Pedagogical Engineering to Develop Digital Fluency Among Pre-Service Teachers and Educational Leaders Of The 21st-Century

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ABSTRACT:

*The children in our classrooms today have advanced skills for texting their friends on their eTablets and cell phones, instant messaging chats to their peers, dialoguing on MySpace, Twitter or Facebook, surfing the web or playing Xbox or Wii games. These Y Gen, Net Gen, Millennials and Z Gen, Digital Natives, are the children of the digital generation. Unfortunately, most of the teachers in today's classrooms belong to the pre-digital generation and are immigrants without the skills required for 21st century digital fluency. Moreover, their classrooms are not engineered for a digital pedagogy. This has created a teacher-student-classroom mismatch, which at worst, is characterized by the tragedy of illiterate teachers teaching literate students and by the dilemma of teachers who find the present **tens**e and the past **perfect**! Pedagogical engineering is urgently needed to develop the digital fluency of teachers so they can speak their students' language. One way to achieve this is to engineer digital technologies into curriculum as discussed in this paper which reports the results of classroom trials conducted with over 400 undergraduate and 15 doctoral students by the author, in the last three years. The paper concludes that there is an urgent need to train pre-service teachers and educational leaders in digital fluency. Failure to do so will perpetuate the mismatch between digital savvy students and teachers stuck in the orthodoxy pedagogy of the last century.*

KEYWORDS: *21st Century digital fluency, Classroom infrastructure engineering and practice restructuring for digital pedagogy, Digital generation, Digital landscape, Digital nativity, Dilemma of finding "the present **tens**e and the past **perfect**", Pedagogical engineering from orthodoxy pedagogy to digital pedagogy, Teacher-student-classroom mismatch, Technophiles and technophobics, The tragedy of illiterate teachers teaching literate students.*

I.   INTRODUCTION: THE INVASION OF THE REAL WORLD BY DIGITAL NATIVES

As Professor Plante [1] ably points out, in today's digital landscape in which we try to facilitate children and students' learning, "the world is getting more and more technology centred, focused and driven" [p. 1]. Whereas barely two decades ago when I taught at high schools in Sydney, Australia, mobile phones were not common among our students (and had to be kept at the main office as students were not allowed to use them at school), today "children of the 21st century, the Digital Generation, .. spend most of their time texting people on their cell phones, chatting with friends using instant messaging, interacting with people on Facebook or MySpace, playing games on Xbox or Wii and surfing the Internet" [2]. What is particularly interesting is the rate and extent to which digital technologies have proliferated in the real world lives of these Digital Natives. For example, Prensky's [3] rather conservative estimates were that "by the time they are 21, the Digital Generation will have played more than 10,000 hours of video games, sent and received 250,000 emails and text/instant messages, spent 10,000 hours talking on digital cell phones, and watched more than 20,000 hours of television and over 500,000 commercials" (p. 1). As Jules, McCain & Crockett [2] put it, "our students are the Digital Generation, and our generations are primarily nondigitally oriented (Digital Immigrants) (p.31). They add that "the Digital Generation has highly advanced skills for functioning in the digital world ….(and that) Teachers … ignore the skill level of their students … because they don't recognise the skills this generation has developed to operate in the digital world" (p. 51).

In contrast to the avid appetite for digital technologies represented in the above figures, an alarming finding by Prensky [3] was that by the time these digital natives are 21, they at the very most, might have spent only 5,000 hours reading books.

II.   LITERATURE REVIEW: DIGITAL FLUENCY, DIGITAL NATIVITY AND DIGITAL IMMIGRATION

Ever since Marc Prensky [3] made the rather bold statement in 2001 that "It is very likely that our students' brains have physically changed – and are different from ours – as a result of how they grew up … surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age" [p. 1], the issue of digital fluency and its implications for teaching and learning; and whether our scarce resources should be utilized for clicks rather than bricks, has become one of high interest. Prensky articulated the new culture that had emerged as a result of the aggressive penetration of digital technology in the lives of young people born since the last two decades of the 20th century as Digital Natives. He justified this label with the explanation that they "are all 'native speakers' of the digital language of computers, video games and the Internet". So, they have the skills for digital fluency. Comparing these natives into the digital world to those of us who only discover the digital technologies as adults, he coined the term "Digital Immigrants"[3, p.3] to ably characterize the fact that we are in the process of learning a new language, - a process that it typical of all immigrants in their new country. Howell [4] has referred to them as "Gen C, Gen I, Net Gen, Gen Y, Gen Z and Internet Generation [p. 6].

A lot of literature suggests that pedagogical engineering to embed technology into teaching, particularly in the teaching of pre-service teachers and educational leaders should be a high priority in today's educational institutions. For example, McNierney [5] admonishes that teacher educators "must model instructional methods which help future teachers understand that technology-based instruction is no longer an option. It is a requirement". A study of the use of social media at the University of Massachusetts Dartmouth [6] found that 100% of all colleges and Universities included in their study were using some form of social media. The same study found that in higher education Facebook was the most used social media tool and its use had grown rapidly from 61% in 2008 to 87% in 2010 and to 98% in 2011. The use of Twitter had increased from 59% in 2010 to 84% in 2011. That of Linkedin has increased from 16% in 2010 to 47% in 2011. The social media commonly used included Facebook, Twitter, Linkedin, Blogging and Message Boards. These findings were consistent with earlier results in the Jones and Madden [7] study which found that high numbers of college students were using emails and instant messaging tools to communicate with their peers and academics and with the Kennedy et al. [8] study of ICT permeation into the lives of 1,973 Digital Natives who commenced their first studies at the University of Melbourne in 2006 and found that 96.4% of them had unrestricted access to mobile phones and 72.9% had unrestricted access to a broadband connection and [p. 4] .

Other literature from Australia shows equally high rates of fascination with digital tools particularly among adolescents and young adults. For example, a study by Oliver and Goerke [9] found that there had been a rapid increase in the numbers of students' use of instant messaging, blogs and podcasting between 2005 and 2007 and that over 90% of 1st year engineering and business students used online resources for their study. Increasing digital nativity of Australian children is supported by data from the Australian Bureau of Statistics (ABS) which show that ten years ago, (2003) some 99% of 12 – 14 year old adolescents in Australia used a computer at home or at school. One can only assume that access to the Internet must have been significantly increased with greater access to broadband that the ABS [10] estimated to have reached 73% of the population in 2011. The same survey also found that social networking was the most popular use of the Internet technologies.

Abundant literature shows that with imagination, teachers can easily increase the permeation of digital tools into their teaching and curriculum. Excellent illustrations of this include the many apps that are freely available on the Internet and can very easily be embedded into our curriculum. Suzanne Lustenhouwer [11], for example, posted a very helpful blog on 21 August 2012 illustrating a wide range of iPad apps that could be used in the classroom to facilitate students' engagement with learning by simply tapping on objects embedded within the Multiple Intelligence (MI) that best serves the content being taught. Figure 1 illustrates the wide range of app icons that could be used in teaching curriculum relating to the Logical-mathematical MI, Bodily-kinesthetic MI and Interpersonal MI. The app icons for the Intrapersonal MI, the Naturalist MI and Musical MI are shown in Figure 2. Examples of apps suggested for learning and teaching with the other two MIs (Visual-Spatial and Linguistic) are also given in the same blog but left out here to economise on space.

From Lustenhouwer's blog it is clear that students and teachers can easily choose whichever app serves them the best in developing their understanding of issues and concepts, for in stance, in critical thinking using Howard Gardner's [12] Multiple Intelligences. Each MI has several active icons, which a student can click on to apply that MI's orientation to critical thinking. For example, Touch Annotate, Codea, Move the Turtle, Wolfram and Khan, can all be used to work with the Logical-mathematical MI. In the Bodily-kinesthetic MI, the icons students could choose from, depending on their topic or subject, include Google Earth, Aurasma, Comic Life or SparkVue. Examples for the Interpersonal MI include Facebook, Skype, Dropbox and Nearpod. Other possibilities are illustrated in Figure 2.

A number of other studies have demonstrated the great timesaving potential of social media technologies if they are well designed for pedagogical use. For example, working with Bloom's Revised Cognitive Taxonomy Kathy Schrock [14] outlined a wide range of icons each of which has a clickable hot spot for Web 2.0, iPad, Google and Android apps that could be used to readily support our teaching of critical thinking using Bloom's Revised Taxonomy of Remembering, Understanding, Applying, Analysing, Evaluating and Creating. She identified several apps applicable to facilitate learning at each of these different cognitive levels as illustrated in Figure 3, for Web 2.0 and in Figure 4 for the iPad. In applying Web 2.0 apps while studying at the low thinking level of Remembering, Schrock listed apps including Wordle, Drigo, Google and Fotobabble. As we move to the second higher-order thinking involving Understanding, Schrock again included Drigo but added Feedly and Google Advanced Search. As she raised the bar to the third cognitive level - Applying, - she included Pipes, Podomatic and Soundation. At the fourth cognitive order of Analysing, she assembled Wufoo, Google Docs, Creator and Mentimeter as the appropriate apps. For Evaluating, -cognitive level five, the apps that Schrock highlighted again included Google and Google +, as well as Blogger. At the highest learning level of Creating, Schrock outlined Fotobabble, Wevideo, Prezi and Screenr. The common icons for all these apps are illustrated in Figure 3. Apart from these rather generalised apps for Web 2.0, Schrock also assembled apps dedicated for use on the iPad when teaching critical thinking using Bloom as illustrated in Figure 4. Space does not allow us indulgence for detailed discussion of these. It is noteworthy however, that for each cognitive level, she designed six alternative hot links that students could choose to work with. Equally instructional are Langitch's [15] apps that could be used on the iPad by teachers and students to complete class activities using Bloom's Revised Cognitive Taxonomy. As illustrated in Figure 5, they range from the simple iBook for the simple Remembering level of cognition, through to the Creating of iMovies at the highest thinking level. The interactive nature of these apps has potential to engage students deeply in their learning, utilizing tools that interest them and which are consistent with their digital fluency.

This is not to say that students' pre-occupation with digital technologies has only benefits without negatives. As Valery [16] points out, Digital Natives "are always performing multiple digital tasks simultaneously – surfing the Internet, watching a video, chatting online with friends using messaging, and downloading music at the same time, all while doing homework"[p. 3]. There is research showing that attempts at simultaneous dexterity could lead to inefficiencies, particularly if tasks require higher-order thinking and involve new processes [17]. While being cognizant of some of the possible adverse effects associated with digital technologies, we need to acknowledge that the world as seen by Digital Natives today is very different to that we older folk grew up in. In today's 24/7/365 world, we need to teach our pre-service teachers how they can maximise the benefits available from engagement of their students with digital technologies. For the Digital Natives, digital bombardment is not a curse. It is a virtue that spices their lives. It keeps them off unsafe streets, away from unsupervised parks and at home, sometimes in un-parented homes, taking on what Jules et al. [2] characterize as substituting for babysitters.

Thus, available literature appears to provide strong arguments in support of engineering digital technologies into teaching and curriculum. Howell [4] suggests that the arguments can be categorized into social imperatives and pedagogical imperatives. Among the former, she identified the expectations of students, parents, employers and the wider community. For the latter, she identified what Sabelli [18] called "constructionism". She also laid emphasis on the central metaphors of "connectivism", "computer-supported collaborative epistemology" and "technological pedagogical content knowledge (TPACK)" to name a few [18-pp. 21-31].

Figure 1: Suzanne Lustenhouwer's [11] Apps for Multiple Intelligences

Figure 2: Suzanne Lustenhouwer's [11] Apps for Multiple Intelligences
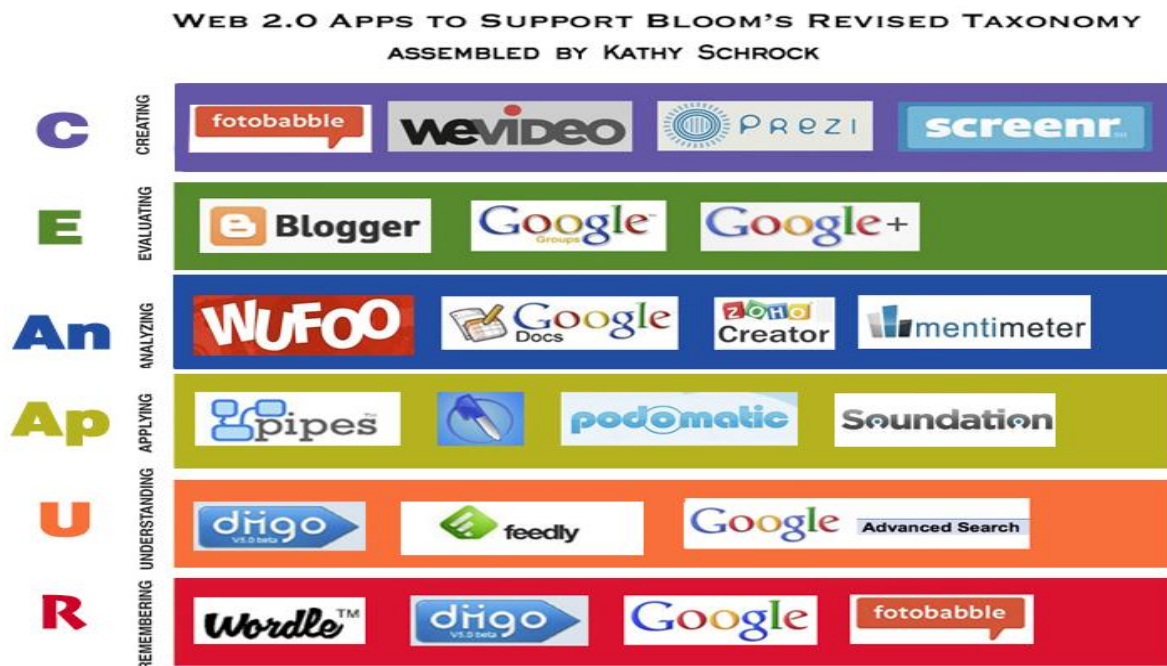
Figure 3. Bloom's Revised Taxonomy using Kathy Schrock's [14] Web 2.0 Apps

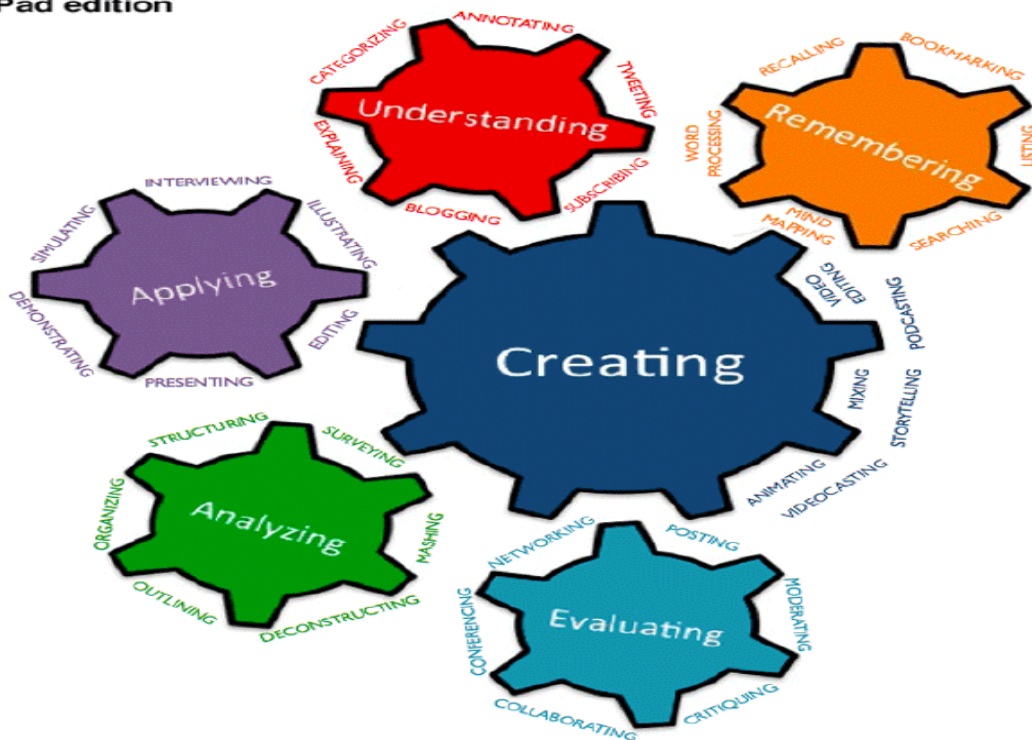If you go to her website (http://www.schrockguide.net/bloomin-apps.html) there are hotlinks to apps for this image.

Figure 4. Teaching with Bloom's Revised Taxonomy using Kathy Schrock's [14] iPad Apps

Bloom's Taxonomy for iPads

http://langwitches.org/blog/2012/03/31/ipad-apps-and-blooms-taxonomy/

Along with this image Langitch has also provided a definition for each category of Bloom's as well as a listing of iPad apps that could be used to meet the category.

Figure 5. Teaching Bloom's Revised Taxonomy using Langitch's [15] iPad Apps

III. METHODOLOGY FOR PEDAGOGICAL ENGINEERING FOR DIGITAL FLUENCY IN THE DIGITAL CLASSROOM

3.1.From Moodle and Sakai Learning Management Systems to Google+.Discussion Circles

This section describes the decisions and the strategies used by the author in his attempts over three years, to engineer or embed social media technologies into the planning, design and teaching curriculum of two Units, which were initially offered using Sakai and then Moodle Learning Management Systems (LMS). This journey in learning and developing appropriate use of social media technologies began with one group of 15 students enrolled in a doctoral degree Unit EDCX782 (Leadership and Culture in the workplace) in 2011 over two semesters. Encouraged by the apparent success of the first trial, the journey continued in trimester 2 of 2012 and 2013 to involve two much larger cohorts of over 400 (258 in 2012 and 169 in 2013) undergraduate pre-service teachers enrolled in Unit EDLT217 (Planning and Assessing for Active Learning) in their second year of a Bachelor in Education degree at one University in Australia.The decision to start this learning and teaching experience with the doctoral students' Unit, was underpinned by good considerations. Firstly, the number of students enrolled in this Unit each semester (now trimester) is small; being around ten per semester. This meant that it would be relatively easy to work on a new initiative with a small number. Secondly, the Unit was offered in a completely online mode to external students. This meant that they were already used to using technologies like Wikis, and online Forums.

Thirdly, most of the doctoral students were employed in Australian schools or other institutions of learning where they occupied leadership positions in middle level management such as Head Teachers in schools, Coordinators or Assistants to Principals. This gave me reason to believe that they would command a reasonable level of integrity and responsibility and respect for each other in the virtual classroom. Moreover, the online mode suited their busy work schedules quite well because of the flexible design, which facilitated their engagement with the Unit at times that suited them rather than regimented by lecture schedules. For ease of presentation (and to reserve part of this interesting story for another day) the experiences reported here relate to semester 1 of the doctoral cohort of 2011 (EDCX782, n = 9) and trimester 2 of the undergraduate cohort of 2012 (EDLT217, n = 258). All students had access to the main LMS called Sakai in 2011 and Moodle in 2012. As was standard practice, before the introduction of GDCs all cohorts relied on posts in Moodle Forums for their discussion. They had opportunities to design Wikis and to textually chat within their groups. Their activities were monitored and facilitated by an Online Tutor. Participation was mandated for the external cohort (n = 160) but ad libitum for the on-campus students (n = 98).

The design engineered in the LMS was that students formed groups of ten. Each group of ten could communicate among themselves but interactions across group boundaries were not possible. As I monitored the posts in the Moodle Forums I noted that the ability for students to communicate with each other and to provide peer support was being undermined by the restrictive group structure (of a maximum of ten). I sensed that there was a demand among the students for greater opportunities to interact with one another. I was also aware of the increasing use of smart phones and eTablets by students in their predominantly non-academic discourses. These discourses helped them to develop skills in digital fluency which, if properly guided, could be applied in learning contexts. In an attempt to meet such demand for increased students' interaction, and to take advantage of the apparent digital fluency skills, I decided to re-design these two Units so as to embed into them, selected social media technologies, namely Google+ Discussion Circles (GDC), eFoliospaces and YouTube products. I was keen to find out whether, inter alia, digital fluency skills in social media technologies could be effectively used in formal constructivist learning, teaching and assessment. This was uncharted landscape at my University and I at times wondered whether the invitation to students to utilize social media technologies in eLearning would trigger technophobia among them and lead to a fall in enrolments in this Unit or whether it would facilitate and/or increase students' engagement with their learning, along Bruner's [19] 5E Instructional Model expectations.

3.2 From Moodle Learning Management System to Social Media Technologies
Because, as already stated above, all our students have access to Moodle LMS, the starting point for their transition from Moodle to GDC were their Forums in Moodle. However, aware that the numbers in each Forum were likely to grow much larger when transferred into the GDC environment, I named them Peer Learning Networks (PLN). The aim of this transition was to enrich peer-to-peer informal learning among the students and to encourage peer support, through a-synchronous, virtual conversations using social media technologies in which they were relatively fluent, or could develop digital fluency relatively easily. This way, the PLNs were designed to become the basic unit of conversation which served as an a-synchronous round table for the participants. Specific instructions were given to the students to facilitate their transition from Moodle to GDCs. The first eleven instructions or steps were the same for all cohorts. As shown in the following list, following these common steps, those designed for undergraduates were simpler than those for the doctoral cohort. Instructions and guidelines shown in steps (xii) to (xviii) were specified for the doctoral students:

i.   Go to the Forum in Moodle and introduce yourself to your peers in 200 words
ii. A *Google+.Discussion Circle* has been created for you.
iii. Create a *Gmail.com* account for yourself and post it in Moodle.
iv. Once your Gmail account has been created you will be sent an invitation to join the unit's Peer Learning Network (PLN) built around a *Google+.Discussion Circle.*
v.   Get the topic I have posted in Moodle and discuss it in your *Google+.Discussion* Circle.
vi. Invite other students from UNE to join in the discussions in your PLN.
vii. Invite anyone you know, from anywhere in the world, to contribute to your discussions in the GDC.
viii. All students and invitees must strictly keep their posts to the academic topic given for discussion.
ix. Non-compliant invitees will be deleted from the GDC and barred from further access.
x.   Continually revisit the *Google+.Discussion Circle* so that you respond to and comment on the postings of your peers.
xi. Your response may include *YouTube* videos, *Lucidchart* graphic organisers, simple text or supporting images.

xii. Design a personal website using *eFoliospaces* and in it discuss your understanding of the culture and climate of a workplace you are familiar with.

xiii. Advise members of your PLN of the URL for your *eFoliospace* so they can access it.

xiv. Engage with the set readings in eReserve and post three Critical Analyses of the Literature.

xv. You are encouraged to apply Critical Thinking Tools (e.g. *Bloom, MI, Bruner, De Bono and GOs*) in your literature critiques, embed *YouTube* products with the assistance of any digital apps you want to work with.

xvi. Create a link via the *Google+.Discussion Circle* and notify your peers that you have completed your critique so they can engage in dialogue conversation about your posting.

You are to respond to three of the critiques in a manner that provokes further sought and discussion.

After the conversations with your peers in the *Google+.Discussion Circle,* revisit your *eFoliospace* and using one of the Theoretical Frameworks from the selected readings on Leadership and Culture, explore and reveal your understanding of the culture and climate of that workplace.

The instructions for the undergraduates following step (xi) above were different in several respects. For example, students were given a new topic for discussion every week. The topic related to the lecture content given in the respective week. This was not the case with the doctoral students because they don't have lectures. Secondly, because of the larger numbers of the undergraduate students, they worked in many core PLNs, each starting with 10 students whereas all the students in each doctoral cohort formed one core GDC as their PLN. Furthermore, again because of the much larger numbers involved, I gave instructions to the undergraduate students to set up *Google+.Discussion Cirles* by themselves whereas I started the PLN for the doctoral students and invited each one of them (steps ii and iv above). This strategy was followed because it would have been inefficient and ineffective for me to set up such a large number of *Google+.Discussion Circles* for the large undergraduate cohort (n=258; comprising 160 off- and 98 on-campus). Apart from such structural differences, the pedagogical approaches and practices were similar. All students were encouraged to apply Critical Thinking Tools drawn from Bloom's Taxonomy [13], Gardner's MI [12], Bruner's 5E Instructional Model [19], De Bono's Six Thinking Hats [20] and Graphic Organizers. The caption of the GDC-PLN-EDCX782 comprising the first 9 students in the doctoral Unit EDCX782 in trimester 2 of 2011 is illustrated in Figure 6. That for one GDC-PLNCK1 showing 47 participants is illustrated in Figure 7.
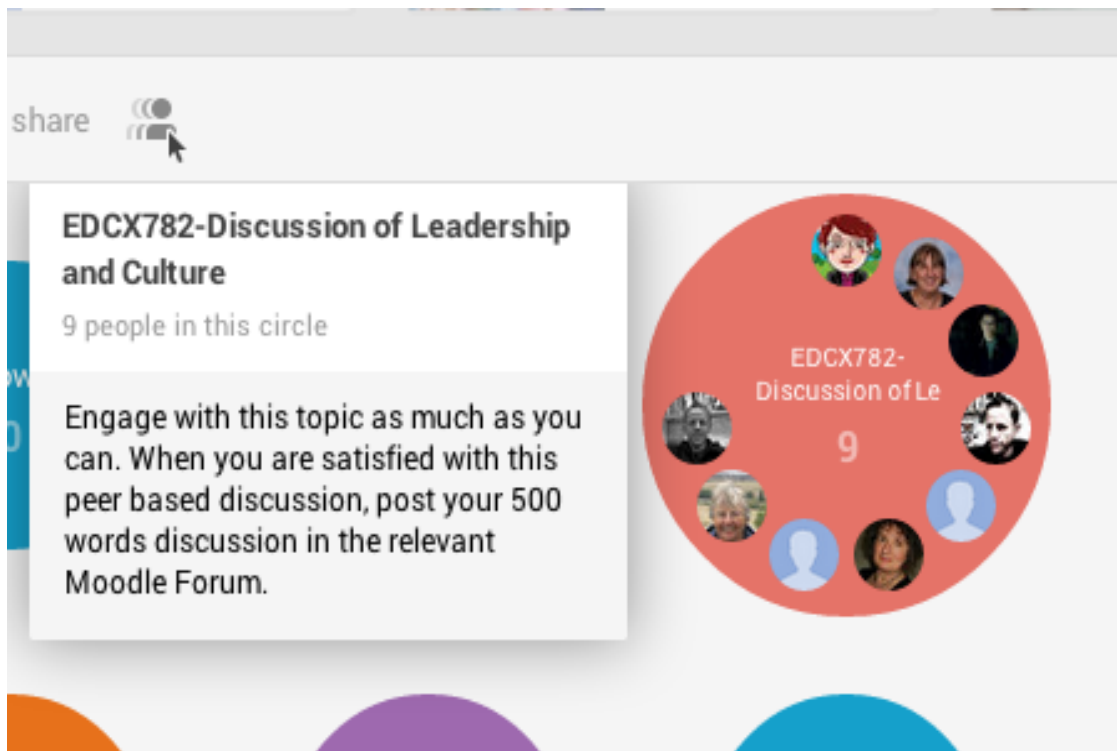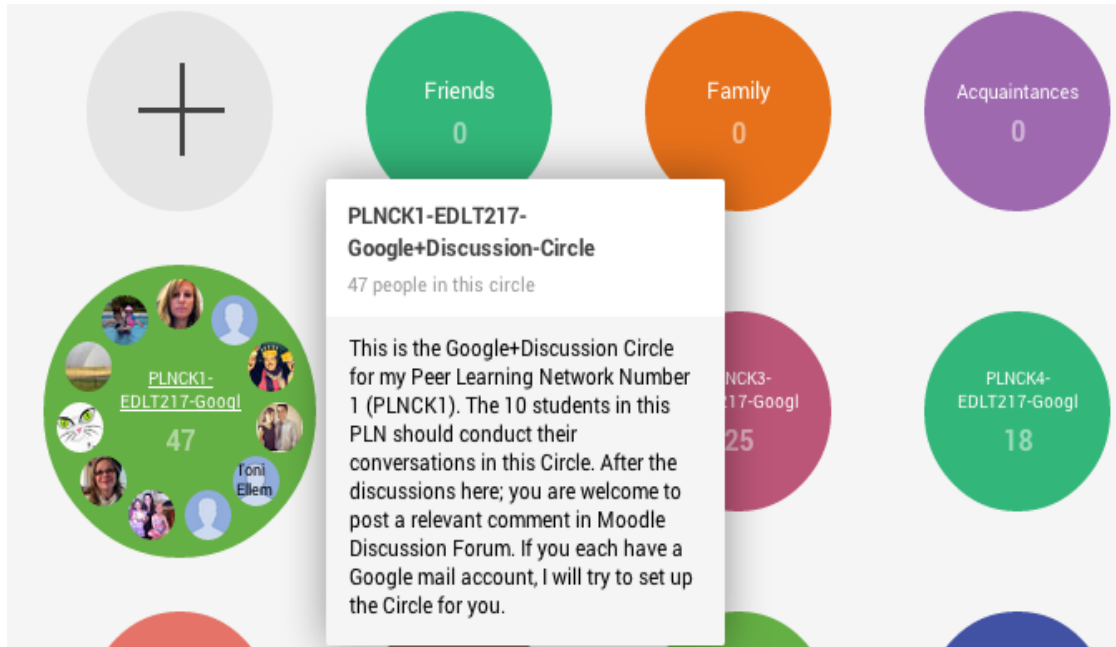

Figure 6. Google Discussion Circle for the doctoral cohort studying Leadership and Culture

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Figure 7: Examples of a Google Discussion Circle for Undergraduates PLN-CK1

IV. OBSERVATIONS AND FINDINGS

As illustrated in Figure 7, what emerged very clearly was that the introduction of GDC as social media technologies, reduced the tyranny of distance and enhanced social presence as students participated in discussions in their virtual classrooms founded on PLNs. For example, in the GDC for my first undergraduate PLNCK1, the number of participants rose by 470% from the original 10 to 47. The reason this was possible was because, whereas under the old system, every student participated and as this was a mandated requirement, there was a 100% response, under the new GDC technologies, each student was asked, not only to participate in the discussions but also given the opportunity to invite other people from outside their group of ten to participate in the GDC discussions. As a result of this design, instead of the ten members of each PLN, the PLNs increased their membership. Thus, whereas under Moodle each Group of 10 had 10 participants, under the GDCs engineering, PLNCK1 initially comprising 10 students ended up with 47 participants. Space does not allow illustration of all the GDCs but significant multiplier effects were realized across all the GDCs. For example, GDC 2 grew to 72; GDC 3 to 51 and so on. What is interesting and particularly noteworthy was the observation that group participation under the old Moodle LMS was mandated, but the invitation of others under the new GDC technologies was voluntary. So, the observed multiplier effects were the results of personal interest and desire to participate rather than a response to mandated instructions. It was evident too, that given the opportunity to apply digital technologies in their learning, students took initiative to extend their understanding of issues and concepts in a digitally connectivist mode. Looking at the streams posted in the GDCs, it was also noticeable that their engagement through PLNs was not only absolutely greater than that under the old Moodle Learning Management System, but also more frequent and with greater zest.

The results shown in Figure 7 are very encouraging for the application of GDC social media technologies in pedagogy but what is even more interesting, though not discussed here for shortage of space, and because these results are rather tentative, is that the frequencies of posts among the GDC-PLN members were much more frequent than those among the old Moodle groups. Moreover, the comments students posted in the GDC-PLNs indicated that they appeared not to see themselves as individual learners, or learning in isolation, but in PLNs that were supportive of each other. They did not appear to be competitive with each other, but collaboratively seeking to engage with the concepts and issues being discussed rather trying to outsmart each other. For students enrolled in the online, distance education mode to be expressing such feelings, lends a lot of support to and shows potential merit in learning engineering which embeds interactive, interconnecting social media technologies into pedagogical practice and curriculum development.

It was also very interesting and encouraging, to see how students sourced and shared stimulus materials with members of their PLNs. Many of the comments in the streams reflected peer mentoring and guidance for each other. The extent to which students shot videos of their own workplaces or designed Graphic Organizers using Lucidchart or used iPad apps to apply Bloom or to discuss MIs in their critiques, and freely shared these with their PLNs, indicated a move towards self-regulated learning based on interest, motivation and personal drive. The comments made on other students' posts reflected aspects of peer feedback, peer support and peer assessment.

It was clear from monitoring the streams in the GDC that students' construction of knowledge was moving from the orthodoxy cognitive constructivist thinking that emphasizes Piagetian [21] personal construction of knowledge not only towards Vygotsky's [22] social constructivism but more importantly towards digital connectivist pedagogy. By connectivist pedagogy I mean what Castells [23] characterized as learning that focuses on building and maintaining networked connections that are current and flexible. An underlying assumption of connectivism as envisaged by Castells [23] and also discussed by Anderson and Dron [24 p. 87] that I found to be very evident among my students was that "information is plentiful and that the learner's role is not to memorise or even understand everything, but to have the capacity to find and apply knowledge when and where it is needed". This is digital fluency in the 21st century of our Digital Natives. Students' apparent enthusiasm to engage in GDC (apparently more so than in Moodle Forums) appears to be very consistent with what Kanuka and Anderson [25] characterize as knowledge acquisition that needs to be subject to social discussion, validation and application in real world contexts. The fact that students took initiative to invite their friends outside of the University to participate in their academic discourses in the GDC reflected their sense of self-efficacy and personal competence in utilizing PLN-based digital technologies. These skills appeared to fall within Bloom's [13] higher-order thinking skills of Applying, Analyzing, Evaluating and even Creating. Students' critiques of readings from the eReserve, designing eFoliospaces in which they embedded technological apps and sharing their Urls with their peers demonstrated high levels of Engagement, ability to Explore, Explain, Elaborate and Evaluate that appears to be consistent with Bruner's [19] 5E Instructional Model, using tools that enhanced their digital fluency in eLearning.

V.   DISCUSSION AND CONCLUSION

It has been suggested that the brains of the Digital Natives in our classrooms are wired differently. As Prensky [3] proposes, their brains are used to the "twitch-speed, multitasking, random-access, graphics-first, active, connected, fun, fantasy, quick-payoff world of their video games, MTV, and Internet". As a result these children very easily find most of what is offered in the orthodoxy, tradition engineered classroom content, boring and possibly irrelevant to their real world lives outside the classroom. If we are to engage them, keep them interested and help them to learn, we must speak their language. This means that the Digital Immigrant teachers need to rapidly acquire 21st digital fluency so they can catch up, and hopefully keep pace with their Digital Native students.

It is clear that there is a mismatch between our understanding of how to share information and construct meaning as adults and that of the children we teach, - the Digital Generation. Given this understanding, if we uphold 19th century French psychologist Jean Piaget's [21] proposition that "The principle goal of education is to create men and women who are capable of doing new things, not simply of repeating what other generations have done", then we should encourage our students (pre-service teachers, educational leaders, secondary and primary) to utilise digital tools for construction of academic knowledge in addition to their high utility as tools for sharing and construction of social knowledge. This way, we shall enable our students to learn in their own ways rather than simply replicating how we learnt in the old world. Failure to do this will perpetuate the mismatch between digital savvy students of the 21st century and teachers stuck in the orthodoxy, traditional pedagogy of the last century and fail to achieve what Fullan [26] conceptualizes as the moral purpose of education:- educating productive citizens.

This is why I argue in this paper that digital nativity should be allowed to replace digital immigration as teaching and learning in today's classrooms, at all levels, (primary, secondary and tertiary), progressively gets engineered for the digital landscape. In this new landscape, Facebook, Twitter, MySpace, Bebo, Google Circles and other social media technologies are rapidly becoming the preferred media of intellectual exchange among students rather than simply tools of recreational and conversational dialogue.

In this new landscape, institutional technophobia of social media is rapidly waning, as there is an increasing realisation of the compelling need to restructure our pedagogical approaches and to engineer our LMS so that they cater adequately to the current and future needs of our students. I believe that my experiences with the students' cohorts discussed in this paper lead to the conclusion that one of the ways technologically savvy educators can meet students' demands in this digital landscape of the 21st century is through embedding social media technologies into standard constructivist pedagogy. This paper has discussed my experiences of introducing the use of *Google+. Discussion Circles* in both an undergraduate and a doctoral degree program that I have taught, in the hope of encouraging other practitioners to embrace the application of social media technologies in learning, teaching and assessment. The results reveal that the application of social media technologies as instructional and learning tools has significant potential to engage students' learning in more interesting, exciting and motivating ways that enable these technologies to provide critical higher-order thinking and construction of meaning. This new approach to teaching, learning and assessment, is fully supported by leaders in the field [24] who suggest that "restructuring the curriculum to incorporate technology is no longer a trend but a requirement".

As a reflective practitioner, I often ask myself the question, 'How can I be the best teacher I can ever be?' In contemplating an answer to this question I argue that we owe it to our students, the Digital Natives, to develop a Digital Pedagogy that can make the children's learning experiences more interesting, motivational and enriching experiences of knowledge creation by the children we teach in the digital economy. I argue further that for us to be able to do this, we need to move our teaching from the orthodoxy Vygotskyian Constructivit Paradigm to a more contemporary Connectivist Paradigm that is driven by digital technologies in which our Digital Natives are fluent. I suggest that it is the expectation of our Digital Native children (and their Digital Immigrant parents), that their teachers will use the tools that they (the students) understand, are familiar with and prefer to communicate with. Failure of teachers and educational leaders to rise to this challenge will fail to enrich the learning experiences of our digital students. We should not expect that children of the present Digital Generation, (the Gen C, Gen I, Y Gen; Net Gen; Millennials; Z Gen or Internet Generation) will be taught, learn and be assessed using approaches of previous generations - technophobics. I argue that for pedagogy to be Best Practice Pedagogy, it will need to speak the language that the children understand best: – that is digital fluency of the 21st century. Traditional approaches are no longer educationally effective for our children and students in the present new world of technology and work: – the digital economy. The challenge is for all of us practising pedagogues, to shed our technophobic inclinations and become avid technophiles in the new digital economy. For as Peter Cochrane [27] succinctly puts it, can we "imagine a school with children that can read and write, but where there are many teachers who cannot"? (p.57). Hence, learning, developing and applying 21st century fluencies, are essential parts of Best Practice Pedagogy and of becoming the best teacher we want to be. They are no longer an option, but an imperative, if we are to make our instruction relevant to our pre-service teachers and educational leaders (and any other students that we are privileged to teach) and to give them a richer and memorable educational experience. Yes, as Digital Immigrants our digital fluency will inevitably have a foreign accent. However, we owe it to our students, parents, universities, educational authorities and other stakeholders, to embrace 21st century digital technologies. If we allow ourselves to get left behind by our students, our teaching and curriculum will not only suffer from our immigrant accents but will become irrelevant and an unintelligible language for the Digital Natives of today and tomorrow. Teachers in the 21st century classroom must learn the language of the present generation. It might be inconvenient, but technophobia must give way to technophilia. As ably stated in Jules et al. [2], we cannot afford to find the present **tense** and the past **perfect.** Only then shall we reap the many rewards of engineering digital, technological infrastructure into our LMSs, teaching, curriculum and assessment in the 21st century classroom.

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