Digital Technology and Student Learning:

The Impact of the Ecology

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There is no significant linear connection between the use of digital technologies and enhanced student attainment.

It is time to appreciate the traditional, simplistic way of looking at the impact of digital technology on student learning has to fundamentally change and for all associated with schools to understand that the impact of digital technology on student learning can be profound if an apposite school ecology is created.

We need to recognise that the impact of the digital technology on student learning is complex, far more deep seated than previously thought, is largely non-linear in nature, and appears to emanate in the main from the ever-evolving digital operational base and the associated tightly integrated ecology found in those schools that have infused the use of the digital technology in all facets of their operations.

That profound impact is evidenced increasingly in those pathfinder – early adopter - schools in the UK, US, NZ and Australia where all the teachers in the school by using the digital technology in their everyday teaching have moved the school from a paper to digital operational base.

Those schools have, often unwittingly, created digitally based, tightly integrated strongly educationally focussed ever-evolving school ecologies that simultaneously address the many factors that enhance each child's learning.

That ecology is not simply amplifying the impact of the suite of variables known to enhance student learning but is also facilitating the emergence of an additional suite a set of variables, intended and unintended, that have the potential to markedly lift school attainment globally.

What needs to be understood by all, and in particular government and the media, is that at best there is limited direct connection between the use of a particular digital instructional technology and improved learning in the academic curriculum.

It is particularly important that the school principal, the principal orchestrator of the apposite ecology within each school, understands that reality and the necessity of the new focus.

It is imperative the more deep seated, and in many respects more complex, all pervasive and tightly interrelated impact of the digital technology is understood. Educators need appreciate today it is the total school 24/7/365 use of the digital technology, by all within the school's community that is key to helping shape the desired teaching and learning.

If I gave you an iPad and said that in a year it would markedly enhance your literacy, numeracy and on top of that your attainment in physics you'd look at

me askance and rightly question that claim. You know there is far more entailed in your learning.

The Research

And yet for the last century educators, governments, technology companies and the media have promoted the assumption that by introducing a new technology, be it a magic lantern, film, educational TV, video, a PC or iPad, there would be an immediate improvement in student learning (Lee and Winzenried, 2009). From the 1950's, and the then concerted research into the impact of educational television (Schramm, Nelson and Betham, 1981) onwards study after study focussed on a direct link between the new technology and enhanced student attainment. Rarely was any kind of linkage found, and only then usually in the research commissioned by the technology corporations.

Typically the studies focussed in a micro fashion on a particular technology, its strengths and weaknesses, the technology's use within the classroom and its impact on students' attainment within the existing curriculum. Scant or no consideration was given the macro scene, trend lines, school's ecology or any unintended benefits that might have been realised.

Tellingly in 2009 Underwood (Underwood, 2009) prepared for Becta a major study on the impact of digital technology on schools and in so doing concentrated solely on the connection between the kit and learning, not touching on the by then very considerable impact of the digital technology on every facet of the ecology in those schools that had gone digital.

Little is the wonder that by 2012 Higgins and his colleagues at Durham concluded in their meta-analysis of the by then numerous studies on the impact of digital technology on student learning concluded;

> Taken together, the correlational and experimental evidence does not offer a convincing case for the general impact of digital technology on learning outcome (Higgins et al, 2012, p3).

Disturbingly – nay dangerously – that and like studies have prompted some educators and administrators to make the leap and conclude that as there was no significant impact it is not worth using digital technology in the classroom.

Interestingly the same people have to have been watching the profound impact of the digital technology on their own lives and the learning and teaching of their children over the last couple of decades outside the school walls. Indeed since the mid 1990's parents and society in general have talked of the profound impact of the digital technology and in particular the Net on the learning, the lives and the outlook of the young, outside the classroom. Early work by Tapscott (1998) and Meredyth et al (1998) and later studies by Green and Hannon (2007), Tapscott (2009) Lee and Finger 2010) and Ito et al (2013) all affirmed the very considerable impact the young's all pervasive use of the digital technology has had on their daily lives, their learning and preferred mode of teaching outside the school walls. Indeed Tapscott's 2009 *Grown Up Digital* study is aptly subtitled 'how the net generation is changing your world'.

What those studies did, in marked contrast to the in-school studies was to examine the actual impact the digital had had, directly and indirectly on the learning and teaching of the young, and not what some educators would like to see happen.

That same focus on the actual was taken in the author's study of the impact of the digital technology on the transformation of those schools in the UK, US, NZ and Australia that had normalised or nearly normalised the use of the digital. Significantly the study examined the impact on every facet of the school's operations and thinking, educational and administrative, in and increasingly outside the school walls. That research and its initial findings are detailed on the School Evolutionary Stages blog at http://www.schoolevolutionarystages.net.

Digital school ecologies and student learning

The transformational impact has been dramatic in everyway, creating a mode of schooling, and a teaching and learning culture fundamentally different in outlook and form to the traditional paper based school.

While the purpose of the study was not to examine student attainment it was of note that all the schools were performing above their socio-economic standing.

What the study did reveal was that when schools move to a digital operational base they, like all other organisations before them, will experience considerable natural growth, largely outside the control of the organisation, and will continue to evolve and transform. The schools become evermore tightly integrated, ever higher order and distinct ecologies, marrying the in and out of school teaching, opening the way for them to markedly enhance the student attainment.

Significantly ever school studied, regardless of level or nation had the overarching educational focus of providing the best possible holistic 24/7/365 education for the 21st century. Somewhat surprisingly all moreover took the view that if they provided an apposite, more personalised holistic education – of the type enunciated by Pellegrino and Hilton (2012) – for every child it would matter not what type of tests or exams their children would experience.

These are tightly integrated organisations where the use of the digital and the network connectivity underpins not only all relationships and every operation, but also the mindset of the school's community.

The digital connectivity by all is as imperative to these schools as the pen paper and blackboard availability was to the traditional school.

It is that digital operational base and the associated digital convergence that enabled these schools to create an ecology that promotes the simultaneous addressing of the key variables known to enhance student learning. Look for example to Hattie's (2009) meta-analysis of the known ley learning variables and you'll see all the pathfinders had for example a clear shaping educational vision, set high expectations, had clearly identified the desired educational benefits, had an astute principal willing to lead and develop a culture that encouraged risk, had striven to empower all their teachers, to consistently lift

the quality of teaching, to employ a diversity of teaching strategies and to foster the collaboration between the school and the home.

By all within the school having their own suite of digital technology – often in their hands – the teachers and students were able to instantly access the desired information anytime, anywhere, to analyse it, to re-configure it as desired, to video, record, photograph and create their own quality multi-media presentations, to author e-books and to swiftly store and/or despatch those materials whenever desired.

Little is the wonder the student attainment in all the pathfinders was above the SES norm.

Harnessing the potential

The same ever evolving ecology of the pathfinders also provided an insight into the very considerable, largely untapped potential that exists for all schools operating on a digital base to markedly enhance their student learning.

- **Home-school – community collaboration**

One of the more significant underdeveloped resources available to all digital schools is the expertise and resources of its homes and the opportunity for schools to harness that capability (Lee and Finger, 2010).

One of the major developments in the pathfinder schools, made possible in many respects by the all pervasive inexpensive digital technology, has been the concerted effort to extend the school's educational remit and for the schools to capitalise upon the educational and technological capability outside the school walls. One sees in all the schools a burgeoning and authentic home – school – community collaboration. As indicated in *Collaboration in learning* (Lee and Ward, 2013) it appears that when – and only when - schools move to a digital operational base they are willing to genuinely collaborate with their homes in the teaching of the young and to distribute the control of teaching and learning. Look at the schools that have normalised the whole school use of the digital technology and you'll see a marrying of the teaching of the home with that of the school.

The current home-school educational and digital divide is being replaced by genuine collaboration in teaching.

The existing home – school collaboration identified by the likes of Hattie (2009) while significant is actually very low level and restricted, of the type found in any good school.

The level and extent of the collaboration found in the pathfinder schools represents a quantum leap that logically ought in turn markedly enhance the student learning.

- **24/7/365 networked teaching**

Another development with the facility to markedly enhance both the quality and relevance of student learning is the move by the pathfinders towards a 24/7/365 mode of teaching and schooling, with the school collaborating

closely with all the teachers of the young, often from birth onwards, in the holistic teaching of the children (Lee and Ward, 2013). While the school continues with its intensive teaching of the curriculum it also recognises that in many areas of teaching, particularly in the intra and interpersonal the collaborative 24/7/365 teaching of the key attributes in context by the home can markedly enhance the student learning.

This represents a fundamental change in the nature of schooling and flows from the reality that in a digital and networked school ecology learning and teaching can occur anywhere, anywhere and is not restricted to a physical place called school.

Current schooling is on reflection highly insular in nature, occurring within the school walls, for X hours a week for Y days of the year. That teaching and learning occupies less than 20% of the children's learning time each year.

The remaining 80% of the learning and teaching is handled by default by the parents and children, with virtually no support or recognition from the schools (Lee and Finger, 2010).

The pathfinders are taking advantage of the technology to dismantle the school walls and work more closely with their homes and community in making astute educational use of the largely undeveloped 80%. In so doing they are building on the children's self and peer teaching, individualising the teaching and capitalising on the facility to teach many attributes 'in context'.

Logic and indeed existing research would suggest that by extending the 'teaching' and learning beyond the current 20% by an extra 10% - 20% - 30% one can only but enhance the student learning. This is in essence what happens now in the educated homes. The technology not only makes it that enhancement much easier for all children's homes but as Ito and his colleagues argue in *Connected Learning* (2013) it is imperative schools broaden their remit.

- **Individualised**

The digital technology, the children's choice of their own suite of digital instructional technologies, the collaboration with each child's family and the working with those families assist all schools to more individualise the children's learning.

Educators for generations have recognised the potential educational benefits of a more individualised, more differentiated mode of teaching, but have been markedly hindered by the technological limitations of paper. The all-pervasive use of ever more sophisticated digital technology removes most of the old limitations.

- **Relevance and attraction for 'all'**

Those developments, the facility to learn 24/7/365 in context, to use one's own suite of digital technologies anytime and indeed to take greater control of one's own teaching should also enable schools broaden their attraction and relevance to a greater proportion of the student cohort. It is appreciated equity is and will ever be an issue but it is note that all the pathfinder schools

had normalised ensuring every child at least had apposite kit for 24/7/365 usage.

The reality is that the present mode of schooling actively engages only around a third of the student cohort. It has been a concern of educators for decades. The insight provided by Eckert's 1989 study on *Jocks and Burnouts* is echoed in the 2007 Illinios study on Digital Schooling that observed

> Kids lead high-tech lives outside school and decidedly low-tech lives inside school. This new 'digital divide' is making the activities inside school appear to have less real-world relevance to kids. A blend of intellectual discipline with real-world context can make learning more relevant, and online technology can bridge the gap between the two (Illinois Institute of Design, 2007, p24).

Make schooling more relevant and attractive to even 10% - 20% more of the cohort and the implications are considerable.

- **Synergy**

One of the fascinating developments in the pathfinder schools, again facilitated by the technology and the convergence and efficiencies it engenders is the ever greater synergies occurring, where the impact is greater than the sum of the parts.

How one measures that impact is the challenge but what is already clear is that the one development, the one new facility can in tightly integrated school ecologies be used for multiple – and often unintended – purposes.

- **Higher order teaching**

The schools that have normalised the use of the digital, where all the children are using their own suite of digital technologies have recognised the children's competence with that kit, and have thus ceased teaching them the lower level mechanics and focus now on applying the children's functionality in higher order teaching.

Those schools now place the onus on each child from around age 10 not only to choose the desired technology and apps but also to know how to use their chosen technology.

The teachers are thus able to set higher order tasks and bid the children use the preferred digital functionality in addressing the task. The development is particularly apparent in collaborative project based exercises.

While still early days and in need of research it is an historic shift in the use of instructional technology with very considerable potential to further enhance student learning.

- **The unintended**

In an ever evolving, ever more tightly integrated digitally based school ecology that experiences considerable natural growth there is, as has been found in industry the facility for major unintended benefits to emerge.

It is the reality of a digital operational base. One can't control every variable and need instead the capability to optimise the development in the desired manner.

The organisation, be a business or a school, has as Thorp (1998) indicated to be ready to both identify and shape those opportunities.

Challenge

All of the potential learning enhancement opportunities pose challenges for both the schools and those researching the impact of those developments.

Gone in these schools are the days of constancy and continuity and loosely coupled silo like organisational structures.

These are rapidly evolving, at times seemingly chaotic and messy organisations where all the operations are evermore tightly integrated and interrelated and where it will be challenging to identify which threads, or combination of threads are most impacting on each child's learning.

The development in particular obliges educational researchers to not only change their focus but to begin identifying those indicators that reflect the change in learning occurring in the digital ecologies.

Conclusion

That said what is now apparent is that the successful student learning in the pathfinder schools emanates primarily from tightly integrated, digitally based, strongly educationally focussed, ever evolving school ecologies that simultaneously address all the factors the schools' believe enhance educational attainment.

Those schools have changed their focus.

While it is appreciated the technology companies might not relinquish their sales pitch it is imperative that educators, educational researchers, government and the media change their focus.

Enhanced student learning lies in the digitally based school ecology and the relationships therein and not the digital technology per se.

Let's consign the idea of there being a simple linear connection between the technology and student learning to history.

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