high contextual support, although the majority (55%) did have above-average use.

This links back to the findings noted regarding to home computer access where it was observed that how a home computer is used is related to whether or not parents used a computer as part of their work (Nakhaie and Pike 1998). In such cases parents with knowledge and experience can provide support and guidance.

The relationship between access to digital content and frequency of use

At the outset of this study it seemed inevitable that lack of local content (particularly with regards to language) would be an issue. Yet most students felt that online content

was relevant to their courses and applicable to South Africa (79–89%) and agreed that that the content they found was in the language they wanted (80%).

This seems surprising given that less than half the students surveyed spoke English as a home language. However, we have since concluded that our findings may have less to do with students' perception of the amount of and adequacy of online content available in local languages, but may be more likely to be about the fact that they regard English as the lingua franca of academia (Wasserman 2002) and that indigenous languages are regarded to have lesser status (Osborn 2004).

However Figure 12 shows that amongst the small group of students who indicated they found content to inadequate for their learning requirements 58 per cent were also low users.

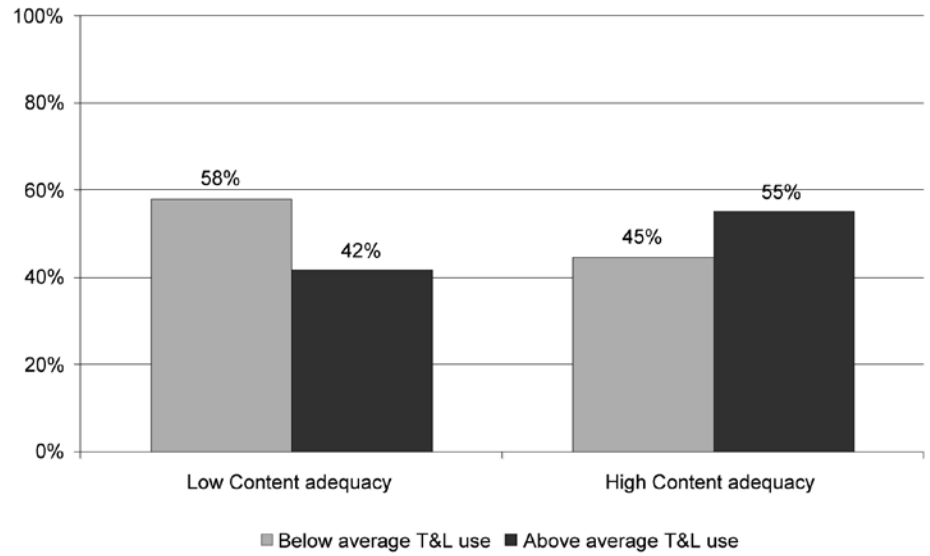

Figure 12: Relationship between perceived adequacy of digital content and the use of a computer for learning

This is interesting as it demonstrates that although the majority of students think that their access to digital content is adequate, those who find it inadequate also have a below-average use of a computer for learning. The issue may require more interrogation as students with low use and low access may well be less skilled at locating adequate digital content.

CONCLUSION

If we build it will they come? The answer to this question is 'Yes, but . . .'.

The positive response is twofold. Firstly, the better the access the higher the frequency of use: those students with inadequate access to a range of resources make very

infrequent use of ICTs for learning, while those with adequate or good access make frequent use. In addition, we see that the majority of students with high access also have a more varied use of ICTs for learning.

Yet, we note too that no matter what the level of access 98 per cent of students use ICTs for learning in some way (Czerniewicz and Brown 2005). This requires a closer look at the differences between low and high access situations.

We note first that even when there is good access there is still a significant percentage (44%) of students who do not make frequent use of ICTs for learning. In particular, students from lower socio-economic groups make less frequent use of ICTs for learning in high access situations. Quantitative data is tantalisingly suggestive, providing pointers for further investigations. The data suggests that broader social divisions become relevant. Institutions can address digital divides by providing fair access on-campus but students come from and live in unequal worlds off campus where access continues to be unequal and framed by disadvantage.

The role of disciplinary needs and the extent of integration into specific courses also become relevant. Thus need and purpose become central drivers of use in high access situations.

Interestingly the opposite is also true. A percentage of students make frequent use of ICTs for learning even with poor access. This occurs more when on campus access is easy and adequate for their learning requirements and in certain disciplinary groupings (such as Business and Engineering) in which ICT use for learning is also required for professional purposes.

These findings suggest that the concept of a 'digital divide' in South African higher education is too simplistic. While increased access does lead to increased use, it does not lead to more varied use nor to equal use for all. As access improves our focus is more likely to shift towards a 'usage divide'. We will need to investigate this with some subtlety given that the disciplinary and personal requirements of students are unlikely to be homogenous. Students will and should use computers to varying extents and for various purposes these being strongly influenced by their context (institutional and disciplinary) and backgrounds (personal interests, values, needs and habits). Studies of digital differentiation in future may do well to investigate whether and how to support student digital use according to student digital and disciplinary need.

Notes

1. In the case of the exception, the survey was administered entirely online and a response rate of 4 per cent of the student and 8 per cent staff population was achieved. Whilst staff (and some students) were invited to participate in the survey online through email invitations via a census method, the print survey was distributed using a stratified sample method, (as per Sayed 1998), to students across all faculties and levels of courses in the five institutions.
2. Correspondence analysis is a descriptive/exploratory technique designed to analyse simple two-way and multi-way tables containing some measure of correspondence between the rows and columns. The results provide information which is similar in nature to those produced by

Factor Analysis techniques, and they allow one to explore the structure of categorical variables included in the table.

3. It is important in correspondence analysis to know how well the graph is measuring the variability of the data. It is worth highlighting here, though, that the two dimensions are capturing the associations between the indexes of use and access very well (as demonstrated by the quality value of 1) and that there is a very strong relationship between use of and access to computers for learning (as evidence by the high chi square with a low p value – chi sq. 666.52 p = 0.00).
4. Although the study did involve college students it was not focused specifically on use for learning activities.

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