Do You Want Your Students to Be Job-Ready with 21st Century Skills? Change Pedagogies: A Pedagogical Paradigm Shift from Vygotskyian Social Constructivism to Critical Thinking, Problem Solving and Siemens' Digital Connectivism

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Abstract

As Michael Fullan (2001) so cogently asserts, the moral purpose of education is to equip students with the skills that will enable them to be productive citizens when they finish school. Whereas pre-21st century learning paradigms catered reasonably well for the pursuit of this moral purpose in turning out school leavers with specialized skills that were applicable in highly compartmentalized and specialized Industrial Age economies, 21st century skills require a new paradigm. In their seminal book entitled 21st Century Skills: Learning for Life in Our Times, Trilling and Fadel (2009) eloquently elaborate on the essential skills for 21st century learning and occupations. I call the adoption of these essential skills the pedagogical paradigm shift.

According to these leaders in the field, the essential skills for 21st century learning and occupations fall into four domains. First are the core subjects and skills such as the orthodoxy 3Rs that every educated person should have mastery of. Second is the learning and innovations skills domain requiring skills such as critical thinking and problem solving. The third is the career and life skills domain, calling for skills such as collaboration, teamwork and leadership. Fourth, is the digital literacy skills domain, requiring skills such as computer literacy and digital fluency. While computers and digital technologies play a central role in the development and utilization of the skills, the more essential skills for 21st century learning and occupations relate not just to the application of technology but more importantly, to the ability to engage in independent critical thinking, and a high level of problem solving, often using technology.

This paper reviews the learning paradigms that have guided pedagogy over the centuries and argues that a shift is needed in pedagogy and curriculum towards a paradigm that emphasizes critical thinking and problem solving as proposed by Trilling and Fadel (2009) within the social connectivist paradigm as well articulated by Siemens rather than the dominant Vygotskyian social constructivist paradigm.

Keywords: Moral purpose of education, 21st century skills, Learning paradigm, Transmission paradigm, Tabula rasa paradigm, Behaviorist paradigm, Cognitivist paradigm, Constructivist paradigm, Connectivist paradigm

1. What is the moral purpose of education?

According to Michal Fullan (2001) the primary purpose of education is to make a positive "difference in the lives of students and to help produce citizens who can live and work productively in increasingly dynamically complex societies." (p. 4). He characterizes this as "the moral purpose of education". As we try to educate our students, an understanding of this moral purpose helps us to appreciate more fully, the proper role and purpose of education in our times and what is needed to achieve it. The pursuit of this moral purpose raises several fundamental questions in pedagogy, including the following, which are addressed in this article. First, what is learning? Second, how do our students learn? Third, how can we help them learn? Fourth, what is essential for them to learn so that they will be job-ready when they graduate from school, college or university?

The pursuit for answers to these questions is not new. It has exercised the minds of great philosophers, psychologists, neuroscientists, and educationists over the centuries and still goes on. The early Greek philosophers Socrates (469 – 399 BC) and Plato (427 – 1347 BC) and Aristotle (384 – 322 BC) were among the well known pioneers of the search for answers to these questions (Monroe, 1925). In the 20th century, these were followed by Piaget (1923, 1950, 1954), Bruner (1960, 1966), and Vygotsky (1929, 1978). More modern researchers on these questions have included the well-known works of Bloom (1956) and Gardner (1983, 1999, 2006) to name but a few. Over the centuries, this search has led to the development of a multitude of learning paradigms, and so it is helpful to start this article with an articulation of the meaning of a learning paradigm, and a brief outline of how learning paradigms have evolved over the centuries, and their impacts on pedagogy.

2. Learning Paradigms and Their Value in Pedagogy

2.1 What is a Learning Paradigm?

A learning paradigm is a conceptual model, or worldview, or mindset that represents a way of thinking or understanding of relationships involved in the learning process. It postulates on the nature of learning, relationships involved, the principles that underpin those relationships and the structural and cultural dynamics responsible for causes and effects of what happens (Denzin & Lincoln, 2000).

2.2 Why do We Need a Learning Paradigm?

A learning is needed to help us answer three very intricately interconnected questions: what is learning? How does it happen? And, how can we facilitate it? If we are to have any hope of organizing teaching, learning, assessment and curriculum so as to produce superior results among learners, an understanding of these three questions is essential (USDHHS, 2003). As Illeris (2009), a Professor of Lifelong Learning at the Danish University of Education and who is internationally acknowledged as an innovative contributor to learning theory, warns, "learning is a very complicated matter … The concept of learning includes a very extensive and complicated set of processes, and comprehensive understanding is not only a matter of the nature of the learning process, … (but also of) all the conditions that influence and are influenced by this process" (p. 18). Wilson and Peterson (2006) say, "learning is a process of active construction; it is a social phenomenon, as well as an individual experience" (p.1). A learning paradigm helps us to understand what learning is and the processes it involves. It thus helps us to gain a better understanding of how children learn and informs what we can do as teachers and how to do so in order to facilitate learning. An understanding of these aspects of learning helps us to create learning environments within which high-quality learning can be facilitated. It sheds light on what you do as a teacher, what your students do, how you set up your classroom or learning environment, and the materials, learning activities and teaching strategies you use.

3. How Have Learning Paradigms Evolved Over The Centuries?

3.1 A synthesis of the Evolution of Learning Paradigms

Over the years many paradigms have been developed to explain the nature of learning and how learning happens. A number of these paradigms have been agreed on by most scholars as providing the basis for a primary understanding of how learning happens, and therefore how we can facilitate it. In a nutshell, the foundational paradigms fall into four broad categories which may be characterized as the transmission paradigms, the behaviorist paradigms, the cognitivist paradigms and the social constructivist paradigms. Table 1.1 provides a synthesis of each of these paradigms by indicating each paradigm's perspective on what learning is, how learning happens, and how it can be facilitated. The Table also indicates the key philosophers that advanced these paradigms. The synthesis in Table 1.1 is followed with this brief description of each of these paradigms.

3.2 The Foundational Paradigms and their Implications on Pedagogy

3.2.1 The transmission paradigm

Dating back to the early Catholic Church in Rome, around 500 A.D. is the earliest theory of learning which postulated that effective instruction takes place when a teacher transfers objective knowledge to the learner (Monroe, 1925). Teaching was seen primarily as the transmission of knowledge by the teacher to a passive, receptive learner. Learning was some kind of gift, delivered to the learner by the teacher who was the fountain of knowledge. This is why this conceptualization of learning and how it occurred was popularly referred to as the 'Transmission' paradigm of learning and the process as the 'Transmission mechanism.' As noted by Cuban (1993), this paradigm guided instruction, not only in Rome, but also throughout the western world for many centuries. Even today, some transmission occurs when we teach using direct teacher instruction strategies such as whole-class explanation (Killen, 2013).

Table 1.1 A synthesis of the foundational pedagogical paradigms over the centuries

		Perspectives of Learning		
	Paradigm and Key Proponent/s	***What is learning?***	***How does it happen?***	***How can we facilitate it?***
The Foundational Learning Paradigms	The Transmission and Tabula Rasa Paradigms [*Aristotle, Plato, John Locke*]	• A gift to the learner • Passive absorption • Empty vessel, sponge, blank slate, tabula rasa	• Transmitted by teacher • Rote • Memorisation • Recall • Factual • From fountain of knowledge	• Pour it in • Deliver • Lecture • Dictate • Instruct • Straightforward work
	The Behaviorist Paradigm [*B.F. Skinner, Ivan Pavlov; Edward Thorndike*]	• Response to stimulus/stimuli from the environment • Basic concepts	• Change in external behaviour due to conditioning • Memorising and responding to targeted stimuli.	• Present stimuli • Observe response • Provide feedback • Reinforcement
	The Cognitivist and Individual constructivist Paradigm [Jean Piaget]	• Active discovery and construction of knowledge ▪ Strategies, rules and patterns ▪ Complex and intellectual storage ▪ Subjective reality.	▪ Individual interaction with environment ▪ Personal discovery and experimentation ▪ Assimilation ▪ Accommodation ▪ Adaptation ▪ Reframing mental models	▪ Activate current schema ▪ Apply cognitive learning strategies ▪ Opportunities to engage, apply, analyse,
	The Social Constructivist Paradigm [*Lev Vygotsky*]	▪ Active discovery and construction of knowledge	▪ Authentic social –cultural relationships ▪ Cooperative learning ▪ Problem solving ▪ Shared meaning ▪ Zone of Proximal Development	▪ Scaffold teamwork ▪ Opportunities to collaborate, ▪ Explain ▪ Discuss ▪ Argue ▪ Create as a team ▪ Extend ZPD.

3.2.2 The tabula rasa paradigm

This paradigm has its origin in the work of the Greek philosopher Aristotle (384 – 322 B.C.) who was a student of Plato (427 – 347B.C.). It is very closely related to the transmission paradigm and although its genesis lies with these Greek philosophers, it was made popular not by the Greek philosophers, but by John Locke (1632-1704), who called it the 'Blank Slate' paradigm. It is often referred to by its Latin equivalent as the 'Tabula rasa' paradigm. Locke (1632-1704) argued that the mind of a child before it receives the impressions gained from experience is a metaphorical blank slate. He postulated that the child's blank slate gets impressions as a result of the child's own experiences. Learning was primarily factual and rote memorization. The tabula rasa paradigm differs significantly from the transmission paradigm in that whereas the learner is a passive recipient of knowledge in the latter, in the former, the learner needs to experience what is happening in the world around him or her to make sense of it. This paradigm thus appears to be an early precursor of the behaviorist paradigm (Monroe, 1925).

3.2.3 The behaviorist paradigm

The behaviorist paradigm of learning is attributed to American behaviorist and social philosopher, Burrhus Frederic Skinner (1953). Skinner focused primarily on the relationship between the environment and behavior and postulated that learning was the result of forming connections between stimuli from that environment and related responses. In this regard, Skinner's paradigm was similar to the learning by conditioning theory, developed by Russian physiologist Ivan Pavlov (1849 – 1936), on his work with dogs. It was also very close to Edward Thorndike's (1874 – 1949) theorization that for children to learn, we should manipulate their learning environments so that they send specified stimuli designed to produce the desired learning among children (Bransford, Brown & Cocking, 2000).

3.2.4 The cognitivist paradigm

In contrast to the behaviorist paradigm, rather than focus on the relationship between the environment and behavior, the cognitivist paradigm focused on the relationship between the learner and the environment. Piaget (1923) as the key proponent of this paradigm proposed that a learner gains knowledge and constructs meaning from the interaction between his or her own experiences and ideas that he or she comes into contact with. Thus, its central tenet was that learning occurs as individual learners think and actively participate in what is happening. He argued that learners construct new knowledge from their experiences through two processes, which he called "assimilation" and "accommodation" (Piaget, 1954; 1971). Later Piaget (1981) strongly articulated that whatever gets into the mind of a learner has to be constructed by the learner through active knowledge discovery. Thus Piaget's paradigm provided the foundation of what is popularly known as "active learning" as the best way to facilitate learning.

3.2.5 The social constructivist paradigm

This paradigm emerged out of cognitivist theorists developing an understanding that learning is a social experience rather than an individual one. First articulated by Lev Vygotsky (1929) this understanding produced what became known as the developmental theory of social constructivism. Vygotsky's 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 wrote: "In the process of development, the child not only masters the items of cultural experience but the habits and forms of cultural behavior, the cultural methods of reasoning" (Vygotsky, 1929, p. 415). In what he called the 'Zone of Proximal Development' (ZPD), Vygotsky explained that the ZPD is 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 main difference between Piaget's and Vygotsky's paradigms is that learning is an individualistic experience with Piaget but a social occurrence in Vygotsky's paradigm.

4. The Essential Skills for 21st Century Learning and the New Paradigm

The foundational paradigms have over the centuries provided frameworks which guided teaching and learning; particularly relevant to the Industrial Age in which memorization, specialization and compartmentalization increased productivity and profits. However, in the last 25 years, the ubiquitous penetration of microelectronics into everyday life has changed the way we live and the way 21st century industries and occupations operate. In particular, to remain competitive, every industrial firm had to embrace technology or drop out of the profitability race. This forced firms to introduce new tools into their production processes and to require new skills among its new employees. This is how the essential skills of the 21st century emerged. So, what are they?

4.1 Which are the Essential Skills for 21st Century Learning?

In *21st Century Skills: Learning for Life in Our Times*, Trilling and Fadel (2009) explain well the core skills of 21st century learning and occupations. They describe them as the skills that young people need in order to succeed as individuals, citizens and workers in the 21st century. They argue that whereas every educated person should have an appreciation of core skills in literacy and numeracy (e.g. the 3Rs of reading, -riting and –rithmetic) to succeed in the 21st century, an educated person must also have skills that enable him or her to think logically and to solve problems effectively and independently (Trilling & Fadel, 2009). Consequently, they propose that the essential 21st century skills comprise a domain of a core of skills plus three other domains as summarised in Table 1.2

Table 1.2 The 21st Century Essential Skills

Key Domain	**Essential skills for 21st century learning and occupations**
Core subjects and skills	• Reading • Writing • Numeracy • [**i.e. *Content needed to be an educated person***]
Learning and innovation skills	• Critical thinking • Problem solving • Communications • Creativity and innovation
Career and life skills	• Collaboration and teamwork • Leadership and responsibility • Initiative and self-direction • Flexibility and adaptability • Social and cross-cultural interaction • Career and learning self-reliance ▪ Productivity and accountability
Digital literacy skills	• Computing literacy • Information literacy • ICT literacy • Media literacy
Source: Summary of 21st Century Skills from Trilling & Fadel (2009), pp. 175-176.	

4.2 The Shift to the New Paradigm: How Do We Teach 21st Century Learning and Occupational Skills?

Trilling and Fadel (2009) found that students graduating at all levels, from schools to universities in the USA, lacked most of the skills summarized in Table 1.2 which are needed in today's industries. These skills include critical thinking, problem solving, effective communication, creativity, innovation, leadership, professionalism and work ethic, teamwork and collaboration, working in diverse teams, and project management; computing, information, ICT and media literacies. They proposed that "In our recently arrived Knowledge Age, our world of connected knowledge work, global markets, tele-linked citizens, and blended cultural traditions, demands a fresh set of skills" (p. 16), as represented in Table 1.2. Teaching our students so that they become well-equipped with the 21st century skills is the new learning paradigm. Trilling and Fadel (2009) argue that "Achieving education's goals in our times is shaped by the increasingly powerful technologies we have for communicating, collaborating, and learning" (p.16). Thus, in teaching our students along this pedagogical paradigm shift, we need to use the powerful technologies available today to educate children and help them become critical thinkers and problem solvers so that they acquire skills that will be the engines for their success in workplaces, trades, occupations, and professions of the 21st century; thus meeting the moral purpose of education. Ted McCain (2007) agrees when he asserts:

> *It is clear that we need to rethink how we teach students if we want to prepare them for the world they will encounter when they leave the school system. In the technologically saturated world of the 21st century, it would be easy to assume that the answer is simply to equip students with up-to-date technology skills. Technology skills are important, but they are not enough. What is needed is a fundamental shift in the way we present material to students. We need an instructional approach that will equip students with real-world problem-solving skills plus, teach them the content they must master to be an educated person* (p.15).

In consideration of the four domains that Trilling and Fadel (2009) propose, as illustrated in Table 1.2, the formula for the pedagogical paradigm shift needed to teach the essential skills that comprise the four domains may be stated as follows:

The New Learning Paradigm

JR 21CS = f(TCS + LIS + CLS + DLS).

This may be expanded as:

JR21CS= Job Readiness with 21st Century Skills

f = is a function of

TCS = Traditional Core Skills e.g. reading, -riting and -rithmetic or basic literacy and numeracy;

LIS = Learning and Innovation Skills; e.g. critical thinking, problem solving and creativity;

CLS = Career and Life Skills; e.g. flexibility, adaptability, initiative, teamwork and leadership;

DLS = Digital Literacy Skills; e.g. technological proficiency, digital fluency, computing, media and information literacy.

Since the traditional core skills (TCS) are well known, as for instance represented by the 3Rs, there is no need to comment on them here. However, some of the key variables in each of the other three domains of this formula are elucidated in the following sub-sections to shed light on how we can teach so as to achieve the needed paradigm shift.

4.2.1 The Learning and Innovations Skills (LIS) domain: E.g.: Teaching critical thinking and problem solving

The need to teach critical thinking, creativity, and problem solving has a high premium across educational jurisdictions of many countries. In Australia, for instance, it is enshrined in the National Educational Goals for Young Australians in which all the Education Ministers at their meeting in Melbourne (MCEETYA, 2008,) declared the National Goal that:

> *All young Australians become successful learners, confident and creative*
>
> *individuals, and active and informed citizens. ... able to think deeply and logically,*
>
> *and obtain and evaluate evidence in disciplined ways as the result of studying fundamental disciplines ... and are able to solve problems,* (p. 8-9).

The ability to engage in deep and logical creative critical thinking and to evaluate evidence, as called for by the Australian education ministers, for example, is the foundational notion of the Learning and Innovations Skills (LIS) domain. Trilling and Fadel (2009) suggest that we can teach our students critical thinking by encouraging them to use inductive and deductive reasoning, getting them to analyze parts of a whole so they engage in systems thinking, teaching them to make judgments as a result of analysis, interpretation, reflection and evaluation.

Ted McCain (2007) has very helpful comments on this very topic in a section entitled 'Teaching Students How to Solve Problems'. He starts the chapter with a very apt quote of Anne Isabella Thackeray Ritchie's (1837-1919) saying which has become famous over the years: "If you give a man fish, you feed him for a day. But if you teach the man to fish, you feed him for a lifetime" (p. 49). The message in this saying is profound. We need to equip our students with the capacity to solve problems they will encounter in the 21st century workplace after school. The

value of what we teach is not just in the pedagogical content knowledge but in the process of its application to real-life situations to solve problems. Arguing that "processes empower people far more than specific content" knowledge, McCain (2007) recommends a four step-by-step process that we should teach our students before they leave school to enable them solve problems they will face in the real-world after school. He also articulates a five process skills set that should help students learn how to solve problems. Each of the four essential steps of problem-solving starts with the letter D and so McCain refers to the process as “the 4DS of Problem Solving” (Ibid, 2007). These are summarized as follows:

1. Define the problem envisioned before starting work at it.

2. Design a plan for the solution of the conceptualized problem. This involves

(a) Developing a plan to make the idea a reality.

(b) Developing and learning the skills and knowledge needed to solve the problem.

(c) Breaking the problem into logical sequences of smaller sub-tasks that are easier to tackle

(d) Deciding on resources needed to solve the problem.

3. Do tackle the problem. This involves putting the plan into action to solve the problem.

4. Debrief. This involves reviewing how well you have accomplished what you set out to do. That is, how successful have you been in solving the problem?

McCain (2007) proposes five key process skills which he says "students must master if they are going to be successful in solving the tasks I give them. Not only will these process skills help them with their schoolwork, but they are also critical skills for success in the world outside school" (p. 50). He calls these five process skills, time management, project management, research, project design and teamwork. Each of these is commented upon briefly below.

1) Time Management

Students need to learn to budget the time available effectively so as to schedule allocation of time to work and recreation. They need to guard against over committing to far too many things only to find that there is not enough time to complete the tasks. Effective time management requires students to learn how to prioritize what to do in the time available.

2) Project Management

Project management skills are required to stick to a timeline along which the various subtasks that comprise the project are to be carried out. Effective project management avoids leaving tasks till the last minute or rushing into the preliminary stages of the project prematurely.

3) Research

Students should develop research skills. This means, first and foremost, that they should be able to determine what knowledge and skills are needed to tackle the problem they are confronted with. Secondly, they should learn how to find the relevant information for the specific problem being tackled. Thirdly, the research skills require that the student be able to analyze the information gathered and get to understand what it really means. Fourthly, they need to be able to apply the discovered new knowledge to the solution of the problem encountered.

4) Project design

Students need to be able to work on their own to design a plan that will enable them to successfully complete the task. Effective project design should include setting what are called SMART goals following Peter Drucker (1909 – 2005) management by objectives concept. This mnemonic acronym means that the goals should be kept simple and specific (S); Measurable (M), Achievable (A); Realistic (R) and Timed (T) to be completed within the time available. The goals should not be set too high, as overachievers tend to do; or too low, as underachievers often do. The process of project design should also spell out the steps to be followed; including the logical sequence of subtasks to be completed (McCain (2007).

5) Teamwork

It is essential for success in 21st workplaces that our graduating students be able to work harmoniously with others as effective members of a productive team. Teamwork is most effective when members of the team are fully committed to the five principles of cooperative learning proposed by Kagan (1994) and which are easily taught using another mnemonic acronym, 'PIEGS'. In this acronym, P is for Positive interdependence which means that every member of

the team works interdependently with the other members, so that every member gains. I is for individual accountability which means that every member of the team takes responsibility for their own contribution to the project. E is for equal participation, which means that every team member has the opportunity to make the maximum contribution to the joint project according to their ability. G is for group processing which means that members reflect on their progress and provide constructive feedback and S is for simultaneous interaction which means that all members of the team are all making their different contributions all at the same time. No one is seating, just observing what others are doing or piggybacking.

4.2.2 The Career and Life Skills (CLS) domain: E.g.: Teaching collaboration, flexibility and self-reliance.

Trilling and Fadel (2009) propose that the development of career and life skills (CLS) requires five sets of skills which they sate as:

1. Flexibility and adaptability skills
2. Initiative and self-direction skills
3. Social and cross cultural skills
4. Productivity and accountability; and,
5. Leadership and responsibility skills.

They argue that because "we are at a time of great change, flexibility and adaptability are now essential skills for learning, work and citizenship in the 21st century" (Trilling & Fadel, 2009, p.74). Success, therefore, requires that everyone be prepared and able to adjust and to adapt so as to accommodate the new and ever changing circumstances. They suggest that adapting to change can be taught by getting our students to adapt to varied roles, responsibilities, and to contexts and working under changing priorities.

To teach our students flexibility, they propose that we incorporate feedback effectively in our teaching and assessment and train our students in dealing positively with praise or setbacks or criticism and help them to be able to understand, negotiate and balance diverse views and beliefs to reach workable solutions. For initiative and self-direction, they say that we should teach our students how to manage goals and time, work independently and encourage them to become self-directed learners. For social-cultural skills, they recommend that we teach students how to interact effectively with others and to work effectively in diverse teams. For productivity and accountability, they propose that we should train students in project management and get then to demonstrate attributes associated with producing high quality products including multitasking, active participation, collaboration, cooperative learning and accountability. For leadership and responsibility they propose that we should teach students to guide and lead others and encourage them to act responsibly, taking into consideration the interest of others.

4.2.3 Teaching Digital Literacy Skills (DLS): E.g: Computer, information and media literacy

Globalization and technological change that has occurred in the 21st century world has led to rapid advances in information and communication technologies outside the classroom. As Kivunja (2013) notes, "the demand for labor in the 21st century economies is for people whose skills are well grounded in technological knowledge, skills and creativity" (p. 140). For us to equip our students with the skills that will enable them to be productive in the globalized 21st digital century trades, occupations and professions, it is imperative that we embed digital technologies in pedagogy and curriculum. Trilling and Fadel (2009), say:

Whether we're ready or not, the Knowledge Age has arrived… With today's and tomorrow's digital tools,

our net generation students will have unprecedented power to amplify their ability to think, learn,

communicate, collaborate, and create. In the 21st century, everyone's level of information literacy

*and fluency will need to rise (*pp. 61 - 65).

These authors suggest that to make the paradigm shift, we should help our students learn information literacy skills by teaching them how to access and evaluate information, teach them how to manage the flow of information and use information accurately. They recommend that to skill our students in the domain of digital literacy skills, we should teach them how to analyse media and how to interpret messages and how to apply a fundamental understanding of the ethical and legal issues surrounding the access and use of media (Trilling & Fadel, 2009). They suggest that we should teach our students how to "use technology as a tool to research, organize, evaluate and communicate information; and create information in order to successfully function in a knowledge economy" (Trilling & Fadel, 2009, p. 71). Kivunja (2014) agrees when he says that there is "compelling wisdom that for us pedagogues to facilitate learning by Digital Natives, we should embed digital technologies in our teaching, learning and assessment,.. (and that) the old way of

learning along a *do-it-on-your-own* (DIOYO) attitude simply doesn't make sense to learners in the 21st century" (p. 106).

This has been well articulated in what George Siemens (2004; 2006) calls the digital connectivist approach to learning. Siemens (2004) explains that in the connectivist approach, 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. This approach focuses on the impact of digital technologies on learning and specifically advocates a collaborative epistemology in which learning is facilitated, amplified and constructed through collaborative activities using social media technologies; thus overcoming the DIOYO (*do-it-on-your own*) syndrome. Siemens (2004) argues that in this approach learning takes place through social interactions connected through the Internet. Social media are used not just for social conversation but also for active learning of pedagogical content and for completing formative assessments in collaborative Peer Learning Networks. This is consistent with a pedagogical experiment in which undergraduates and doctoral students were given the opportunity to utilise social media technologies for their learning and assessments, and Kivunja (2013) found that "the number of participants rose by a multiplier effect varying from 2.5 (i.e. 250%) to a multiplier effect of 4.8 (i.e. 480%) among the more dynamic and more proactive students" (p. 138). What's more, Kivunja's (2013) study found that "the observed multiplier effects were the results of personal interest and desire to participate rather than a response to mandated instruction" (Kivunja, 2013, p. 139). Moreover, the research (Kivunja, 2013), found:

> *students' posts in the streams reflected interest, motivation and personal drive…. The skills that students demonstrated in their conversations appeared to fall within Bloom's (1956) higher-order critical thinking skills of Applying, Analysing, Evaluating and even Creating. Students' critiques … demonstrated high levels of Engagement, ability to Explore, Explain, Elaborate and Evaluate that appears to be consistent with Bruner's (1966) Instructional Model* (p. 139 – 140).

Thus, Kivunja's (2013) research-based findings provide evidence that "when students were given the opportunity to apply digital technologies in their learning and professional practice, they took initiative to extend their understanding of issues and concepts in a digitally connectivist mode" (p. 139). We therefore know that teaching digital literacy skills, as illustrated in the connectivist learning experiment referenced here, makes good sense to learners and pedagogues alike utilising 21st century skills. It certainly aligns well with Trilling and Fadel's (2009) Digital Literacies Skills dimension (DLS).

5. Conclusion

It is a professional imperative that we endeavor to fulfill Fullan's (2001) moral purpose of education: to make each of our graduates a productive citizen in the 21st century economy. This is preparing our students for success, not only in learning but also in their life endeavors after school. The new paradigm proposed in this paper pursues this moral purpose by providing for the training of students to gain mastery not just in the traditional basic skills of reading, –riting and –rithmetic (TCS), but in the domains involving skills in critical thinking, problem solving, creativity and innovation (LIS); career and life skills (CLS), and digital literacy skills (DLS). For us to be effective teachers in the 21st century requires that we make the pedagogical paradigm shift so that we change the way we teach in order to be able to prepare our students, not simply to memorize content and to follow instructions given by others, but to develop skills that are in demand in the 21st century workplace; be able to think for themselves, solve problems, work in teams and lead others to success in the Knowledge Economy.

Of course, active learning as promoted in the hitherto dominant constructivist paradigm will always be a great way to learn but the learning now needs to be steered into the domains of learning and innovation skills, so that students can engage in critical and independent higher-order thinking and real-world problem solving; into the domain that calls for the development of career and life skills and into the domain requiring them to become proficient in the application of technological tools needed to drive 21st century trades and professional occupations. As one of the essential domains of this new paradigm, technological proficiency skills, as postulated in the connectivist orientation, empower our graduates to harness and exploit the enormous power of technology in helping them to think critically and to solve real-world problems as productive citizens in the 21st century digital economy.

As the world has fundamentally changed in becoming the 21st century Knowledge Economy the roles of learning and teaching must also change if education is to meet its moral purpose. While the basic skills needed by every educated person of the 20th century Industrial Age Economy continue to be relevant, they are learned differently in

the 21st century contexts. It is thus a professional imperative for us to change the pedagogical paradigm: to help prepare our graduating students to meet the complex challenges they will face in their real-world lives after school, college or university. This paradigm shift is needed to help our graduates fulfill their civic responsibilities and live fulfilling lives thereby helping us meet Fullan's (2001) moral purpose of education. As suggested by John Wilson, Executive Director, National Education Association, (USA), we should run - not walk - to implement these 21st century skills and competencies. Our graduating students need them to be successful in the Knowledge Age Economy of today and tomorrow.

As one of the four domains of this new paradigm, technological proficiency as encapsulated in the connectivist approach to learning, gives us the opportunity to see learners interconnected in collaborative environments that are open-ended and in which computer mediation, driven by Internet technologies, facilitates and enhances learning. Learning is no longer a lonely, DIOYO experience, but an interactive activity within dynamic communities that comprise Peer Learning Networks. This new approach to learning creates opportunity for an understanding of how social constructivist learning processes can be enriched, extended and improved to levels hitherto unseen, as a result of embedding computer-mediated digital technologies and using them as tools for active learning, critical thinking and problem-solving, innovation, creativity and teamwork in 21st century learning and occupations. And so, with reference to Michael Fullan's (2001) moral purpose of education cited earlier, it is clear that the paradigm shift is needed to change the curriculum, teaching, learning assessment and use of technology to better prepare our students to be productive, creative citizens and workers in the Knowledge Economy of the 21st century and thus ensure that the education we provide helps to fulfil Fullan's (2001) moral purpose of education.

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