Teacher-Student Perspectives of Invisible Pedagogy: New Directions in Online Problem-Based Learning Environments

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Abstract: Universities and institutions of higher education are facing economic pressures to sustain large classes, while simultaneously maintaining the quality of the online learning environment (Deming et al, 2015).. Digital learning environments require significant pedagogical shifts on the part of the teacher.. This paper is a qualitative examination of the nature of teaching in the digital age, and the significant changes facing teachers in the 21C. The authors describe key features of quality distance pedagogy that were exhibited during 12 weeks of a synchronous undergraduate course held in Adobe Connect. The central research questions are 1. How can problem-based learning pedagogy enable instructors to form smaller cohesive groups of students that take greater responsibility for their own learning? 2. What strategies can be used by teachers to develop communities of practice and inquiry? 3. How can an instructorin a large virtual class co-create the level of social capital that is required to build and maintain the relationships that are a necessary condition for a high quality learning experience? and 4. What are the perceptions of teachers about the challenges and benefits of facilitating a high quality problem based learning environment through invisible pedagogy?

The research is grounded in literature through the work of Cousins and Bissar (2012), Kaufman (2013), Badge, Saunders and Cann (2012), Flavin (2012) and McNeill, Gosper and Xu (2012). These authors examine how teachers and learners adapt to the digital age. In addition, more recent work by Bowers and Kumar (2015), Hoadley (2016), Deming et al (2015) and Gunduz et al (2016) are examined.In these digital spaces, teachersbecome facilitators, guides, collaborators and learners themselves, thus making traditional pedagogy virtually invisible.

Further, the paper uses qualitative semi-structured interviews of two assistant professors who instructed the two groups of undergraduate students The teachers identify challenges and successes to using problem based learning as a tool for attaining 21C learning outcomes in digital learning spaces.

Keywords/phrases: Teacher Development, Online Pedagogy, Problem-Based Learning

1 Introduction

It is clear that teachers in the 21C exist in a world that continually reinvents itself. Thus, a key skill for online teachers becomes "learning how to teach in a digital world". The development of new knowledge outpaces instructors' abilities to keep up with content, and one need only acknowledge that our first action when investigating a new phenomenon or problem is "to google it". We may seek out further assistance or expertise from others, but our initial reaction is to use the technology to find the answers for ourselves. Not only have we invented a new verb to describe this self-directed learning process, but this, in itself, demonstrates that 21C learners are in the driver's seat. In anew world that is evolving constantly, educators require different and broader competencies than what have been considered in traditional teacher-centred pedagogy.

As costs of tuition continue to rise, the popularity and accessibility of such digital learning environments becomes more available to students. Bowers and Kumar believe that

> *In the past decade online education has experienced dramatic growth. According to a recent report from Sloan Consortium (Allen & Seaman, 2011) there are currently more than 6.1 million students enrolled in at least one online course. The growth rate for online enrollments (10%) has exceeded the growth in the overall higher education student population (less than 1%) in the United States. The report estimates that 31% of students enrolled in higher education take at least one online course. To address the increasing demand of online education, it is estimated that about 90% of higher education institutions offer some form of online education. Online education has now become an integral part of long-term strategy for over 65% of higher education institutions. Online learning is no longer considered a new phenomenon and has become an important part of our education system. (2015, p. 27).*

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This phenomenon of increasing numbers and decreasing costs of online education has a significant impact on instructors, who may now face the possibility of learning to teach well online or be out of a job. As evidenced by the comments of the teachers interviewed in this research, proficiency in teaching online is fast becoming an essential pedagogical skill. Institutions who move more of their courses online can have significant financial savings, as long as the quality of online pedagogy is maintained. Deming et al (2015) concur that

> *online education is concentrated in large for-profit chains and less-selective public institutions. We find that colleges with a higher share of online students charge lower tuition prices. We present evidence of declining real and relative prices for full-time undergraduate online education from 2006 to 2013. Although the pattern of results suggests some hope that online technology can "bend the cost curve" in higher education, the impact of online learning on education quality remains uncertain.(2015, p. 496)*

Further to this, our pedagogy is being reshaped by the digital world to have a wider variety of non-specific learning outcomes based on the new needs of students. Within the context of this online environment, the traditional roles of teacher and learner became reciprocal and symbiotic. The pace of information flow and knowledge mobilization in 21C learning environments mean that instructors no longer act as top down experts. Several authors have re-defined the essential skills required of the 21C learner. Many of these authors concur that these skills include the development of creativity, self-motivation, innovation, problem-solving and collaboration skills (McNeill, Gosper & Xu, 2012; Voogt, Erstad, Dede & Mishra, 2013; Kaufman, 2013). Several institutions, including the World Economic Forum (2016), the Conference Board of Canada (2015) and the Ontario Ministry of Training Colleges and Universities (2015) concur that teachers need to provide opportunities for students to develop these types of characteristics. As a result, online pedagogy cannot be in lecture format, it must be shaped in ways that students can co-develop the learning goals and work within challenging and supportive environments to develop these "new basics" of 21c skills. Clearly, these are also skills that are developed by students in a problem-based learning context. According to Savin-Baden (2007) there are significant characteristics of PBL that include the following:

Table 1. Characteristics of Problem Based Learning.

Complex real world situations that have no one 'right' answer are the organizing focus for learning.
Students work in teams to confront the problem, to identify learning gaps, and to develop viable solutions.
Students gain new information through self-directed learning.
Staff act as facilitators
Problems lead to the development of clinical problem-solving capabilities. (Savin-Badin, 2007)

In a PBL learning environment, the focus is on student-centred and collaborative learning, moving beyond cooperative learning to an environment where critical feedback and challenge between peers and instructor are essential. Shifts in teacher-learner roles occur, students take ownership of the learning, become involved in the assessment process, and define their own course of learning. Thus, there is a perception that the pedagogy becomes virtually invisible.

This approach to teaching is one avenue to better prepare students for the situations that await them beyond the walls of post-secondary education. Although universities have not traditionally been in the position of preparing students for specific work roles in the economy, financial and other pressures are continually pressing for institutions of higher education to prepare students for the "real world of work". Due to the fact that the world is in a continual state of flux, it becomes almost impossible for universities to predict which content is key for students to learn. This is especially so due to the fact that over the course of an undergraduate's four years in school the jobs for which they apply at the end may not yet exist. Thus, it becomes incumbent upon university instructors to shift their pedagogy, put students at the centre of the learning experience and provide opportunities, situations and experiences to develop the kinds of broad competencies that are required for the 21C economy. Although it has not been the historical purview of universities to provide society with workers, the 21C economic situation of colleges and universities requires them to market themselves as institutions from which students will graduate prepared and ready to enter the workforce.

In response to this, an interesting set of parameters has been proposed by the Conference Board of Canada Employability Skills 2000+ (Conference Board of Canada, 2000). These 21C skills include (a) Fundamental Skills

(the ability to communicate, manage information, think and solve problems, and use numbers), (b) Teamwork Skills (the ability to work with others and participate in projects and tasks), and (c) Personal Management Skills (the ability to learn continuously, demonstrate positive attitudes and behaviors, be responsible, be adaptable and work safely). These align clearly with some of the elements that surround a problem-based learning pedagogy, one which essentially puts students at the centre of the process and renders the instructor perceptually "invisible".

2 Methodology

This research was conducted in two phases using qualitative case study methodology (Merriam (1998).

Phase One: Participants in the study were two groups of 30 students taking a synchronous undergraduate class in a fully online environment. The instructors were Assistant Professors in the Faculty of Education. Classes met once per week using video conferencing through Adobe Connect. Students completed a Likert style questionnaire pre and post course to indicate their level of comfort, engagement and competence in an online community, as well as their self-reported level of their ability to be self-directed learners and take responsibility for their own learning. Further to this, a focus group for each of the two groups was convened in Adobe connect after the course had completed to discuss each of the three research questions. 1. How did a PBL structure help/not help students to take greater responsibility for their learning as a member of a small group? 2. What strategies did the instructor use to develop communities of practice and inquiry? And 3. How did the instructor create or develop/not develop greater social capital in the online class. The researchers analyzed and coded the data to identify key themes that emerged through the class recordings, focus groups, and questionnaire results.

Phase Two: The two instructors of each section were interviewed for one hour each using semi-structured qualitative questions to answer the fourth research question: 4. What are the perceptions of teachers about the challenges and benefits of facilitating a high quality problem based learning environment through invisible pedagogy? Interview questions included:

- What was your previous experience using Problem Based Learning?
- What was your previous experience teaching in synchronous Adobe Connect?
- What were the challenges you faced using Problem Based Learning?
- What challenges or barriers did you encounter in fully online pedagogy?
- Did the roles change between you and the students and if so how?
- How would you describe the level of social capital in your class?
- Did the level of social capital have an effect on the learning experiences of your students?
- What means of assessment did you use in the course?
- Were these different than types of assessment you use in face to face courses?
- Can you describe the students' responses to using problem-based learning?
- Do you believe invisible pedagogy is a good pedagogical tool in digital learning environments?

3 Data Collection

Ethical review was passed (Research Ethics Board # 14-029) and informed consent of participants was obtained. Data were collected via recordings of classes in Adobe connect, including both formal and informal chat rooms for review. Recordings of classes were kept on a secure server located at the university. Students were asked to maintain weekly comments in Blackboard chat rooms and use this as a journal format to record their observations about their online community. Anecdotal information from focus groups was recorded and kept on a secure server. Observations of external professional learning communities created by the students in Linked In and Facebook were obtained. In phase two, interviews were recorded and then transcribed and analyzed by the researcher. Transcripts were stored in a password protected file on a university server and audio recordings were then destroyed as per the ethical review.

Table 2: Elements of Invisible Pedagogy: the Role of Teacher and Student in PBL vs Traditional University Lecture Environments

Pedagogy in PBL	**Pedagogy in Traditional Lecture**
Student-centred	Teacher-centred
Real world situations	Theoretical situations
Collaborative work	Individual work
Co-constructed solutions	Individual solutions
Multiple outcomes	One correct outcome

Assessment in PBL	**Assessment in Traditional Lecture**
Uses real world tasks often assessed in groups	Theoretical concepts individually tested
Collaborative assessment	Individual assessment
Students involved in assessment criteria	Teacher develops assessment criteria
Many possible solutions are correct	One or few possible solutions are correct
Assessment embedded formatively throughout the learning process	Assessment is summative at the end of a course or unit

Community in PBL	**Community in Traditional Lecture**
Community-based learning	Individual learning
Inquiry-based learning allows students to drive learning outcomes	Teacher sets learning outcomes
Students take ownership of learning by selecting problems	Teacher retains power by setting the problems to be solved
Learning is dynamic and ongoing	Learning is contained within course outcomes
Community extends beyond course parameters through digital means	Any group work is contained within confines of the course
Social Capital is at a high level	Social Capital is not connected to learning
Student Engagement at a high level and depends on peer interaction and teacher as facilitator	Student Engagement depends on teacher as leader

Table 3: Teacher Interviews:

Topic	**Instructor #1**	**Instructor #2**
Previous PBL experience	I had never taught with PBL so I found it very frustrating I wasn't sure how to structure the course, I'm great with the tech aspect but didn't really do the PBL part well	I've been looking at PBL since I have taught this way for a while, but, transferring to online has been challenging.
Previous Adobe experience	Very comfortable using Adobe Connect	Very comfortable using Adobe Connect
Challenges of PBL	Students either buy in or buy out and I don't know if it's how I structured the course but they kept needing direct instruction	Well, I teach in a college program where the motivation is challenging because my students, many of whom are in poverty or living on Aboriginal reserve. So, I think the PBL model would help them but I'm not sure it worked so well this time.
Challenges of fully online pedagogy	I think fully online pedagogy is the way to go. I'm not sure which is the best way though as I have taught asynchronous and video based Lots more challenges I think for students who don't have the same access depending on band width and other tech stuff	Access to high speed technology
Roles of teacher and learner	Well at the beginning I thought I was the teacher, then I thought I lost control in PBL, but I stuck with it and in the end, some students took it as a 'bird course' and others really invested So I guess – I have to learn to step back	Here I have to be the teacher, because, that is what the community and the culture expect. I, as a teacher, have respect. So strange compared to what I grew up with in a city. I hope someday these roles change but I

	and they have to learn to step up	don't see it happening for awhile.
Level of social capital	There was lots of social capital in the tech savvy students. I worried about those in international situations that due to time zones and lack of good wi fi they might not feel they belonged	In the community there is a high level of social capital. A high level of respect, and also lots of problems. But in this class, I think students found a digital home
Social capital and learning	I believe social capital, or basically taking the time to know and understand your students, is a huge factor in them learning online.	Yes community means a lot, but it depends if the students know about and have social media accounts and have ethics on how to use them.
Means of assessment	I wasn't sure if I did this well I gave them a rubric for self and peer assessment, but I did feel pressured by the college to produce grades based on written assignments	I used traditional things like quizzes and tests, but it didn't really measure what I thought I wanted to see, things like greater independence and confidence.
Online vs. F2F assessment	I'm really not sure about this yet. As in how do we do online assessment and make sure it's the same student doing the task?	I really think in this community at this time face to face is better than online.
Students' responses to PBL	Well, I wasn't very good at it so they weren't either at the beginning. But then we created this space where we could talk. And then it worked.	In some ways it is how they grew up. For the students who came to class, they had a very positive response to PBL.

4 Key Themes

(i) Problem Based Pedagogy: Student responses to the PBL environment were overwhelmingly positive, however two general trends occurred based on student demographics. For those undergraduates who had recently left a secondary school environment that was based on traditional pedagogy, they found the problem based strategies frustrating. Having not been empowered to be self-directed or to be involved in guiding their own learning, many wanted to be told what to do, how to go about it and what the results should look like. By contrast, mature students (who were working full time and pursuing their undergraduate degree online part time) found the constructivist and social elements of PBL very engaging. As adult learners, they responded very well to the independence, autonomy, and self-direction of the assignments. In addition, having had work experience, this may have prepared them better to work as part of a collaborative team, to contribute their own strengths, accept others' input, and demonstrate a willingness to work as a team. Mature students tended to demonstrate more of the Conference Board of Canada (2000) skills already in place, and this may have been why they embraced PBL readily, as it mirrored what they experienced in their own professional world of work. Teachers with little experience in PBL found the experience challenging, and the process of adaptation can take time, so a recommendation would be to have colleagues share experiences in PBL, share assessment strategies, and dialogue about the successes and challenges of implementing a digital PBL learning space.

(ii) Role of the Teacher: Invisible pedagogy does not mean the teacher is absent, nor does it imply that the pedagogy is simple. In fact, done well, it can be more challenging, more artful, more creative and widely diverse. The instructor must step out of his/her traditional role and become the disruptor, creating situations and experiences that both challenge, inspire, support students while providing critical feedback throughout the process. This is what Flavin (2012) refers to as "disruptive technologies" (p. 103). He states that "when digital technologies are brought into the classroom setting, the lecturer may have to relinquish some of their authority, thus impacting on the 'rules' and 'division of labour' nodes in order to enable enhanced learning" (Flavin, 2012, p. 104). Cochrane (2012) identifies this unique sharing of the digital learning environment as one of the critical success factors in mobile learning. He states that features of a successful virtual learning environment include

> *Pedagogical integration of technology into the course and assessment, lecturer modelling of the pedagogical use of the tools, creating a supportive learning community, and creating sustained interaction that explicitly scaffolds the development of ontological shifts that is the reconceptualization of what it means to teach and learn within social constructivist paradigms, both for the lecturers and the students. (Cochrane, 2012, p. 125)*

Further to this, "invisible teachers", in fact, must be willing to step out of the way; they must demonstrate an ongoing aptitude to embrace new technologies as they develop, in order to help students, not from a position at centre stage, but quietly from the background, empowering students to choose and develop the 21C skills they need. In certain cultural settings, where teachers are imbued with respect almost automatically, this shift to having student-centred pedagogy may be challenging. However, using mobile devices that students already use for social networking can aid in the transition to helping students see the possibility of learning anywhere and anytime on their phones or other devices. Teachers themselves "need to acquire 21st century competencies as well as become competent in supporting 21st century learning" (Voogt, Erstad, Dede & Mishra, 2013, p.408).

(iii) Online Community: Lin and Lee (2006) state that "the online community can be defined as a social relationship aggregation, facilitated by internet-based technology, in which users communicate and build personal relationships"(p. 480). Wenger and Synder (2000) believe that "online communities facilitate virtual collaboration among community members with the potential of transforming the activities of off-line into an online context" (in Lin & Lee, 2000, p. 480). While this social element of online learning remains a predominant challenge to educators, effective online pedagogy relies on how skilled the instructor is at developing and sustaining a sense of belonging to the digital community. By combining problem-based learning and a strong sense of community, educators can become adept at helping students become independent autonomous learners who are capable of solving the complex problems facing 21C learners. Instead of taking the power role normally assumed by the teacher, instructors become equal members of the community, bringing unique strengths and learning needs themselves. In this way, instructors blend into the community, become one with the background. By appearing to be on a level field with students, the teacher's role in the community disappears, and reappears as something completely different – as facilitator, lurker, guide and co-learner. As evidenced by the teacher interviews, there may be some cultural differences in accepting online learning and this can create a barrier to accepting new ways to build digital communities. Teachers need to align their pedagogy with the values in the local culture to enable digital learning to be more accessible and user friendly.

(iv) Development of Social Capital: Kearney et al (2012) attest that learning "is a situated social endeavor" (p. 1). Students in these classes invested a great deal of time in developing social networks within the course, many indicated that they also created a Linked In or Facebook group to supplement their contact with peers, following Twitter feeds on their mobile devices outside of scheduled class time. Kearney et al (2012) reiterate that "this socio-cultural view of learning takes into consideration both technical characteristics as well as social and personal learning processes" (p. 2). LittleJohn, Beetham and McGill (2012) agree that the social elements of learning are being embraced by students, and that "learners are responding to the new technical and social opportunities with little help from the formal education system" (p. 551). Student responses in the anecdotal focus groups indicated that they felt safe to take risks, ask questions and go to peers for support and present seminars with confidence. Many attributed this to the PBL climate of the course, and the expectation that a community of mutual respect had been developed. Within this relationship-based community, it became the norm to challenge, ask critical questions, provide feedback and respond to it constructively. As a result, the level of engagement, motivation and the quality of products generated by students increased. Again, it is important to understand, what the cultural values are when discussing social capital. In addition, it is key to consider whether there is an equitable access to technology.

(v) Development of 21C Skills: As McNeill, Gosper and Xu (2012) state, "universities increasingly acknowledge the value of skills such as problem solving, critical thinking and creativity, yet the curriculum needs to be designed to support and scaffold development of these skills. 92012, p. 283). They go on to state that "academics who were likely to introduce the development of student creativity in their curriculum found that confidence emerged as a key characteristic" (2012, p. 284) Students in this PBL class demonstrated skills in collaboration, the ability to come to a variety of workable and diverse solutions, and they also acknowledged that each member of the community, while possessing different skills, had an important and valuable place in the group. These are critical skills for anyone working in the knowledge economy. LittleJohn, Beetham and McGill (2012) indicate that the nature of the workplace has changed, and digital forms of information are changing the meaning of what it means to work. They state that these changes are being exacerbated by three factors

> *First, workplaces are being transformed such that production and practice are increasingly knowledge driven. Second, work problems are becoming more complex and third, people are*

> *regularly and repeatedly transitioning into new roles and careers, necessitating life-long learning. (2012, p.547)*

Students in this study were often mature adults who had changed careers several times, and during the focus groups it was mentioned several times that the PBL approach to learning enabled them to contextualize their learning to their workplace, as well as develop the confidence and competence to use digital tools to solve work-related problems. During the teacher interviews, both instructors mentioned the ongoing challenges of keeping up with new developments in technologies, and the difficulty of having students know more about the technology than they did as instructors. However, once they accepted it, they began to take more of the learner's role, and they found this began to equalize roles in the community. They did mention, however, that there still existed some challenges begin bound by the university/college grading system, noting that it was somewhat artificial to give students power during class, and then take back the power when it came time for giving grades. As a result, they started to dialogue about alternative means for assessing students, and they both appreciated the ongoing conversation about what assessment and evaluation can, or should look like when assessing 21C skills.

(vi) Student Self-Responsibility: During the course of the twelve weeks students built a considerable amount of what they determined to call "social capital". This networking and ability to create and sustain relationships within the learning community was a key feature in helping students take more responsibility for their own learning. An interesting feature that emerged was that students also felt an element of responsibility to the community, to come to class prepared, to engage in discussions, to prepare thought-provoking seminars and case study presentations. Self-responsibility did not mean "going it alone", and as the course progressed students indicated that because of the community they had built they felt safer to ask questions, take risks and help one another. What evolved was not only an improvement in student self-responsibility, but a redefinition of it. Being self-directed also meant a reliance on others for critical feedback, discussion and challenge, as well as being prepared to provide reciprocal feedback for peers to enable their learning and development.

5 Discussion

This paper examines four primary research questions: 1. How can problem-based learning pedagogy enable instructors to form smaller cohesive groups of students that take greater responsibility for their own learning? 2. What strategies can be used by teachers o develop communities of practice and inquiry?? 3. How can an instructor in a large virtual class co-create the level of social capital that is required to build and maintain the relationships that are a necessary condition for a high quality learning experience? 4. What are the perceptions of teachers about the challenges and benefits of facilitating a high quality problem based learning environment through invisible pedagogy?

To answer question one, it is clear from the surveys and comments of students and the observations of the instructor that PBL pedagogy can work effectively to enable instructors to step out of the way, to empower students in smaller groups to take ownership of the learning. While the research began asking the question of how individuals can take greater self-responsibility, it became apparent that the PBL process also means individuals feel a greater responsibility to their community of inquiry. Students commented that they felt the seminars each week were improving, that each member of the group felt a certain obligation to their peers to be well prepared and deliver an engaging and thought provoking seminar or case study. Thus, it is only by allowing students more control, that the instructor can take on large classes effectively. By investing up front and modelling a PBL structure, smaller groups of students can grow into the autonomy required to develop successful pods within a large class.

Responses to question two involve strategies to build online communities. In this case, the initial use of Digital Moments, a community building strategy in the first few classes means that individuals share in an Adobe connect video pod a photo or visual image that shows the community a bit about themselves, their learning backgrounds, reasons for taking the course, age and stage of career, and their personal goals and learning outcomes. In this way, the instructor can see more readily how to create diverse groups, can identify the students having greater experience with PBL, and those that may need greater support. In addition, it appears important that students connect outside of class time, using social media, Twitter, Facebook or LinkedIn. This occurred around the third week of the twelve week course. This phase appears to be important in order for students to invest more of themselves in the course, since they become more accountable to one another and thereby own the learning experience more fully.

Third, how can a network of students in a large virtual class create the level of social capital that is required to build and maintain the relationships that are a necessary condition for a high quality learning experience? Many of the students in this class were simultaneously taking classes with other instructors who were not using a full PBL pedagogical model. Often they commented that the level of social capital in this class was far superior to courses where they did not connect to others. Several students said they had taken full courses and "not even known anyone's names", whereas it became a norm in this class for students to know one another. It was not, in fact, necessary for all students to connect or get along with everyone, but respect for diversity was a key factor. By sharing personal backgrounds (work, family, weekly challenges) the students gravitated to those with whom they felt they had commonalities. At the same time they worked collaboratively in diverse groups, often commenting that this diversity was an important feature in helping them to think critically outside of their own sociocultural perspective and to see with one another's "lenses".

Finally, teachers' perspectives indicated that they appreciated the opportunity to reflect collaboratively about teaching online and using problem-based learning strategies to develop greater social capital and sense of community. An important observation by both teachers indicated that they felt the pressure to 'keep up' with new technologies, and often found their students knew more about the latest affordances than they did. However, they successfully learned to adapt and relinquish some control as they themselves were placed in the role of the learner. In addition, teachers mentioned the need to move towards more open educational resources (OER) as this would be a big step forward in increasing access for low income communities. Further, isolated or rural communities can greatly benefit from online education that may not have been accessible due to long distances from colleges or universities, so students would be able to remain in their local communities while getting a digital education. While the idea of 'invisible pedagogy' was appealing to the instructors, they acknowledged that it would be a work in progess because both they and their students were products of a more traditional teacher-centred model.

Overall, several key themes emerged through this learning environment that ultimately wove together to create increased levels of student self-responsibility. The primary aspect included a focus on a problem-based pedagogy which clearly put students at the centre of the learning process. Second, there were significant changes in the roles of the teacher-learner, requiring the instructor to step into the background and have less of a "top down expert" presence. Third, it became critical that there was the development of an online community of learners that broadened to the larger digital world beyond the class. Using social media and mobile devices, students stayed connected beyond traditional class time. This then resulted in a significant level of social capital and networking, which increased student engagement, commitment, accountability to peers and improved the quality of assignments they produced. Teacher reflections indicated clearly that they favoured open access educational resources, and felt that problem based learning was a unique and successful strategy for facilitating the development of 21C skills. Finally, the interdependent combination of all these themes created an environment in which students could develop the confidence and competence that they needed to be successful in a digital workplace.

6 Conclusion

This paper has provided a qualitative analysis of a case study in problem based learning, where the pedagogy of PBL helps undergraduate students develop greater self-responsibility for the learning process. The authors have argued that a significant outcome of PBL is also the enhancement of what many have termed 21C skills. This is what Littlejohn, Beetham and McGill (2011) refer to as "the capabilities required to thrive in and beyond education, in an age when digital forms of information and communication predominate" (p. 547). Kaufman concurs that "school is not simply about tests and 'checking boxes' of topics and assignments. Rather, schools today should have a mission of developing students as individuals and igniting their creativity" (2013, p. 79). Voogt et al (2013) also attest that it is generally agreed upon that "collaboration, communication, digital literacy, citizenship, problem-solving, critical thinking, creativity and productivity are essential for living in and contributing to our present societies" (p. 404).

Universities and other institutions of higher education have a moral and social obligation to prepare big thinkers for the needs of the 21C. To accomplish this, teachers need the opportunity and resources to develop skills in digital pedagogy. Using open educational resources, this should not come at an additional cost, however, investing in teacher development for online pedagogy will be a significant direction for higher

education. Despite the fact that these colleges and universities are undergoing severe economic cutbacks, surely it is still incumbent upon them to provide education that is relevant, forward thinking and that empowers students to become contributing members of society. While financial pressures may require universities to hold very large classes with one instructor, PBL can be used as a pedagogical strategy to empower students in smaller learning pods. In this way we maintain or enrich the quality of learning by placing it in the hands of the community of students, and the teachers become learners as well.

The problems of the 21C are complex, multi-dimensional and diverse, situated in different geographies, economies and cultures. People living and working in these environments must continually use digital technologies to learn, relearn and come to collaborative solutions. Problem-based pedagogy can be one aspect of higher education that can prepare students for what they will experience in this new world. It prepares them to take responsibility for their own learning as well as contribute to the learning of their colleagues, a skill that they will need as they continually change careers and roles in the workplace. As educators, we must step out of the way, facilitate PBL environments and experiences that help students to leap forward while we, as instructors, simultaneously move quietly into the background. Universities will still need professors, but maybe it's time we begin making their pedagogy invisible.

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