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The Use of Social Media Technologies as Novel Ways to Teach and to Promote Learning

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Abstract

The ubiquitous use of new information technologies, computer software and multimedia interfaces, particularly driven by the Internet technologies of the 21st century, has created opportunities for novel ways of teaching which promote learning. In the 21st century classroom or lecture theatre, teachers can no longer teach effectively through the application of the traditional individualistic or competitive learning models (Johnson & Johnson, 1978). Rather, what is needed is collaboration among students as well as between students and teachers. Internet driven collaboration is advantageous because it transcends spatial barriers and it creates opportunities for people to work in virtual workplaces (Jackson, 2002), and for students to learn together in peer learning networks (PLNs), which provide peer support and feedback in virtual classrooms (Howell, 2012) and thus enhance teaching and learning in novel ways. This paper is drawn from a study which investigated how selected social media technologies, namely *Google+.Discussion Circles*, (GDCs) can be used to support teaching, learning and assessment for 2nd year, Bachelor of Education students, training to be teachers at a University in Australia. Data were collected from 145 students 60 of whom were enrolled in one face-to-face unit and the other 85 students were enrolled in the online, non-face-to-face mode in the same unit. The research found that the majority of participants felt mutually supported in the PLNs driven by GDCs and developed strong feelings of social connectedness as they completed their learning activities and assessment tasks. They valued their learning experiences and felt that this novel way of learning was more user-friendly than the lecture method, or the more conventional Learning Management System called Moodle, in promoting their learning.

Keywords: Novel ways of teaching, promoting learning, social media technologies, peer learning networks.

Introduction

The ubiquitous use of new information technologies, computer software and multimedia interfaces, particularly driven by the Internet technologies of the 21st century, has created opportunities for novel ways of teaching which promote learning. In the 21st century classroom or lecture theatre, teachers can no longer teach effectively through the application of the traditional individualis-

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tic or competitive learning models (Johnson & Johnson, 1978). Rather, what is needed is collaboration among students as well as between students and teachers. Internet driven collaboration transcends spatial barriers as it creates opportunities for people to work in virtual workplaces (Jackson, 2002), and for students to learn together in peer learning networks (PLNs), which provide peer support and feedback in virtual classrooms (Howell, 2012) and thus enhance teaching and learning in novel ways. Yet the full potential of Internet driven technologies, particularly social media technologies, to support teaching, learning and assessment, is yet to be fully investigated. This paper describes the results of a quasi-experimental study involving two cohorts of 2nd year, Bachelor of Education students enrolled in a pre-service teachers award, who were given the opportunity to use *Google +. Discussion Circles* (GDCs) social media technologies to complete their learning and assessment tasks in the School of Education at a University in Australia. One cohort comprised on-campus, face-to-face students (n = 60) and the second (n = 85) was a fully on-line cohort, who received all their instruction and assessment via the Internet. The study was conducted in the second trimester in the 2014 academic year with the approval of the Human Research and Ethics Committee of the University and complied fully with all the ethical requirements.

Supporting Literature and Theoretical Framework

The relevant literature contains several theoretical frameworks, which lend support to the use of social media technologies to support and promote learning. For example, as outlined below, learning with the assistance of socially networked structures or peer learning networks (PLNs) is consistent with the foundational cognitivist theories of learning first proposed by Piaget (1923) and developed further by Vygotsky (1929) and Lewin's (1948) work on group dynamics. It is also supported by the work of leaders in the field of instructional strategies such as Jerome Bruner (1966), Howard Gardner (1983), Spencer Kagan (1994), as well as supporters of eLearning including Ted McCain (2007), Don Tapscott (2009), Kelly et al., (2009) as well as Trilling and Fadel (2009).

Swiss psychologist Jean Piaget (1896 – 1980), to whom is attributed the cognitive developmental theory of learning, believed that individuals construct meaning of the world for themselves and accordingly, his four-stage theory became known as the epistemological theory of constructivist learning. Based on observations of children and adolescents whom he studied as they solved problems he set them in natural situations, Piaget (1954) concluded that learners construct new knowledge from their experiences. In a later book Piaget (1981) strongly argued that whatever gets into the mind of a learner has to be constructed by the learner through active knowledge discovery. So, Piaget's cognitivist theory is undergirded by the understanding that learners construct meaning from their experiences gained as they interact with the environment. Virtual social networking broadens and enriches these interactions and can therefore enrich and promote learning. Thus, the use of social media technologies in pedagogy is informed by cognitive and social psychology as applied to learning based on PLNs. The PLNs comprise learners that cooperate in the exchange of ideas and views, which they share in peer-to-peer networks that are technologically enriched and driven by the Internet.

Moving the understanding of how people learn beyond Piaget's (1954) work were the cognitivist theorists who developed an understanding that learning is a social experience rather than an individual one. They argued "the social occasions of conversation, discussion, joint work, groups, and debate play a critical role in learning" (Wilson et al., 2006, p. 4). As a result, they developed several theories of learning, which focused on the social aspects of learning and called them sociocultural theory, or activity theory or social constructivism for which the Russian cognitive psychologist Lev Vygotsky (1896 – 1934) became most famous and the foundational theorist for the pedagogical approach known as constructivism, (Vygotsky, 1929).

Vygotsky (1929) conducted intellectual development studies on the social environment of children and produced what became known as the developmental theory of social constructivism, whose key proposition was that children's cognitive development is influenced most by interaction with people, especially parents, other children, teachers, and mentors in the child's social environment. He argued that it is the collaborative interactions between a learner and members of his or her immediate society that enable the learner to make meaning of their world in their cultural setting (Vygotsky, 1978; 1981). He wrote: "In the process of development, the child not only masters the items of cultural experience but the habits and forms of cultural behaviour, the cultural methods of reasoning" (Vygotsky, 1929, p. 415). This understanding, that learners make meaning of their world through social interactions, adds impetus to the power of socially interconnected networks to promote learning. Another aspect of Vygotsky's theory that is very relevant to the use of PLNs to learn is what he called the Zone of Proximal Development (ZPD). He explained the ZPD as the level of competence on a task in which a learner cannot yet master the task working by himself/herself but can complete the task successfully if given appropriate support by a more capable mentor. The significance of the the ZPD in PLNs is that the mentor who provides scaffolding, could be another student, providing guidance and feedback during the virtual interactions. It does not have to be a teacher. Herein lies the power of social media technologies to promote learning, beyond facilitation by the teacher or lecturer.

In his studies of group dynamics, German-American social psychologist Kurt Lewin (1890 – 1947) investigated how to resolve social conflict (Lewin, 1948) and his work also led to studies of how learning is influenced by cooperation and competition (Deutsch, 1949). Lewinian social-psychological theory became the basis for several cooperative strategies, which were made more popular in pedagogy later by scholars such as Johnson and Johnson (1991) and Dr. Spencer Kagan (1994) as will be discussed further below.

Like Vygotsky, Jerome Seymour Bruner (1966) also emphasized the importance of the constructivist principle of active learning. Bruner (1996, p.84) proposed that learning was a "participatory, proactive, communal, collaborative construction of meaning" rather than an individual pursuit of knowledge. It was this emphasis that led him to embrace what is popularly known as The 5E Instructional model and to apply it widely in educational contexts. Developed by biological scientist Bybee and his colleagues for the Biological Science Curriculum Study (BSCS) at Colorado Springs in the USA (Bybee et al., 2006a), The BSCS 5E Instructional model postulates that to maximize students' active learning and construction of knowledge, we should give them opportunities to be involved in five key elements of constructivism, each beginning with the letter 'E', namely:

1. Engage
2. Explore
3. Explain
4. Elaborate; and,
5. Evaluate.

This 5E Instructional model is a learning cycle based on a constructivist view of learning, with each of the 5Es describing a phase of conceptual involvement, which seeks to maximize active learning, through coherence of teaching and learning strategies. Briefly, as explained by Bybee et al., (2006b), in the Engage element, students' prior knowledge is accessed and their interest engaged in the phenomenon being studied, in Explore, students are given the opportunity to participate in an activity that facilitates conceptual change, in Explain, students generate an explanation of the phenomenon, in Elaborate, students' understanding of the phenomenon is challenged and deepened through new experiences, and in Evaluate, students assess their understanding of the phenomenon. This active learning is optimized when children are given opportunity to work to-

gether in cooperative learning teams, such as PLN based GDCs, rather than on their own or in competitive structures.

Kagan asserts that "Cooperative learning promotes higher achievement than competitive and individualistic learning structures across all age levels, subjects areas, and almost all tasks" (Kagan, 1994, p. 3:1), thus lending support to the use of PLNs which are the nuclei of networked social media interactions. As Sherman (2001) rightly points out, the discipline of social and cognitive psychology advocates the use of cooperative learning strategies, which are the basis for technologically enriched peer learning networks. Artz and Newman (1990) explain that cooperative learning involves "small groups of learners working together as a team to solve a problem, complete a task, or accomplish a common goal" (p. 448). Cohen (1994) agrees when he says that cooperative learning is a teaching strategy that involves students working together in small teams where everyone participates in a clearly assigned task or role, and in so doing contributes to the learning of each member of the group and to all members in the group. Johnson and Johnson, explain that in cooperative learning, there is positive goal interdependence and individual accountability so that learners work together in small groups, with each making a contribution so that they "sink or swim together" (Johnson & Johnson, 2002, p.1). Cooperative learning is characterised by three important dimensions, namely, it is non-individualistic, it is non-competitive, and it is collaborative teamwork in nature. These characteristics are fulfilled through the five principles of cooperative learning which many leaders in the field including Kagan, (1994), Johnson and Johnson, (1991, 1994) Slavin, (1988), Stahl, (1997), and Metzke and Berghoff, (1999), in slightly different wording agree, are:

1. Positive interdependence
2. Individual accountability
3. Equal participation
4. Group processing; and,
5. Simultaneous Interaction.

It helps to unpack each of these principles briefly. Kagan (1994; 4:7) explains, "strong *positive interdependence* is created, if the success of each member depends on the success of every member. …students have the subjective experience of 'being on the same side' and will behave positively toward each other." In explaining the principle of *individual accountability*, Harkins and Petty (1982), say that it means that no team member can enjoy a "free ride". There is no "hitchhiking" or piggybacking". Gillies and Boyle (2013, p.10) say that *equal participation* is enhanced when students provide each other with efficient and effective help and assistance, exchange needed resources to facilitate each other's contribution, provide each other with feedback in order to improve each member's contribution to the task, question and challenge each other's conclusions, and advocate and encourage each other's efforts to achieve mutual goals. The fourth principle, *group processing,* gives students the opportunity to reflet on learning experiences during teamwork, so they understand better what happened during the cooperative learning activities, to evaluate how they have achieved the set goals, and to discuss their overall experiences among themselves. *Simultaneous interaction* happens because, when students are organised into their cooperative learning teams, they are talking among themselves and working together all the time, and so within each team, there is *simultaneous interaction* among the students (Kagan, 1994).

The traditional approaches to instruction assume homogeneity in learning styles and we know from Howard Gardner (1983; 1999) that this is simply not the case. Giving students the opportunity to work in their own networks assumes and provides for heterogeneity among learners. This approach can therefore be said to be better suited to providing for the diversity and inclusivity of students. Moreover, students learn with each other at times of their own choosing that are convenient to them on a 24/7 basis. Siemens (2004) agrees when he proposes the connectivist

paradigm to extend an understanding of how learning occurs beyond the traditional behaviourist, cognitivist and constructivist paradigms, discussed above. The connectivist paradigm proposes that the construction of knowledge includes learning by individuals, machines, groups, organizations as well as other systems (Siemens, 2006). Siemens (2006) explains that in the connectivist paradigm, we have a new technological society in which *know-how* and *know-what* are being supplemented with *know-where* to find the knowledge that is required to make sense of a given situation. The use of PLNs gives students opportunities to work in Internet based connections which enable students to utilise the connectivist paradigm not only to *know-how* and *know-what* but also to *know-where* by individually taking the initiative to search for information and then sharing it asynchronously with members of their PLN.

This sharing through PLNs is supported by Howell (2012) who directly advocates a collaborative epistemology in which learning is facilitated and amplified through collaborative activities using social media technologies. She argues that learning takes place, not through data bases, but through social interactions connected through the Internet. She presents the understanding that social media are used not just for social conversation but for active learning of pedagogical content and for completing formative assessment in collaborative Peer Learning Networks (PLNs).

Trilling and Fadel (2009) say that working in teams, scattered around the globe and connected by technology are becoming the norm for 21st century work. Thus, the advent of technology in a global village means that students will grow up and work increasingly through interactions with other people rather than individualistically. Teaching them using social media in PLNs helps to prepare them for more pro-social learning and working environments. In those environments, the information economy will be driven by the ability to share knowledge with others rather than simply having the know how; and by ability to work cooperatively not just competitively.

This is not to say that the use of social media in teaching and learning has not been questioned. Some theoretical perspectives which have questioned the use of computer-mediated social interactions for learning have cited what they have called deindividuation of people and behavioral disinhibition among participants in cyberspace during virtual interactions (Zimbardo, 1969). They have argued that deindividuation occurs in such interactions because they involve many people communicating anonymously, with non-identifiable virtual genders (Burn, 1996), with intense task absorption, and little self-focus (Joinson, 1998). Those proposing the disinhibition argument have suggested that people engaged in cyberspace conversations become less inhibited in disclosing information about themselves. However, other scholars (such as Postmes & Spears, 1998) have argued that the deindividuation hypothesis lacks empirical evidence. Similarly, (Jazwinski, 2001) dismisses the disinhibition proposal.

Other critics of the quality of conversations conducted in virtual social networks have argued that it is bound to be poor because it lacks the nonverbal cues, appearances, body language and contextual vibes that guide social interactions in normal, face-to-face dialogue (Sproull & Kiesler, 1991). However, studies by Weisbad, Schneider and Connolly (1995) found no significant difference between face-to-face communication and computer-mediated social interaction, thus dismissing the Sproull and Kiesler argument.

What emerges from this literature review is a strong theoretical framework in support of the use of social media technologies to support teaching, learning and assessment by providing students opportunities to learn together in cooperative rather than competitive or individualistic structures which are less conducive to engagement, higher-order learning and overall knowledge construction. Thus it would appear that the use of social media in pedagogy is fully consistent with the theories of learning advanced by leaders in the field discussed in this section. The theories provide consensus that children learn best when they are given opportunities to co-construct knowledge through social interactions. They learn better through social interactions than they

would learn on their own. As Mercer (1995) asserts, since the 1970s there has been increased understanding that children learn readily when they are given opportunities to collaborate and communicate with their peers, parents, siblings and caregivers. Similarly Toohey (2000), admonishes that "learning must be understood as a process embedded in social relationships and cultural practices, a situated practice within a community of learners rather than a process of individual acquisition transmitted by an expert" (p. 79). Additionally, as proposed by Prensky (2001), Kelly et al., (2009), and Tapscott (2009), social media are the most preferred means of communication among young people in our classrooms today. Thus, the theoretical and research evidence available suggests that it is prudent to maximise the use of social media technologies in pedagogy as a way of striking congruence between the language and platform used by educators to deliver instruction and by learners to engage with that instruction.

Methodology

Research Question

The research was undertaken to answer one overarching question with four subsidiary questions. The questions were stated as follows:

1. How does the use of selected social media technologies, namely *Google +. Discussion Circles,* (GDCs), support teaching, learning and assessment? The subsidiary questions were:
    i. How does the use of GDCs influence students' levels of participation, engagement, exploration, elaboration, explanation and evaluation? (Bruner's 5E Model).
    ii. Are there noticeable differences in the level of student engagement with learning and assessment activities, depending on whether the students are using GDCs or not?
    iii. What is the nature of content that students share while engaged in learning and assessment activities, using GDCs?
    iv. What does the nature of the contents in the GDC streams reveal about students' interest, motivation and collaborative peer mentoring while engaged in learning and assessment activities using GDCs social media technologies?

Research Design

To investigate the above questions the research was designed as a quasi-experimental case study utilizing mixed methods to gather and analyze the data. The case was bounded (Smith, 1978), to consist of students enrolled in two cohorts of a 2nd year Bachelor of Education Unit in the second trimester of 2014 at a University in Australia. One cohort was internal and the other external. This design was consistent with Yin's (1994), definition that the "case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 14). As Merriam (2001) admonishes, "the case could be a person such as a student, a teacher, a principal; a program; a group such as a class" (p. 27). The participants in each of these two groups (the internal and external cohorts), are discussed further in the next subsection.

The quasi-experimental design was chosen as the most appropriate because it would not have been possible to apply randomization procedures and have one set of students as a random experimental group and another as the control group to have a true experimental design (Burns, 2000). However, following Keeves (1997) and Denzin and Lincoln (2000), the closest to an experimental design that was possible, was to have both the internal and external cohorts of students

conduct their learning and assessment activities in practically identical ways, except that the external cohort utilized GDCs whereas the internal cohort did not. Both the internal and external cohorts enrolled in this Unit use the University's learning management system called Moodle. Both cohorts receive the same lecture notes every week. However, while the internal cohort receive theirs in both the face-to-face mode and online, the external students get theirs delivered through a communicative software called Camtasia Relay, which delivers not only the PowerPoint of the notes but also the audios, videos and graphics that are presented in the lecture. The internal students can also access the Camtasia folder if they wish. The lecture is delivered early Monday morning but the lecture notes are available to both cohorts, online 24/7 following each lecture. Each lecture is followed by a series of activities given to all students to help them engage further with the contents of the lecture, and prepare for the various assessment tasks. However, while the internal cohort also have a weekly face-to-face tutorial in which they discuss the topic for the week, the external cohort do not have this opportunity. Instead, they discuss the topic in two ways. First, they do so in Forums in Moodle. Secondly, they form PLNs within which they discuss the topic using GDCs. Both the internal and external cohorts are encouraged to participate in the Forum discussions in Moodle, and to set up GDCs if they wish. Participation in the Moodle Forums is mandated, and monitored by the lecturer; but engagement in the GDCs is voluntary, and by mutual invitation. This includes the lecturer.

The mixed methods approach enabled the sub-research questions to be investigated and answered through a qualitative or a quantitative analysis of the data. This paper reports the findings in answer only to sub-research question 1, as it would not be practical to discuss the findings of all the four sub-research questions in one paper. Questions 2 – 4 will be the subject of future publications.

Participants, Sample Size and Sampling Procedure

As stated earlier, the study involved two cohorts of students, an internal cohort (n = 60) students and an external cohort (n = 85) giving a total population of 145 participants (n = 145) in the Unit in the second trimester of 2014. The trimester ran from the end of June 2014 to the end of October 2014. Whereas the trimester ran for 13 weeks, participation in the study involved only 9 weeks because students were out on professional practice in different schools for four weeks. During those four weeks they were not required or expected to participate in the study. They were also not expected to participate during two weeks of the mid-trimester break in August.

For the internal cohort, students work in tutorial groups of no more than six. Each tutorial normally follows a jigsaw cooperative learning structure (Kagan, 1994), in which the workshop starts as a whole-class before they break up into individual groups; and then back into a whole-class structure for demonstration of teaching strategies that they are learning. The internal cohort are introduced to the use of GDCs and encouraged to work with them if they wish. For the external cohort, their PLN has a core of ten members. Starting from this nucleus, they are free to invite anyone they want to join their PLN using GDCs. The invited participants can be from any other group in the Unit, from another Unit altogether, from a different faculty or even from another university; or for that matter, not even a student at all. The criteria governing participation are that a) the invited participant must limit their contribution to matters relevant to the pedagogical topic being discussed in the PLN, b) they must not post in the stream of the GDC anything derogatory or offensive, and, c) there must be no 'put-downs'. I monitor what happens in the GDCs and if need arose, I could block any participant from seeing what goes on in any of the circles, if they contravened any of these conditions. However, over the three years that I have taught using GDCs, there has not been a single infringement. For the external cohort, the participation in the GDCs is seen as a substitute for the face-to-face tutorials held by the internal cohort. But, as I said

earlier, students in the internal cohort are also free to engage in GDCs if they wish and are in fact encouraged to do so.

Sampling procedures

The internal cohort were asked to form groups ranging in size n=4 – 6. These groups were treated as random samples, as any student could join any group, and they were in fact encouraged to do so. On this basis, the internal cohort created eleven samples with n values ranging between 5 – 6. There were only 6 male students in this cohort. These randomly assigned themselves to different samples, without influence of the lecturer.

The external cohort (n = 85) were asked, first to form a random group of 10 in Moodle, and then use that sample as the basis for building a PLN using GDCs. There was no limit on potential participants in any of the PLNs. The PLNs were purposely designed like this, to allow for maximum participants and interactions among PLNs utilizing the dynamics of social media – the GDCs. Participation in any GDC was by mutual and reciprocal invitation. This means that a participant in a PLN initiates a GDC and invites others into their Circle. The invited participants respond through a similar process. This design made GDCs preferred over Facebook because it gave all participants greater control of whom they interacted with in cyberspace. Also, in posting into the stream of each GDC, participants were urged to always make sure that they chose the 'Share in Private' option rather than 'Share Publicly'.

Ethical Considerations

The researcher sought permission to conduct this study from the Human Research and Ethics Committee of the University at which this study was conducted. Permission was granted under Licence Number HREC-HE14-2014. This License stipulated several conditions which had to be met including that the names or identities of the participants were not to be identified. For this reason, the data presented in the next section deliberately blurs or blots out the photo images of the participants so that their identities are protected. Furthermore, students in both cohorts were given exactly the same opportunities, so that no student was disadvantaged.

Information to participants and participant consent

Students were informed of the study and its purpose through an announcement in Moodle. Detailed information was given in a special page posted in Moodle. Students were invited to participate in the study using GDCs, and it was made clear that participation was entirely voluntary, and that if they chose not to participate in the GDC, they would not be subjected to any disadvantage. They were to give consent by opening a Google account and sharing their email address with their peers.

Limitations to the study

The study could not have one of the cohorts as a control group and so relied on students' utilisation of GDCs as the distinguishing feature between the two cohorts. As the internal cohort did not use GDCs, this enabled the study to make comparisons of students' participation and engagement in the activities. Data were gathered only over a period of nine weeks because the trimester has four weeks of professional practice when students could not be expected to participate in GDC activities. Participants were not required to post a specified number of comments in the GDC streams. This meant that some students could be very active, while others could participate rather infrequently.

Data Gathering and Analysis

The data comprises the postings made into the GDC streams, including whatever resources the students embedded into the GDCs stream from whatever sources they wanted. These included resources from texts on pedagogy, teaching strategies, YouTube, and their own creations, such as photographs and graphic organisers. The analysis started by simply observing the posts in the GDCs, reading them, and making sense of the contents in the GDC stream. This enabled an analysis of frequency of posts, variety of posts, content in the posts, demonstrated interest, levels of participation, engagement, exploration of ideas, elaboration on what had been posted, explanation of what was posted and evaluation of others' contributions.

Results

Because the data gathering process has just been completed, the results available for discussion in this paper relate only to sub-research question number 1. As said earlier, the answers to the other research questions will be discussed in future publications. The research found that when students were given the opportunity to learn using GDCs, the majority took advantage of the social and structural dynamics created by these technologies in many ways that supported their learning and assessment activities. The evidence shows that the benefits included increased participation, greater interaction within each PLN, richer posts in the GDC streams, greater peer mentoring, greater engagement, exploration of issues, elaboration of what was being discussed, evaluation and explanation consistent with Bruner's (1966) 5E Instructional model for supporting and maximizing students' learning. The evidence encourages universities and other higher education providers to explore opportunities for utilizing selected social media technologies, such as GDCs, in pedagogy, as a novel way to promote active learning.

Level of Participation

A very interesting observation was the extent to which students took initiative not only to set up their own GDCs, but to also invite their peers, from outside their own PLN to contribute to the discussions for the week in their GDC. Although there was a great divergence in the level of participation, it was clear that every PLN enjoyed a multiplier factor among its participants. This varied from a low multiplier effect of 160% for the PLNCK5, to a high multiplier effect of 460% in PLNCK1. These results are illustrated in Figures 1, and 2 respectively.

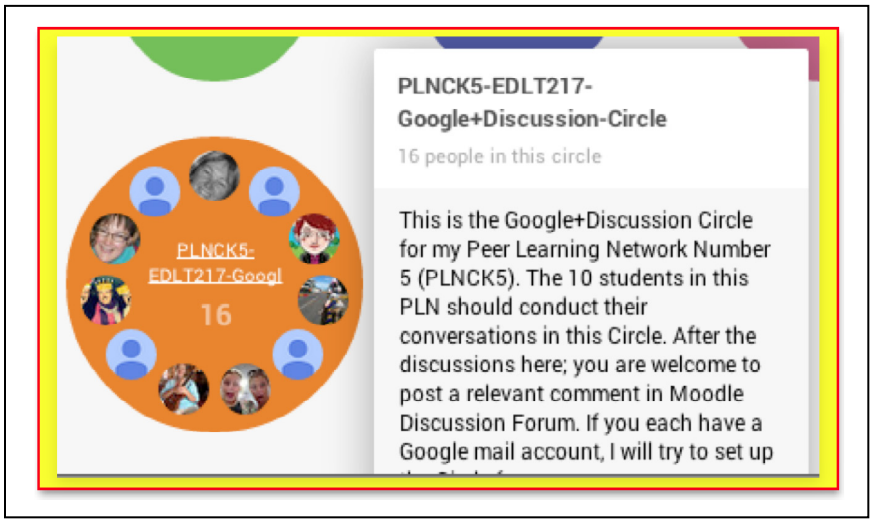

Figure 1: Level of participation by students in the GDC for PLNCK5

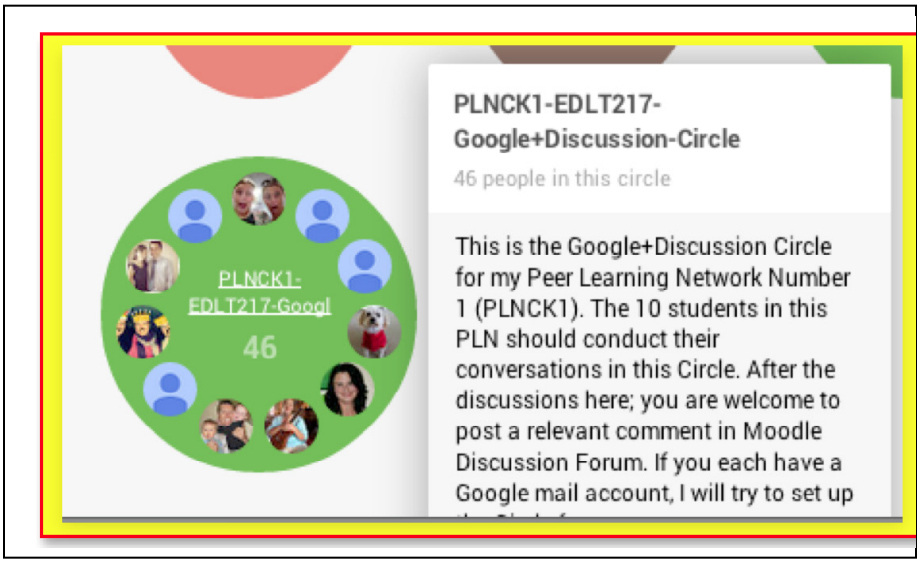

Figure 2: Level of participation by students in the GDC for PLNCK1

This multiplier factor is very significant when the participation in the PLNs driven by GDCs is compared to that in the groups that relied on Forums in Moodle. Whereas the Moodle groups remained constant at 6 – 10 students in a group, those in the PLNs used GDCs to amplify their membership and participation. Students said that they felt a lot of mutual support for each other, through the increase in participation.

Level of Engagement and Exploration

An analysis of how often individual students visited and revisited the GDCs to make a post in the stream showed that students made several visits each week to participate in the GDC discussions. What's more, the posts were conceptually deep and extensive in discussing the points raised in the stream. The high frequency of posts in the stream and the extensive nature of the discussion was interpreted to indicate a high level of engagement and exploration of the topics that were being discussed. Consistent with the 'Elaboration' element of Bruner's 5E Model (Bybee et al., 2006a; 2006b), students made comments which showed that they were using their prior knowledge or information that their peers had posted in the GDC stream to generate new ideas, explore additional questions and possibilities, and offer additional ideas for discussion. They expressed strong feelings of connectedness as they explained and explored further, the posts made by their peers in the GDC streams.

Level of Interest, Motivation, Explanation and Elaboration

According to Bruner's 5E Instructional Model, in the 'Explanation' element of the model, "The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept." (Bybee et al., 2006b, p. 2). These learning attributes were very evident in the posts in the GDCs. Students' posts demonstrated their grasp of the topics being discussed and their response to the posts demonstrated their conceptual understanding of the issues raised. New concepts were introduced by the lecturer each week; and additionally as students engaged with and elaborated upon the points raised. The frequent use by students, of graphic organizers to summarise their understand-

ing and the posting of photos and Youtube video clips into the GDC streams were further evidence of interest, explanation and elaboration by the students, and that they valued their experiences in the GDCs, which they found more user-friendly than Moodle Forums.

6. Conclusion

The results appear to support the hypothesis that learners in the 21st century, digital age, communicate mostly using digital technologies, particularly social media technologies, including GDCs. For example, we know from the work of leading scholars into how children of the present generation learn, such as Prensky (2001), Jukes, McCain and Crockett, (2010) that "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" (Jukes, et al., 2010, p. 20). It therefore makes a lot of sense for pedagogues to communicate with their students using the media that the students prefer. What's more, leaders in pedagogy such as, Vygotsky (1962), and Bruner (1966) tell us that children learn best if they are given opportunity to actively engage with the activities in the learning process and in figuring out what those activities mean to them. This is the essence of the constructivist paradigm that is the cornerstone of our pedagogical practice today. The use of GDCs in teaching, learning and assessment can be very engaging as students can work within the GDCs to extend their own understanding, to question that of their peers and to challenge their peers to engage in critical thinking and active imagination as they contribute to the GDC stream.

As indicated above, students frequently posted photos and used graphic organisers to summarise their contributions to the GDC streams. We know from the extensive work of Howard Gardner (1983) that ability to see form, shape, colour, and texture in the "mind's eye" helps the learner to transfer these images to concrete representations which facilitate understanding and construction of new knowledge. As Chapman (1999, p. 107) explains, "The way one sees the world in the "mind's eye" is that personal view of the world as pictured in one's mind. Thus, the students were able to offer each other a window into the "mind's" eye and thereby facilitate critical thinking within their PLNs. Moreover, students whose learning style prefers visual representations could capitalise on their strength using spatial learning techniques like the photos, graphic organisers, and YouTube video clips that the students posted in the GDC streams.

In our understanding of how children learn and therefore how we should teach and assess their learning, we are guided by the foundational theories of Piaget (1896 - 1980), Vygotsky (1896 - 1934), Bruner (1915-), Skinner (1904-1990), Edward de Bono (1933-) Bloom (1913 - 1999) and Gardner (1943-). The consensus from these theories is that children learn better through interaction with others than on their own. The use of GDCs creates opportunity for students to maximise these interactions and experiences.

In consideration of the findings of this study I argue that the old, traditional approaches to education and teaching that do not utilise digital tools are no longer adequate for teachers of digital children, who thrive on social media, and study in classroom environments driven by information technology. Therefore, as the world becomes increasingly more and more interconnected, pedagogues need to make sure that they are well equipped with eLearning and eTeaching technologies, including the use of social media technologies, such as GDCs. I believe that if properly embedded in pedagogy and curriculum, social media technologies have great potential to provide for social learning (Piaget, 1923), and co-construction of knowledge (Vygotsky, 1978). They are very engaging and exploratory (Bruner, 1966) in nature and encourage children to approach learning from different perspectives (De Bono, 1956), which helps them to learn from their peers by applying knowledge (Bloom, 1956) and in their own way (Gardner, 1999, Skinner, 1953).

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