Toward the Application of Constructivism and Constructionism to Work-Related

Training in Service of the Enhancement of Human Capital Development

in Postsecondary Education Settings in the United States
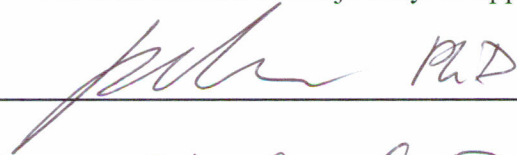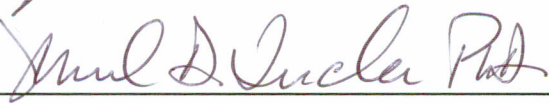

by

Antje Mays

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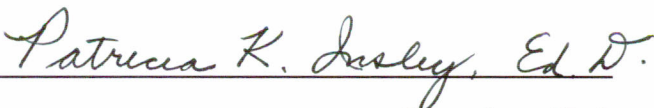Doctor of Education

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The Dissertation of Antje Mays is approved:

_____ PhD

_____ PhD

Patricia K. Insley, Ed. D.
Committee Chair

California Coast University

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Abstract of the Dissertation
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Education research and employer surveys reveal that the skill gap in the United States spans across the realms of academic foundations, industry qualifications and technical competencies, higher-order cognitive skills, and behavioral skills and values. The purpose of this investigation was to identify key components of the two theoretical models of constructivism and constructionism which have been found to enhance children's intellectual and affective development and to apply these components to career instruction in postsecondary education settings. Through a critical analysis of existing theory and research related to human capital, constructivism, and constructionism, the components which might be logically applied to workforce development in postsecondary career education settings in the United States were identified.

The goal of applying constructivist and constructionist strategies would be to empower postsecondary career learners to internalize their career fields' knowledge base and its practical applications as well as strengthen learners' analytical skills, creativity, perseverance, ethics, and behavioral workplace competencies. To accomplish this goal, seven core components were distilled from constructivism and constructionism: the whole person, knowledge structures, strategically prepared learning environments, the teacher as expert guide and subtle facilitator, experiential learning, social interaction and collaborative learning, and reflection.

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CHAPTER ONE

Introduction

The current skill gap in the United States encompasses industry-specific and technical competencies, basic skills, complex reasoning, social and collaborative skills, professionalism, and ethical sensibilities (Hart Research Associates, 2010; Kuczera & Field, 2013; Manpower Group, 2013; Nagle, 2010). Prevailing methods in schooling and job training focus on repetition and narrow skills (Hall, 2009; Suárez-Orozco, 2007), but the active-learning theories of constructivism and constructionism show promise for cultivating the above-cited widely needed broader competencies. This chapter presents the current skill gap, US educational developments, and the theoretical foundations for applying constructivism and constructionism to the development of key work skills.

Background of the Problem

The skill gap in the United States today is the cumulative effect of over four decades of automation, large-scale production offshoring, shifts toward technology-infused smart manufacturing, and growth in high-end analytical and creative work. US employers are widely reporting that multifaceted skill shortages are impeding business functioning (Manpower Group, 2013) and adversely affecting the nation's global competitiveness (Schwab & Sala-i-Martín, 2013). Skill shortages manifest in a variety of ways: Manufacturers endeavoring to fill skilled positions in the United States rely on automation and robotics to boost their competitiveness through enhanced productivity, but they face an inability to find enough technically skilled workers (Dahl, 2012).

Current skill shortages are considered so severe that skilled immigration has entered the public discourse as a proposed solution (Salam, 2011). A recent study led by New York Schools Chancellor Klein and former US Secretary of State Rice (Klein, Rice, & Levy, 2012) found that the skill gap also impedes national security, as young people are unable to meet skill and knowledge requirements for military service.

Over 8,000 US employers polled in ten research studies between 2008 and 2013 widely agreed that skills important to workforce success but in short supply span technical and industry-specific competencies, tangible work-pertinent skills and their practical application, written and oral communication, conceptual grasp, math skills, analysis and synthesis, social and collaborative skills, as well as values of ethics and integrity, good citizenship, work ethic and professionalism (*Closing the Gap*, 2012; *Critical Skills Survey*, 2010, 2012; Manpower Group, 2012a, 2013; Nagle, 2010; Hart Research Associates, 2010; Schwab & Sala-i-Martín, 2012, 2013; SHRM, 2008). Education scholars also place high priority on these skills (Gerver & Robinson, 2010; Jacobs, 2011; Suárez-Orozco, 2007; Wagner, 2010). Concurrently, weak basics such as literacy, numeracy, and academic foundations present obstacles for workers endeavoring to adapt to new and evolving types of work which require complex reasoning and analytical skills as well as higher levels of diversified knowledge and ability to synthesize across the boundaries of discrete subject areas (Kuczera, 2011; Kuczera & Field, 2013; OECD, 2012; Wagner, 2010).

These skill gaps have emerged in part due to underlying shifts in the economy paired with corresponding changes in the nature of work and employer needs' shifts toward higher-order competencies (Cappelli, 2011; Lindsey, 2013; Manpower Group, 2012a, 2013; Torraco, 2007). Skill gaps also emerged because schooling methods have

not kept pace with the evolving nature of work and the skills needed to thrive amidst heightened complexity (Suárez-Orozco, 2007). Training designed around narrow job skills does not sufficiently raise trainees' skills to reap economic benefits from further training; narrowly focused training fails to instill the continuous learning and adaptability needed in the face of a rapidly and profoundly changing world (Hall, 2009). As the high-demand creative and analytical skills are largely taught in postsecondary settings rather than in earlier schooling and narrow training settings (Brennan & Powell, 2010), a postsecondary credential has become key to life-sustaining earning opportunities (Carnevale, Rose, & Cheah, 2011; 2012; Iranzo & Peri, 2009) while financially out of reach for many (Kuczera & Field, 2013; Torraco, 2007).

The above-described combined factors have eroded traditional employment opportunities for lower-skilled workers while simultaneously raising the bar for required skills (Blinder, 1987; Lindsey, 2013; Peck, 2011; Torraco, 2007). The skill gap and its implications for social cohesion and economic health are of concern to educators, employer communities, and policymakers (Klein, Rice, & Levy, 2012; Peck, 2011). Yet human capital challenges are not new to the United States. Prior eras of societal and economic shifts have also wrought evolving skill needs and calls for reforms:

Skills and Knowledge: A Brief History

Throughout human history, education and training have been charged with turning out viably skilled people who could assume productive roles in their respective societies. From education reserved for an elite few to endeavoring to educate everyone, instructional strategies have historically imparted skills and knowledge and reinforced values important to the social and economic systems of their day. Although societal and economic structures have evolved tremendously from social orders with assigned roles

pre-determined by birth to today's complex and knowledge-driven global economy with the promise of skill-based meritocracy, the need for systematic human capital strategies has endured. In the United States today, human capital needs are a major focus of debate, policy measures, and thoughtful inquiry among education scholars.

Desired learning outcomes for human capital development include academic content knowledge (Hirsch, 1988; OECD, 2012), skills relevant to existing and evolving types of work (Manpower Group, 2013; Torraco, 2007), moral reasoning (Nagle, 2010), intellectual curiosity (Wagner, 2010), and informed citizenship (Dewey, 1916; Hart Research Associates, 2010). Historically such skills have been imparted to varying degrees around the world through tutors, schools, universities, craft and trade guilds, apprenticeships, internships, vocational education, and technical training (Charland, 2005; Wallis, 2008; Wallis, Webb, & Minns, 2010; Wolek, 2004). In the West, advancement from feudalism and agrarian economies was spurred by intellectual movements, acceleration in scientific discovery, industrialization, knowledge proliferation, and representative government resulting in expansion of individual freedoms (Ferguson, 2011). With these changes came education's expanding population reach and rising prominence as a vehicle for preserving knowledge, cultural heritage, and equipping individuals with relevant skills for contributing to society (Gutek, 1994).

The Importance of Skills and Knowledge in the USA: Historical Path to the Present

In the United States, the nation's Enlightenment-era founders recognized the importance of an educated populace to both the welfare and stability of the nation and sustained liberty for the individual. America's founders were influenced by European Enlightenment notions of education as a prerequisite for meaningful exercise of citizenship: Rousseau noted that "public education ... is one of the fundamental rules of

popular or legitimate government" (as cited in Alexander & Alexander, 2001, p.22).

Similarly, Montesquieu posited that "... It is in a republican government that the whole

power of education is required..." (as cited in Alexander & Alexander, 2001, p.22). John

Jay, the first Chief Justice of the newly independent United States, stated in 1785 that he

considered "knowledge to be the soul of a republic" (Alexander & Alexander, 2001,

p.21), while the third US President Thomas Jefferson's emphasis on the importance of

education found expression in his words that "a people who mean to be their own

Governors must arm themselves with the power which knowledge gives" (Alexander &

Alexander, 2001, p.24). Such notions of each citizen's need for access to education

reflected these early leaders' desire to grow human capital capable of gainful and

productive participation in the economic and social life of the nation (Beadie, 2010). As

large-scale immigration and migration to cities wrought complexity and social problems

in the 19th and early 20th century, thinkers and educators became concerned about erosion

of common culture and values, prompting character and civic education; industrialization

brought the challenge of workforce preparation, giving rise to vocational education.

Instruction strove for students' academic and moral preparation for navigating the social

shifts of their day, while vocational education focused on preparing learners for work

(Brewer, 1933). America's advances in development, knowledge, discovery, and

emerging international leadership in times of geopolitical tensions spurred social and

political concern with US educational outcomes in internationally comparable measures

(Kennedy, 2001; Patterson, 1997). When in 1957 the Soviet Union launched its satellite

Sputnik into earth orbit ahead of the satellite under development in the United States,

many in America became concerned about falling behind the nation's Cold War foe in

scientific education and advances (Cavanagh, 2007). This *Sputnik moment* triggered

stronger emphasis on math and science education – a zeitgeist eloquently expressed in President Kennedy's stated goal of "putting a man on the moon before the decade is out and returning him safely to the earth" (Swanson & Dickson, 2012, p.329). This vision was achieved – a testament to an effective combination of education and focus on goal accomplishment. Following the energetic era of lunar missions in the late 1960s and early 1970s, the recession of the 1970s and early 1980s coincided with burgeoning foreign competition, US manufacturing industry declines marked by urban and rural plant closings, businesses' and professionals' continuous flight to suburbs, and rural areas' slide into poverty (Wilson, 1997). The resulting erosion of inner cities' and rural areas' tax base and waning public services such as transportation and schools left the affected areas' undereducated and low-skilled residents without access to stable employment and skill-enhancing educational opportunities, leaving schoolchildren locked into the bottom by way of under-resourced schools unable to equip them with competitive skills. Talent flight brought further economic and educational isolation for such communities (Jensen, Findeis, Wan-Ling, & Schachter, 1999; Klein, Rice, & Levy, 2012; Wilson, 1997). The seminal research report *A Nation At Risk* (1983) described the erosion of US products' global lead in the face of high-quality foreign competition and admonished readers of the great importance of education to a nation's continued well-being and prosperity. Drawing on their research findings on US education and skill trends, the report's authors warned that if industry declines and mediocrity in education continued unchecked, ill-prepared students with inadequate knowledge and skills would precipitate the nation's long-term moral, social, and economic decay. Four years later, economist and educator Blinder (1987) and – more recently – Peck (2011) noted the worker displacements emanating from technological developments, job consolidations,

offshoring, and gravitation toward higher-skilled work: Automation, proliferation of

technologies, growing globalization, increasing foreign competition and imports

coincided with offshoring of US-based operations and production to low-wage countries

during the 1980s and 1990s. These factors continued the erosion of employment in US

manufacturing and displaced many workers whose skills could not make the leap to

newly evolving work of a more knowledge-based nature. The Clinton-era *Goals 2000*

legislation (1995) arose from skill mismatch and rising long-term unemployment with

their attendant social ills which prompted policymakers to again question the efficacy of

America's education system. The legislation articulated eight goals centered on students'

academic and socioemotional development, aiming for grade-level reading proficiency,

math and science proficiency, global awareness, drug-free schools, as well as rigorous

professional development programs for teachers (*Goals 2000*, 1995; *Goals 2000:*

Educate America Act; 1994). The Bush-era *No Child Left Behind Act* (2002) was

instituted to enlist standardized test scores as indicators of academic achievement and as

incentives for improving educational outcomes, with mixed results (Chudowsky,

Chudowsky, & Kober, 2009; Kober, Jennings, & Peltason, 2010; Menken, 2010; Neal &

Schanzenbach, 2009; Rothstein & Jacobsen, 2007; Scott, 2009). *Race to the Top* grant

funding is included in the American Recovery Act of 2009 enacted under President

Obama. These grants for local school districts are designed to support targeted efforts in

critical educational areas including design of standards and outcomes assessments, data-

informed instructional improvements, turnarounds for struggling schools, and education

reform. Race to the Top grant funding was motivated by a sense of urgent need for

creative solutions toward ensuring that students graduate with higher-education-ready

and career-ready skills (*Race to the top*, 2009). Recent findings on educational outcomes

have heightened concerns over falling behind other developed nations in educational outcomes as reflected in the Organisation for Economic Co-operation and Development's Programme for International Student Assessment (OECD/PISA) rankings (Klein, Rice, & Levy, 2012; Preston, 2010; Schleicher, 2009).

Most recently, the current economic downturn has hastened the deepening divide between promising prospects for the high-skilled and diminishing prospects for the low-to-middle-skilled (Carnevale, Rose, & Cheah, 2011; Peck, 2011). The scale of the crisis has intensified concerns over incurring national harm from falling behind in the globally competitive knowledge economy. Social concern over educational attainment and workforce readiness has spurred the search for theory on which to base education and training strategies to promote beneficial outcomes for individuals and society. Efforts to understand skills conducive to success and how to instill these competencies are at the heart of seeking meaningful human capital formation strategies.

Human Capital Theory

The theory of human capital, first conceptualized in 1776 by Scottish Enlightenment economist Smith (1904), echoed by the 19th-century philosopher Mill (2012), and developed further in the 20th century by economists Friedman and Kuznets (1945) and Becker (1962, 1994), affirms the power of education to shape the human mind and character through knowledge and intellectual, cognitive, and affective development (Mill, 2012; Montessori, 1912; Smith, 1904). Recognized as an engine for economic growth, human capital powers productivity and economic gain in ways similar to financial and physical capital such as production facilities and equipment. Yet unlike facilities and funds which are consumed and depreciated in service of production, human capital – the pool of intellectual capital of range and levels of skill in existence among

the workforce – increases in value through education and training (Becker, 1994) and is vital to an organization's ability to carry out its mission, perform income-producing activities, gain a competitive advantage through its employees' talents, and sustain itself in the long term (Hansson, 2009; Manpower Group, 2013; Torraco, 2007).

Schooling from preschool through higher education or vocational training imparts subject knowledge and relevant skills, while on-the-job training fine-tunes skills to the specific aspects of the actual work to be performed (Becker, 1994). Education and training are both considerable investments of public and private resources in the learners' skill development (Mincer, 1958; Schultz, 1961). Talent management posits that developing home-grown talent from the existing workforce is more sustainable in the long term than grooming only small workforce subsets or aiming to hire existing talent away from competitors. Rather than accepting the limitations of a finite talent pool subject to pervasive competition for the best-skilled, talent management strategy aims to enlarge the aggregate talent pool and enhance skill levels through developing the existing workforce (Davies & Kourdi, 2010; Hansson, 2009) – a goal philosophically compatible with the aims of developing learners' full human potential as envisioned by past and present educators (Montessori, 1912, 2007; Freire, 1970; Gerver & Robinson, 2010; Howe & Covell, 2009; Wagner, 2010, 2012).

As organizations reap the rewards of their talent pools, the educated individuals themselves benefit as well: Through possession of skills and knowledge relevant to a nation's climate of advancing knowledge paired with shifts in intellectual and skill needs, individuals are able to fully participate in the economy and benefit from its opportunities. Individuals benefit from education, gaining upward mobility through meritocracy (Marshall, 1920). Elevated levels of education and higher-order skills have been linked to

increased earnings compared to the lifetime earnings of less educated workers, as evidenced by differences in earnings between college-educated and high school graduates and between high school graduates and high school dropouts respectively (Carnevale, Rose, & Hanson, 2012; Iranzo & Peri, 2009; Turner, Tamura, Mulholland, & Beier, 2007). Additional returns are reaped from graduate and professional degrees beyond the baccalaureate (Carnevale, Rose, & Cheah, 2011). Owing to accumulating work experience through tacit learning at work, on-the-job training, vocational and technical training, and further higher education, workers increase in value to their employers and the workers themselves benefit from higher earnings gained from their skills' enhanced value (Becker, 1994; Ben-Porath, 1961; Juhn, Murphy, & Pierce, 1993; Mincer, 1974).

Related to human capital, externalities theory posits that an educated populace benefits society-at-large. A nation's industry and capacity for technical advancement are highly dependent upon the skill base residing in that nation's workforce. Technological developments, scientific discoveries, and advances in knowledge cannot propel a nation forward unless its workforce has the skills to make use of them (Becker, 1994; Lacy & Stone, 2007; Onsomu, Ngware, & Manda, 2010; Ramcharan, 2004). As viable knowledge and skills provide access to self-improvement, self-determination, and merit-driven upward mobility for many, the benefits of higher earning power and improved quality of life are shared by many citizens as the society is raised to greater heights of prosperity (Breton, 2010; Marshall, 1920; Mill, 2012). A nation also benefits socially from investment in education (Mill, 2012; Smith, 1904): Education elevates moral standards and improves character; educated people serve as a positive example for others to emulate, thus leading to a more stable society. More knowledge also improves citizens' understanding of government policies, promotes greater government

accountability, and leads to better balance between the interests of all segments of society. More highly educated and skilled citizens support cultural and civic life, thereby enhancing the collective quality of life and heightening civic pride and sense of community (Sachs, 2012). As individuals continue to follow each other's lead toward self-improvement and civic engagement, such virtuous circles perpetuate the society's continued reach for higher standards and quality of life. Conversely, undereducation precipitates economic decline, social and moral decay, and – under extreme duress – political instability (Belfield, & Levin 2007; Blinder, 1987; Klein, Rice, & Levy, 2012; *A Nation at Risk*, 1983; Stiglitz, 2012).

While the economist's view of human capital considers education's effects on a nation's moral fiber, social fabric, knowledge advancement, and economic prosperity, the educator views human capital in light of human potential and learning outcomes: The educator considers instructional strategies for developing the whole person by instilling content knowledge, higher-order cognitive skills and affective development, moral and social development, a habit of lifelong learning and a spirit of inquiry, informed citizenship, and constructive contributions to society (Dewey, 1916; Freire, 1970; Gerver & Robinson, 2010; Montessori, 1912, 2007; Steiner, 1996).

Human beings have the major distinction of being able to think, plan, and shape the world outside themselves through their abilities and individual contributions (Dewey, 1922; Freire, 1976, 1997). Major building blocks for developing full human potential and social inclusion fall into the realms of fundamental skill sets, a sense of worth as a human being, higher-order cognitive and affective skills, and moral and social development: Literacy and subject-area learning build academic knowledge; a sense of self-determination and a sense of the right to self-improvement help motivate individuals to

aim higher and grow (Freire, 1970). Analysis, synthesis, interdisciplinary thinking, and creative problem-solving skills enable learners to grasp concepts and apply knowledge meaningfully (Bloom, 1956; Hofmann, 2008). Socioemotional and psychological maturation, empathy, interpersonal and collaborative skills enable learners to work together and grow into contributing positively to society (Montessori, 1912). Moral guidance prepares students to lead ethical lives (Steiner, 1996). Education also fosters knowledge, reason, and understanding of government workings - key elements of the informed citizenship necessary for preserving a democratic society (Dewey, 1916, 1915; Howe & Covell, 2009; Maclure & Davies, 1991; Mill, 2012; Smith, 1904).

Current Human Capital Research and Approaches to Skill and Knowledge Gaps

Some current human capital research follows the traditions of Becker (1994), Mincer (1958), and Ben-Porath (1967) in studying the relationships between education, earnings, organizations' and nations' human capital, and economic development (Iranzo & Peri, 2009; Lacy & Stone, 2007; McMahon, 2007, 2011; Miller-Adams, 2010).

Practically-oriented research on human capital challenges around the world elicits the recurring theme that individual countries' respective strengths and challenges largely reflect the extent and effectiveness of their institutions and civil societies, economic opportunity, meritocracy, and education and training systems' capacity and population reach (Schwab & Sala-i-Martín 2013; UNCTAD, 2012).

Action-oriented research examines best practices including policy measures, curriculum and training strategies, workplace talent development pipelines, stakeholder synergies between business and education, instructional strategies, and learning environments (Aamodt & Havnes, 2008; Bray, 2010; Davies & Kourdi, 2010; Hansson, 2009; Kuczera & Field, 2013; Onsomu, Ngware, & Manda, 2010; Wallenborn, 2010).

Business research on needed skills is augmented by education scholars' research on knowledge and competencies. Important learning outcomes include higher-order cognitive skills, abstract reasoning and analysis, numeracy, communication, creativity, imagination and a spirit of inquiry, interdisciplinary thinking, as well as work ethic and propensity to keep learning (Ballanca & Brandt, 2010; Wagner, 2010; Pohl, 2000; Hofmann, 2008; Schneeberger, 2006; Yorke, 2004; Yorke & Knight, 2006).

Grasp of higher-level work-pertinent skills requires a solid basis of academic foundations (Onsomu, Ngware, & Manda, 2010). The need for clearly defined content knowledge endures, as evidenced by education professor Hirsch's call for a fundamental knowledge base shared throughout society (Hirsch, 1988, 2007) and the current Common Core curriculum movement in the United States (*Common Core Standards for English*, 2010; *Common Core Standards for Mathematics*, 2010; Klein, Rice, & Levy, 2012; Roberts, 2012). Some scholars posit that student-centered pedagogies detract from the all-important imparting of necessary core knowledge and that learner-centered methods enable excessive proneness to omitting important curricular content as byproduct of open-ended exploration (Hirsch, 1999; Kirschner, Sweller, & Clark, 2006).

Other education scholars point to the needs of the 21st-century learner enmeshed in a complex, globalized world demanding heightened creativity (Wagner, 2012). These scholars note that current schooling's largely industrial-style approaches are inherently incompatible with the knowledge-intense, creativity-thirsty 21st-century global economy and nature of work (Thornburg, 2002). Although tasked with developing human capital for the economic frameworks of today's complex world, schooling still proceeds as if operating in a world of preparing industrial workers for repetitive tasks (Scott, 2009); prevailing teaching and learning methods focus on test preparation through memorization

and generally neglect important higher-order skills such as interpersonal skills and collaboration, interdisciplinary thinking, pattern recognition, conceptual and abstract reasoning, and creative problem-solving (Gerver & Robinson, 2010; Jacobs, 2011; Suárez-Orozco, 2007).

Constructivism, Constructionism, and Related Theory

Research suggests that learning environments and social interactions influence intellectual and cognitive growth (Montessori, 1912; Vygotsky, 1978) and that students' construction of tangible objects related to the knowledge objectives (Harel & Papert, 1991; Papert, 1993) deepens the learners' understanding of the knowledge base, ability to synthesize, and creative problem-solving skills – key outcomes in the ongoing search for effective human capital formation strategies (Gerver & Robinson, 2010). Key tenets of two interrelated learning theories – constructivism and constructionism – empower students to advance their knowledge though purposeful learning activities and creative design, exploration, collaboration, and reflection.

Constructivism. The instructional theory of constructivism places the cognitive task of constructing meaning from new knowledge firmly in the learners' hands. Learning is deepened by purposeful hands-on learning activities (Montessori, 1912). Students actively construct knowledge by making sense of the continual exposures to experiences which build on each other (Bruner, 1977; Dewey, 1997) – either by integrating new concepts with prior knowledge or by recognizing when a given new concept's revelations may make previously held prior knowledge obsolete. While learners bear primary responsibility for reflection and building a structure of meaning in their own minds through integrating and harmonizing prior and new knowledge (Piaget, 1929; 1977), teachers are responsible for presenting knowledge and for guiding learners'

thinking in ways conducive to analysis, reflection, and deepened understanding (Bruner, 1977). When new knowledge is beyond students' existing frameworks of understanding, learners cannot independently navigate the new knowledge and make sense of it (Vygotsky, 1978). To determine students' readiness to examine and make sense of new knowledge, teachers guide classroom conversation and elicit students' thoughts through skillful questioning. Teachers' expert and often subtle guidance is designed to gently spur learners' active engagement in restructuring and augmenting their own knowledge. The seminal observations of Montessori (1912) and Vygotsky (1978) on the importance of social interaction endure: Social interaction is also important to cognitive development, as social development fosters interaction, collaborative learning, and moral development in addition to building knowledge structures (Gerver & Robinson, 2010).

Constructivism emphasizes the importance of learning environments, purposeful activities, and social and collaborative interactions in fostering students' grasp of the knowledge base and learners' ability to synthesize across disciplinary boundaries (Beisser & Gillespie, 2003; Bruner, 1977). The Italian child psychiatrist and educator Montessori (1912) understood the power of self-directed, active learning in propelling knowledge acquisition, motivation to learn, intellectual growth, and cognitive development. She pioneered learning environments supplied with toys and other appropriate objects to spur learner-initiated, self-directed activities and exploration based on individual interests. Learning spaces with child-sized furniture and child-appropriate learning objects are the backdrop for student work with knowledge-related games, toys, play, and creative activities. In the constructivist classroom, the teacher takes an observer's stance and steps in only when students need help individually. Learning is deepened further through social interaction and moral guidance (Froebel, 1895; Steiner,

1996; Vygotsky, 1978): Students also learn social skills, empathy, respect, and collaboration (Gerver & Robinson, 2010; Wagner, 2012). The college concept of DEEP learning (Documenting Effective Education Practice) sees student engagement as a key driver of learning and success (Kuh, Kinzie, Schuh, & Whitt, 2010). Fink's (2003) work on college-course design emphasizes the importance of collaborative learning, hands-on activities, reflection, and bridge-building between learners' prior and new knowledge.

Constructionism. An offshoot of constructivism, the learning theory of constructionism is built on the premise of *learning by making* through students' creation of tangible objects related to the knowledge base (Harel & Papert, 1991). Through crafting these tangible artifacts, learners actively engage with the knowledge base as they explore needed information and make the knowledge their own through reflection and practical application (Kafai & Resnick, 1996). Through its emphasis on knowledge pursuit and practical application embedded in hands-on learning activities, constructionism shares tenets of *learning by doing* with Dewey's (1997) constructivist element of experiential learning. Constructionism taps learners' imaginations while strengthening the comprehension of content knowledge. Computer scientist and educator Papert (1993, 1994) immersed children in mathematical knowledge by teaching them to write computer programs designed to present and teach mathematical concepts. Through enlisting computer-aided learning as a way to engage pupils more actively with the knowledge base, Papert observed similarities between learning through computer-aided knowledge immersion and Piaget's (1977) mental mapping processes of building and augmenting knowledge structures in the mind's eye of the learner. In advancing the work with children writing computer programs, doctoral student Harel together with Papert (1991) observed the pupils' deepened grasp of mathematical knowledge. They also noted

the value of Vygotsky's (1978) social elements in students critiquing each other's work and learning from each other. Computer scientists and educators Kafai and Resnick (1996) later continued in the spirit of Papert's (1993, 1994) work in designing mentoring programs, group collaborative projects, and after-school programs built around computer-centered constructionist projects and learning communities (Kafai & Resnick, 1996; Kafai, Desai, Peppler, Chiu, & Moya, 2008; Kafai, Peppler, & Chapman, 2009). In a recent study in the computer-aided learning tradition, authors Baytak, Land, and Smith (2011) observed ten fifth graders designing a computer game using the Game Maker software to teach nutrition to first graders. In the process of designing a game to teach others, the older schoolchildren organized their thoughts and examined the knowledge base to determine how to best structure its presentation – an intellectual step which deepened their own understanding of the knowledge of both nutrition and computer programming: Designing this didactic game entailed exploring the game-design software's capabilities and structure as well as translating between the nutrition knowledge structure and the software structure. Students' social interaction around game design and computer programming strategies further deepened their learning.

Current Research in Constructivism and Constructionism. Several recent research studies bring together principles from constructivism and constructionism: These studies have examined e-learning communities (Chng & Coombs, 2004), art apprenticeships (Charland, 2005), practical work-based learning embedded in a social entrepreneurship college course (Huq & Gilbert, 2009), a college course assignment of crafting a professional code of conduct to teach business ethics (Willey & Burke, 2011), teaching learning theory to college education majors through contraption-building and reflective

writing assignments (Beisser & Gillespie, 2003), and teaching citizenship to children through immersive creation of a charter for school conduct (Howe & Covell, 2009).

Constructivist and Constructionist Legacies Found in Current Instructional Approaches

The legacy of constructivism and constructionism permeates several current instructional practices: The flipped classroom redirects classroom time from its traditional use for lectures to teacher-supervised in-class learning projects and problem-working and repurposes out-of-school homework time to readings and knowledge absorption (Roehl, Reddy, & Shannon, 2013). Case-based learning is steeped in purposeful learning activities centered around specific projects and applying knowledge to creating solutions to a selected real-world problem (Hung, 2013; Grant & Branch, 2005). Service learning bridges students' classroom learning with practical application of their growing theoretical knowledge to specific community needs, often in conjunction with reflective documentation assignments (Garcia & Longo, 2013; McDonald, 2012; Ng, 2013) Place-based education combines subject-specific learning including, for example, biology and history with immersion in study-related environments in students' home communities. Examples include study of local flora and fauna or historical sites (Smith & Sobel, 2013; Sobel, 2006). Farm-based education immerses boarding school students and farm visitors from day schools in hands-on agricultural sciences ("Chicago students visit the farm", 2008; Simescu, 2009). Outdoor education and nature-based education utilize hands-on and immersive methods for cognitive skill-building (Fleming, 2012; Krodel, 2003; *Outdoor education*, 2012; Weston, 2009).

Constructivism and Constructionism in Action: Current Examples and Outcomes

Several situation-specific interventions rooted in the principles of constructivism and constructionism have been lauded for successfully spurring students to take

ownership of the knowledge base, understand the material, and overcome the limitations and diminishing influences of their blighted neighborhoods. Instructional methods centered on learning environments include immersive environments such as Washington DC's SEED School ("SEED Public Charter School", 2006) and Chicago's Urban Prep Academy (King, 2011) with their strong focus on academic content and study skills. New York City's Harlem Children's Zone incorporates teaching life skills to parents in order to improve the schoolchildren's life environments beyond school with the aim of reinforcing school learning (Brooks, 2009; Perlstein, 2008). Chicago's Little Black Pearl Art and Design Academy teaches pupils the creative and business sides of art through hands-on creative works and student-managed art-sale events. Students gain transferable skills and psychosocial growth (Benson, 2004; Phillips, 2014). A work-based rehabilitative prison program in Nevada teaches inmates how to restore vintage cars and employs them in this craft. Through this hands-on training program with restored cars as tangible knowledge artifacts, participating prison inmates learn a skilled trade with high niche demand as well as pride of workmanship and self-respect (Millman, 2011).

Individual programs drawing from constructivist and constructionist methods have garnered attention for their noteworthy successes in learning outcomes, especially schooling interventions focused on at-risk children where approaches centered on hands-on academic-study and skill immersion and life-environment mitigation have achieved impressive successes against formidable odds. Students emerge with a deepened ability to grasp content knowledge, synthesize, and solve problems. Similarly, the Nevada prison program centered on training and employing inmates in classic car restoration yields impressive results of knowledge and pride of workmanship which are important for employability and ultimately rehabilitation in society. Yet despite these individually

noted – and at times widely publicized – successes, there exists a research gap in systematic application of constructivism and constructionism to human capital development in the context of work training in postsecondary education settings.

Statement of the Problem

The demonstrated effectiveness of constructivism (Bruner, 1977; Dewey, 1915, 1916; 1997; Montessori, 1912; Piaget, 1929; 1977, Vygotsky, 1978) and constructionism (Harel & Papert, 1991; Kafai & Resnick, 1996; Kafai, Desai, Peppler, Chiu, & Moya, 2008) in enhancing learning outcomes suggests that distilling core components of these two learning theories might be useful for application to work-related training in US postsecondary education settings.

Several specific instructional approaches designed to actively engage learners with the knowledge base have produced encouraging results: In addition to deepened understanding of the subject matter and related skills, students gain higher-order competencies such as analysis, synthesis, mathematical and abstract reasoning, creative problem-solving, and effective communication of ideas (Harel & Papert, 1991; Montessori, 1912; Wagner, 2012; 2010) – the very skills recurring as dominant themes in US employer surveys on workforce skill needs (*Critical Skills Survey*, 2012).

Research related to human capital development, constructivism, and constructionism has steadily streamed into four discrete areas: Studies focus specifically on human capital and the externalities of education, human capital formation and nations' development stages, human capital goals as articulated in learning outcomes and employer needs, as well as constructivist and constructionist methods applied in very specialized settings. Yet despite the abundance of research in each of these areas, no

comprehensive research has as of yet endeavored to tie together the strands of human capital, workforce training, and the related learning theories of constructivism and constructionism. While current constructivism and constructionism scholars still refer back to the early theorists including Dewey (1997), Montessori (1912), Piaget (1929, 1977), Vygotsky (1978), Bruner (1978), and Papert (1993), current research focuses on applications in very specific settings and no attempt has been made to distill these learning theories' key components for broader deployment. Narrow research studies and constructivist or constructionist approaches in specific settings show favorable outcomes in critical areas such as knowledge grasp and application, analysis, synthesis, collaboration, and creative problem-solving, but a sweeping analysis of constructivist and constructionist core components' systematic application to human capital development has never been undertaken. The current gap in research reflects the need to identify these core elements for utilization in career preparation. No research has been undertaken to distill the core components of constructivism and constructionism for their systematic deployment in cultivating the crucial skills repeatedly cited in US employer surveys.

The research in the present study was designed to address the following question:

What components of constructivism and constructionism can be applied to workforce development in service of enhancing human capital formation in postsecondary education settings?

Purpose of the Study

The purpose of the present study is to distill from constructivism and constructionism core components which can be systematically applied to workforce training in postsecondary education settings. Together these two related learning theories

emphasize learning environments and content-targeting learning activities to instill subject mastery, technical and industry-specific competencies, higher-order cognitive skills, and social skills – the very skill sets deemed crucial and widely lamented as lacking by employers and identified as key learning outcomes by leading education scholars in 21st-century skills research. Constructivism's and constructionism's key instructional methods engage learners with the knowledge base, thereby deepening individual learning and fostering creative problem-solving and collaboration. Learners take ownership of the knowledge base through purposeful hands-on educative activities and exploration in an intellectually stimulating environment. Through classroom conversation and insightful questioning, the teacher subtly guides students' active learning and encourages growth; students' interactions and collaborative learning help develop communication skills and further cement students' learning. Because constructivism and constructionism emphasize active student learning and practical knowledge application, their core tenets are widely compatible with skill-oriented workforce training in postsecondary education settings. Ideally, the wide range of application could provide postsecondary career educators with training-related iterations of instructional elements derived from constructivism and constructionism and a blueprint for matching the best-suited instructional elements to each of the needed learning outcomes identified through human capital research.

Definitions of Terms

For the purposes of the present study, these definitions of terms will be used:

Human capital. Human capital has been defined as knowledge and skills residing in the workforce and population. Human capital is developed through education and training (Becker, 1994; Onsomu, Ngware, Manda, 2010; Ramcharan, 2004).

Constructivism. Constructivism has been defined as students' active engagement in their own learning growth through reflection, critical analysis, involvement in purposeful learning activities, and collaborative learning. The learner bears primary responsibility for crafting meaning by mentally integrating new knowledge with prior understanding; the teacher's role is to guide learner reflection and analysis through classroom conversation and knowledge-related activities (Dewey, 1997; Montessori, 1912; Piaget, 1977; Vygotsky, 1978).

Constructionism. Constructionism is marked by crafting tangible objects. This work immerses students in the knowledge and its practical applications (Harel & Papert, 1991). High-tech examples of tangible knowledge artifacts created by students include content-focused didactic computer programs (Harel & Papert, 1991; Papert, 1993) and computer games (Baytak, Land, & Smith, 2011). Examples of low-tech knowledge artifacts include student-designed displays pertaining to the curricular content (Grant & Branch, 2005), student-authored documents drawing from the study of subject matter (Howe & Covell, 2009; Willey & Burke, 2011), and artistic creations (Phillips, 2014).

Postsecondary Education. Postsecondary education is United States terminology for the higher schooling which follows after secondary education. In many countries this higher learning is known as tertiary education (Kuczera & Field, 2013).

Limitations of the Study

While it is anticipated that this analysis may illuminate the application of constructivist and constructionist instructional elements to workforce training in postsecondary settings, there are limitations to how universally they might be implemented.

First, the vast differences between vocations and the highly specialized nature of some career fields could present difficulties in standardizing constructivist and constructionist tenets' applications across all occupational fields.

Second, postsecondary career education builds upon academic foundations which should be in place from secondary education. The scope of this study cannot fully address remedial strategies for postsecondary participants whose secondary schooling has left them with learning gaps severe enough to hinder their grasp of career-related knowledge.

Third, owing to this study's focus on postsecondary career education, the scope of this study cannot address remediation for learners who dropped out of high school and never developed academic foundations, employability skills, or sound work habits.

CHAPTER TWO

Human Capital: Economic and Social Catalyst

Introduction and Overview

Human capital and nations' economic health are inextricably linked. Human capital, the skill composition residing within the members of populations, is fundamental to organizations' ability to carry out their missions and sustain their viability in the long term. Along similar lines on a larger scale, nations cannot sustain themselves – let alone grow and develop further – unless nations' populations possess the skills and knowledge necessary for harnessing technological and intellectual advances (Becker, 1994). This chapter presents education's social and economic impact on nations and individuals, the importance of skills to organizations' ability to carry out their missions, and current global observations of the interplay between countries' educational effectiveness and their respective economic and social conditions.

Human Capital: Theory and Related Research

Human capital theory is centered on the strategic value of education and skills to nations' intellectual and economic progress. Education is a leading indicator: The degree of nations' effectiveness in education and training is a key driver of economic health over the long term (Davidson, 2014; Mamoon & Murshed, 2009) and the strength of nations' commitment to educating and training their citizens determines in large part how well those nations' economies and societies will fare in the future (Becker, 1994). The major tenets of human capital include externalities in the sense of education's spillover effects

on society and national income growth, education as contributor to earning power and employer gains, and talent management which emphasizes skillful management of enhancing existing workers' skill sets over poaching talent from competitors.

Positive Externalities: The Beneficial Spillover Effects of Education and Skills

Human capital was first conceptualized in the Enlightenment era of the 18th century, an epoch which also saw the rise of the modern nation-state. During this time, Scottish philosopher Adam Smith (1904) set out to explore why some nations advance in knowledge and make economic progress, in particular why some nations' wealth is propelled to greater heights while other nations remain stagnant and fail to advance. Smith observed the power of education to elevate both the individual and society: Educational attainment brings higher levels of achievement, spurring income growth which in turn contributes to growth in nations' aggregate wealth. By the mid-19th century, industrialization had largely taken hold of the Western world and Smith's notion of education's benefits to society endured: Educational attainment is a catalyst for elevating standards of individual behavior, which in turn raises individual achievement (Mill, 2012): Rise in educational attainment and greater individual accomplishment spill over in form of greater levels of civic engagement, contributing to rising quality of life for society-at-large. Through support of civic and cultural life, educated individuals serve as positive role models for others to emulate – a positive force helping raise societal standards of conduct and terms of life. More highly educated populations have a firmer grasp of government policies and broader issues – an intellectual foundation conducive to greater government accountability, rule of law, and individual rights and life chances. American educator and philosopher Dewey (1916) noted education's contribution to social stability by imparting a common body of shared knowledge, common culture, and

shared values. In the mid-20th-century United States, educator and economist Friedman (1962) noted public schools' positive contribution to social cohesion: He acknowledged the power of the school-related mingling across social classes to help soften the class polarization that would become entrenched in absence of mechanisms for bringing schoolchildren and parents from different backgrounds into contact with each other. In addition, public schools embody population-wide access to education and universal attainment of a minimum common denominator of knowledge. Basic education for all plays a crucial role in preventing formation of a permanent underclass spawned by exclusion from schooling – an important factor in protecting the social fabric from the destabilizing effects of large population segments too illiterate and unskilled to participate in society.

Educational status also impacts behaviors and lifestyle choices (Becker, 1994): Marriage and reduced fertility rates are more likely among those of higher educational attainment. Choices in favor of smaller families result in concentration of family resources on fewer children, resulting in each family member's increased life chances. Greater life chances raise the likelihood of growing up to contribute positively to society and participate gainfully in the formal economy. Such individual development helps promote social stability, economic growth, and upward progression in development. The same is true of regions within nations: McMahon's (2007) study examining education's impact in the Deep South of the United States revealed education as a driver of economic growth, reduced infant mortality, increased longevity, and democratization. Ramcharan's (2004) study exploring the links between education and economic development established the crucial role of the composition of human capital as embodied by a meaningful mix of schooling levels. A diverse base of secondary and postsecondary

education suited to meeting the economy's task needs is highly conducive to raising the development level of a nation's economy. While the initial costs of educational investments are high compared to immediate economic gains, sustained investment raises skill levels which then supply the intellectual fuel for innovation and thereby spur economies' evolution toward higher states of development over the long term.

Current research on prevailing conditions around the world corroborates that strong educational systems and population reach, strategic measures to meet specific educational needs, and commitment to education and skill-building contribute to nations' economic strength and social cohesion: The World Economic Forum's *Global Competitiveness Report* (Schwab & Sala-i-Martín, 2013) analyzes the institutional, societal, and economic soundness and educational effectiveness of 148 nations from across the globe ranging from the least developed to the most advanced. Conducted annually, these studies vividly illustrate the importance of institutional soundness and stable macroeconomic underpinnings, the quality and extent of education and training infrastructures, and native workforces' knowledge and skills to the economic and societal health of nations.

The *Global Competitiveness Report* (Schwab & Sala-i-Martín, 2013) documents the differences between countries with regard to social and economic stability and advancement, institutional effectiveness and support structures, health and infrastructures, education and training mechanisms' extent and effectiveness, educational reach and attainment, as well as collaboration across societies' stakeholder groups for the growth and nurture of their nations' skill bases. To achieve consistency and logic in measuring the examined countries' competitiveness, the World Economic Forum classifies attainment in these areas into three distinct development stages including

rudimentary development at Stage 1, middle-level efficiency-driven Stage 2, and the innovation-driven most advanced economies at Stage 3, plus two transition phases from Stage 1 to 2 and Stage 2 to 3 for upwardly mobile countries progressively solidifying their institutions, education and health, and economic sophistication. The wide range of human capital characteristics is largely framed by these development characteristics.

Many of the world's economically and socially most advanced countries are member nations of the Organisation for Economic Co-operation and Development (OECD). Largely concentrated in western and northern Europe, North America, and the advanced among the Asia-Pacific region, these countries share widespread educational reach and attainment. Shared traits among these highly advanced countries are compulsory education and its enforcement, the educational capacity and population reach to achieve high levels of educational participation and attainment, as well as high levels of postsecondary attainment (OECD, 2013). Additionally, educational quality, variety and relevance of vocational and management training, as well as higher education and research infrastructures provide the intellectual foundations for innovation and continued progress (Schwab & Sala-i-Martín, 2013). Several OECD studies examine numerous advanced countries' characteristics as well as progress evidenced in several upwardly mobile countries. In Germany and Austria, for example, consistent policy support for education and training have contributed to economic stability and population employability (Hoeckel & Schwartz, 2010) and low youth unemployment in Austria (Hoeckel, 2010). Chile's aggressive push for broader educational population saturation paired with societal respect and demand for education has lifted post-compulsory education participation from 46% in 1995 to 71% in 2007 (Kis & Field, 2009). Compulsory education laws mandate primary education between ages 6 and 13 and

secondary education from 14 to 17 years of age. In 2013, 93.3% of school-aged children were enrolled in primary school and 90.1% in secondary school; Chile's economy is now the most advanced in Latin America (Schwab & Sala-i-Martín, 2013). In Asia, South Korea's sustained commitments to education and training have spawned huge advances to top rankings in a very short time: 97% have completed upper secondary education and 53% have completed post-secondary education. Gross postsecondary enrollment rate at 103.1% is the world's highest; South Korea is known for its highly skilled and educated population (Kuczera, Kis, & Wurzburg, 2009; Schwab & Sala-i-Martín, 2013). Similarly, Taiwan's economy rapidly rose in a few decades due to sustained attention to education and training (Friedman, 2012); Singapore's high education and training quality has made its economy the most advanced and competitive in Asia (Schwab & Sala-i-Martín, 2013).

OECD researcher Schleicher's (2012) study focused specifically on natural-resource-rich countries' educational investments and skill levels. The study examined OECD member nations's Programme for International Student Assessment (PISA) scores for and non-OECD members nations' Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading and Literacy Study (PIRLS) scores for literacy, math, and science skills in countries with high incomes derived from lucrative mining industries spanning oil, gas, minerals, gemstones, and precious metals. Countries included in the study spanned Europe, the Middle East, and the Americas; the highest skill levels and social and economic soundness prevailed among those natural-resource-rich countries with long-term policy commitments to specifically invest in education and citizen services. Canada, Australia, and Norway in particular stood out for their long-term stances toward investing in education and their high literacy, math, and science scores (Friedman, 2012). The World Economic Forum's research (Schwab &

Sala-i-Martín, 2013) complements these findings by noting that rapidly developing Brazil has steadily enlisted income from oil and natural resources toward citizen services and its stance of broadening population access to education and improving educational quality is steadily raising skill levels in the native workforce. Among oil-rich Middle Eastern countries, the United Arab Emirates' long-term investments in sustained educational and economic growth over the long term have led to upward growth and diversification (Porter & Schwab, 2008; Schwab & Sala-i-Martín, 2009, 2010, 2011, 2012, 2013). Qatar's sustained pursuit of educating and training its native workforce has raised its economy from the low-to-middle-level economic transition phase at Stage 1-2 observed between 2009 and 2012 to advanced status at Stage 3 in 2013 (Schwab & Sala-i-Martín, 2009, 2010, 2011, 2012, 2013). Similarly, Oman's persistent pursuit of education and training has contributed to its rise from the low-to-middle-level economic transition phase at Stage 1-2 observed in 2008 (Porter & Schwab, 2008) to Stage 2-3 transition phase between middle-level and advanced economic attainment observed in 2013 (Schwab & Sala-i-Martín, 2013). Such trends were also found in sub-Saharan Africa: Income from Botswana's diamond mining is consistently directed toward citizen services; the country's share of national wealth committed to education is among the world's highest and Botswana has one of Africa's most stable societies and advanced economies (*Botswana*, 2013; Kuzcera & Field, 2013). Although its TIMSS scores are still low by international standards, they are rising and Botswana's educational attainment and skills are among the highest in Africa (Martin, Mullis, Foy, & Stanco, 2012; Mullis, Martin, Foy, & Arora, 2012; Mullis, Martin, Foy, & Drucker, 2012; Porter & Schwab, 2008; Schwab & Sala-i-Martín, 2013).

Negative Externalities: The Corrosive Effects of Undereducation

Belfield and Levin (2007) report that negative externalities of undereducation make themselves felt in form of erosion of a nation's skill base, national income decline, social disintegration, falling behind, and regressing to a reduced state of economic development. As education helps propel nations forward, an eroding skill base on the other hand leads to lower earnings, growing structural unemployment, declining life chances, rise in crime, falling quality of life and standard of living, and de-development.

Studies by OECD's Hansson (2009) and the International Monetary Fund's (IMF) Ramcharan (2004) found that high levels and density of relevant skills fuel idea exchange and innovation, prompting economies to converge toward a high-skill / high-income equilibrium. Concurrently, falling demand for low skill levels leads to long-term unemployment for workers with lower skills and fewer transferable competencies applicable to new and evolving work that is more high-skilled in nature. Globalization continues to restructure many economies, with the greatest benefits accruing to those with the highest skills able to make use of technological advances. When employees lack skills in using high-tech equipment and lack the intellectual agility to adopt new technologies, organizations are disinclined to invest in new technologies; such skill gaps then create a disincentive against training employees in using the technologies. Such situations lead to a low-skill / low-wage equilibrium from which neither the employees nor the businesses can rise to a level of competitiveness conducive to long-term viability. As education and skills fall further behind, incentives for skill-raising investment are diminished as such investments appear fiscally counterproductive – especially in climates where public policy and business training decisions focus on the short term rather than long-term vision. Economies thus settle into low states of development.

A nation's operational functioning, development trajectory, and social cohesion are adversely affected by inadequate education (Belfield & Levin, 2007). Widespread undereducation and illiteracy owing to uneven access to schooling spawns formation of a permanent underclass whose members are too unskilled to participate in society owing to the lack of knowledge needed to tangibly improve their lives (Freire, 1970; Friedman, 1962; UNCTAD, 2012). Access to skill-improving education is important to individuals' life chances as well as social stability: Inequality without opportunity for meritocracy and upward mobility permanently conscripts an unschooled underclass to the bottom rung – factors which have historically precipitated economic underperformance, tearing of social fabric, social unrest, and political instability (Belfield & Levin, 2007). Some advanced economies' current trends of public sector starvation undermine public education's operational capacities and drive higher education increasingly into quasi-privatization: Public colleges' higher tuitions as a cost-recovery measure and reductions in need-based financial assistance such as Pell grants in the United States, paired with stagnant and declining family incomes, lead to growing numbers of aspiring students unable to afford pathways to opportunity (Kuczera & Field, 2013). Such shutting-out from skill-raising opportunity locks many into low rungs of society, contributing to a society's decay from within (Porter, 2013; Stiglitz, 2012; Torraco, 2007).

While those without higher-level skills are increasingly shut out of economic participation, national security also suffers from populations' lack of skills: Several US studies on youth qualifications for military service (Klein, Rice, & Levy, 2012; *Our Troubled Education System*, 2012; *Ready, Willing, and Unable to Serve*, 2009) reveal insufficient high-school graduation levels and low levels of literacy, mathematical reasoning, problem-solving, and critical thinking skills. Many youth lack the knowledge

and competencies necessary for serving in a technology-infused modern military. Economist and educator Blinder (1987) first noted – and was more recently corroborated by Peck's (2011) observations – that economic globalization has further complicated the interlacing of skill shortages, implications for nations' economic competitiveness, and risks to social cohesion: Globalization has brought about worldwide movements of work, largely in form of moving manufacturing operations to low-wage countries, outsourcing of back office business processes and services to low-cost regions, and concentration of high-end design and analysis work in countries with mature advanced economies. These shifts have made rich countries' low- to middle-skilled workers vulnerable to structural unemployment and economic and social exclusion: Without access to retooling mechanisms to help them reorient toward new and growing fields with viable career paths, low- to middle-skilled workers face obsolescence without remedy. The risk to society is formation of a large underclass comprised of formerly established workers left behind as unemployable. Human resources scholar Torraco (2007) and OECD education researchers Kuczera and Field (2013) observe that a nation's underinvestment and lack of strategic commitment to education over the long term leaves those unable to privately fund their own retooling with insufficient education and training opportunities. School intake areas' demographic characteristics determine local school resources available for curricular offerings and instructional quality. Peck (2011) and Lindsey (2013) note that educational inequality in the context of a global economy leaves the undereducated without competitive skills for securing a viable place in the global economy. As large numbers are unable to sustain themselves through gainful employment and lack the skills to transition into new lines of work, the emerging and evolving fields suffer skill shortages and thus-impacted nations find it increasingly difficult to remain competitive

and economically sound. According to Belfield and Levin (2007), undereducation and inadequate skills bring erosion of individual earnings and national income, declining individual and public health, and growing dependence on public assistance while tax revenues for public services shrink. Corrosive effects of undereducation also include reduced citizen participation in civic life and rising crime levels. The US report *A Nation at Risk* (1983) detailed the toxic national risks of economic decline and of moral and social decay spawned by inadequate education.

The current country studies showcased in the previous section on education's positive externalities also portray in practical terms the negative externalities of undereducation. Shortage of educational capacity and population reach, social and political instability, as well as lack of commitment to education contribute to nations' economic weakness and societal fragmentation (Schwab & Sala-i-Martín, 2013). In countries at low development stages, low enrollment in primary education is logically accompanied by shortages in educational capacity in primary education and beyond, resulting in children's isolation from education and widespread illiteracy among native populations (UNCTAD, 2012). Absence of educational foundations prevents secondary and postsecondary attainment, further exacerbating the legacy of education's low population reach. This combination leaves large percentages of populations too unskilled to contribute to economic growth (Schwab & Sala-i-Martín, 2013). Brain drain further exacerbates acute skill shortages in less-developed countries as their most-educated and highest-skilled citizens, already few in number, emigrate in large numbers to more advanced countries in search of greater economic opportunities (Docquier & Rapoport, 2011; Schwab & Sala-i-Martín, 2012). Education and development are also undermined by more specific factors: Child soldiering in lieu of education widely contributes to

illiteracy, undereducation, and diminished trust in countries torn by wars and civil strife. This lack of foundations hinders social stabilization and economic progress (Blattman & Annan, 2010; Child Soldiers International, 2013). Child labor in lieu of education in rapidly industrializing low-income countries with still-underdeveloped education and training pathways spawns high illiteracy rates and capped learning, which in turn hinders progress in economic and quality-of-life dimensions (ILO, 2013a, 2013b; Tuttle, 2006).

Lack of policy commitment to education also stymies progress. OECD researcher Schleicher's (2012) aforementioned study of natural-resource-rich countries' skill levels found that earnings from lucrative extraction industries do not automatically translate into education and citizen services investments: The study found persistently low TIMSS and PISA scores among least-developed and upward-transitioning countries rich in natural resources. Saudi Arabia, Bahrain, Oman, Kuwait, Syria, and Algeria derived high incomes from oil but had low TIMSS scores. Qatar and Kazakhstan had the highest oil rents and lowest PISA scores (Friedman, 2012; Schleicher, 2012). Contrary to Qatar's aggressive education investments and sustained progress, Kazakhstan's education regressed dramatically between 2008 and 2013. Its primary education quality ranking fell from 68th among 134 compared nations in 2008 to 97th of 148 in 2013-2014. Corruption and an inadequately educated native workforce were executives' most pressing concerns in both years (Porter & Schwab, 2008; Schwab & Sala-i-Martín, 2013). Latin America's natural-resource-rich countries including Mexico, Brazil, and Argentina were found with lower PISA scores (Friedman, 2012; Schleicher, 2012). Contrary to Brazil's steady skill-raising efforts and successes (Schwab & Sala-i-Martín, 2013), Venezuela's oil wealth has not translated into overall development and well-being (Wakin, 2012a, 2012b); Venezuela's education and institutions were among the lowest-ranked of the 148

countries examined by the World Economic Forum (Schwab & Sala-i-Martín, 2013). Africa's natural-resource-rich but less-developed countries follow similar patterns. For example, the Democratic Republic of Congo has vast potential diamond, gold, and rare earths wealth, but mining proceeds have only brought personal gain to invaders and local warlords instead of providing for Congolese society-at-large (Kulish, 2013). With its weak educational reach with 77% male literacy and 57% female literacy, $400 annual per capita GDP, widespread corruption, as well as protracted insurgency, Congo ranks 141st among 187 nations on the Human Development Index and is poised to remain one of the world's least developed countries (*Congo-Kinshasa*, 2013).

Negative Effects of Skill Shortages on Business Operations and Services Delivery

The negative effects of undereducation on nations' trajectories also manifest themselves as skill gaps which harm organizations by impeding business operations. The effects of skill shortages range from unmet capacity needs on one hand to catastrophic inability to operate on the other hand. The Manpower Group, a US-based staffing firm with offices on every continent, conducts extensive research on human resources. In its *Talent Shortage Survey*, the Manpower Group (2013) surveyed over 38,000 employers in 42 of the world's advanced and upwardly mobile countries throughout the Americas, Asia-Pacific, and the region encompassing Europe, the Middle East, and Africa. 35% of respondents expressed difficulty in filling positions. While 32% of worldwide employer-survey respondents cited lack of applicants, 34% cited lack of hard skills and technical competencies, particularly industry certifications; 19% reported insufficient soft skills such as interpersonal and collaborative skills, agility and problem-solving skills, intellectual grasp of complexities, and attitudes of professionalism. The adverse impacts of unfilled positions owing to skill shortages were high: 43% reported reduced ability to

serve clients, followed by reduced competitiveness and productivity (39%), increased employee turnover (25%), reduced innovation and creativity (22%), and lower employee morale (21%). One extreme example from the Philippines illustrates the debilitating effects of skill shortages: Several Manila hospitals were forced to close due to catastrophic shortage of qualified staffing to perform a broad range of duties from health care to business operations (Wescott, 2008). In the Executive Opinion Survey within the World Economic Forum's *Global Competitiveness Report* (Schwab & Sala-i-Martín, 2013), over 104,000 executives in 148 countries corroborated such skill shortages as key risks to business health and economic soundness in their respective home countries.

Education and National Income Growth

Education is an important factor in enhancing individual incomes and nations' aggregate incomes. Higher education levels spur choices in favor of smaller families, spawning increased life chances for each family member and higher caliber economic participation opportunities for each family member. This in turn leads to a higher state of development for nations (Becker, 1994). Early into the 20th century, Marshall (1920) observed that education and training enable individuals to earn more, positively impacting aggregate wealth. Educated individuals benefit employers, as these skilled individuals' capabilities enable the organizations to carry out their income-generating activities and thereby achieve their missions. By extension, national economies are propelled to greater heights as the available skill base forms fertile ground for making use of intellectual and technical advances in ways that enhance economic growth.

Several seminal and historically significant studies established research methodologies which still largely permeate current research in this area. Schultz (1961) established that investments in human capital include education and training, health, and

food: Education and training raise skill levels, while health and sufficient food and housing improve human beings' physical ability to produce greater economic outputs at higher and sustained levels. Becker's (1962, 1994) seminal research established that higher skill levels make higher use of existing physical and technological resources, spurring national income growth and rise in aggregate wealth. Ben-Porath (1967) found that higher levels of education lead to deployment of valuable skills into the economy, which in turn leads to increased individual earnings, allowing for rise in aggregate wealth and other positive spillover effects into nations' economies (Becker, 1994) – a virtuous circle of individual benefit and social gains such as elevated states of cultural and economic development.

These links between schooling and national income have remained strong and recent studies have reaffirmed them: Educational attainment raises national incomes and the aggregate wealth of societies-at-large (Breton, 2010). Benos (2010) observes that public investment in higher education, in form of tax revenue transfers to public education or vouchers toward private schooling, augments private inherited education in the following manner: Public investment facilitates access to learning beyond families' own financial capacity to self-fund their educations. Economy-wide human capital formation investment allows individuals to develop greater knowledge and skills than their private resources alone could make possible. As education's beneficiaries deploy their enhanced knowledge and skills, their higher levels of learning translate into higher individual earnings and wealth generation, which in turn provides greater aggregate wealth for the society. As national income rises, tax revenue increases and strengthens society's capacity for economy-wide investment in education, thus powering the virtuous circle of investments in education, merit-based higher earnings for individuals – a cycle

which fuels subsequent growth of aggregate wealth and further growth in capacity for society-wide investments in education. Ramcharan's (2004) study of skill levels and national incomes observed that as rising skill levels enable economies to grow and contribute to rise in aggregate earnings, incentives for continued investments in higher levels of education are strengthened. As the mix of secondary and postsecondary education and skill levels meets the demands of evolving economies, nations gravitate toward higher-skill, higher-income states of development.

Three recent studies examining rising education levels and incomes document links between education and growth in aggregate earnings and wealth: First, McMahon (2007) examined education's impact specifically on the American Deep South. His study revealed higher educational attainment linked to higher earnings – factors bringing greater aggregate wealth, improved vital statistics, and higher quality of life.

Second, a study by Turner, Tamura, Mulholland, and Baier (2007) systematically tracked educational levels and incomes by state in the United States between 1840 and 2000. The authors normalized the myriad income figures gleaned from numerous historical data sources to Year 2000 US dollars and organized the US states into nine geographic regions. Over the study's 160-year span, education in the United States rose steadily from an average of less than two years of schooling in 1840 to an average of 13.75 schooling years in 2000. Concurrently, national average real output per worker, which the authors reported in 2000 dollars, rose from $4,114 in 1840 to $58,791 in 2000. The authors found logical links between each region's historical pace and timing of industrialization and economic diversification and differences in the timing and pace of each region's rising educational attainment, earnings, and output. For example, the agrarian South Atlantic region trailed the US in years of schooling and earnings by nearly

half between 1840 and 1940, while other regions industrialized and spread education's reach earlier and more rapidly. By 2000, the South Atlantic region caught up to national average years of school and – at $60,216 – surpassed the US average output of $58,791 per worker in 2000. Incomes rose in tandem with increased education: The authors found that between 1840 and 2000 each state gained 11% to 15% additional earnings per worker for each additional year of schooling. The authors attribute the rise in the labor force's educational levels to the spreading outcomes of compulsory education and child labor laws occurring alongside industrialization and increased urbanization, followed by economic shifts toward emphasis on knowledge industries and increasingly complex types of work requiring progressively higher skills.

Thirdly and similarly, Iranzo and Peri (2009) analyzed US schooling levels and real earnings between 1960 and 2000. Their study measured returns on each year of schooling in 1960, 1970, 1980, 1990, and 2000. The authors tracked schooling and earnings at ten-year intervals. While in 1960 the earnings and income accrued to the nation's economy steadily grew with each additional year of education beyond the first two years of completed schooling, the returns on schooling up to high school diminished with each decade. By 2000, earnings remained flat for completers of up to 11 years of schooling, rising only after 12 years of schooling. In 2000, educational attainment below high school demonstrated no returns to states' economies. Concurrently, the largest gains in aggregate income came from postsecondary education: Each year from college onward yielded returns between 6% and 9% to the state's economy. Similar to Turner's research team, Iranzo and Peri attributed the flattened returns on high school or less and the higher economic returns on postsecondary credentials to macroeconomic shifts between 1960 and 2000 in favor of higher skills over lower skills. Their 40-year findings reflect trends

toward increasing bifurcation into traditional low-tech work held by lower-skilled lower-paid workers and technology-infused high-end work held by higher-paid workers with college and graduate degrees, corroborating the next section's research on the payoff of higher education and skills in sustained earnings growth over the lifecycle.

Skill Premium: Education and Earnings over the Lifecycle

Postsecondary educational attainment yields positive returns for individuals as well as their respective societies; individual gains and society-wide benefits derived from postsecondary education are intertwined (Murray, 2009). Current research on educational attainment and lifetime earnings (Carnevale, Rose, & Cheah, 2011) progresses in the footsteps of several seminal studies, and the first such study examining the impact of specialized professional training on earnings focused on the links between education and earnings payoff to the individual skill-holder. In their *Five Professions Study*, authors Friedman and Kuznets (1945) examined earnings of doctors, dentists, certified public accountants, engineers, and lawyers between 1929 and 1937. They also compared lifetime earnings of high school graduates with earnings of workers with baccalaureate, graduate, and professional degrees. The authors determined that in order to recover their cost of higher schooling, postsecondary degree holders would need to earn more than 70% above their high school graduate counterparts. They found that undergraduate and graduate degree holders' additional earnings far exceeded mere recovery levels: In fact, postsecondary graduates earned 2 to 3 times their high-school-educated counterparts, with the highest additional returns above the baccalaureate yielded by PhD and MD degrees (Friedman & Kuznets, 1945). Following Friedman and Kuznets (1945), Ben-Porath (1967) noted links between investments in human capital through education, on-the-job training, accumulating work experience and rising skills, and increased earnings

over the life cycle. Mincer's (1958, 1974) research attributes income inequality to differences in education, training, and skill levels. Driven in part by the higher degree of complexity for which higher level skills are in demand, higher education levels' longer span of earnings growth and peak, and in part by the higher demand for higher-level skills required for work of greater complexity, more highly educated and trained professionals earn at higher levels for longer periods of time than the lower-skilled workers for whom earnings peaks last for shorter periods of time and productivity decline sets in earlier. Earnings are considerably higher in professions which require higher levels of education; degrees of formal education place workers in an earnings hierarchy not readily bridged by other forms of knowledge acquisition in lieu of higher education.

In the decades since these early seminal studies of the link between educational attainment and earnings, the high-skill premium has persisted. Juhn's (1993) study examined data on wage returns on education between 1963 and 1989 and revealed 5% decline in real wages for the least skilled and 40% rise in real earnings for the most skilled. The skill premium arose from a combination of relevant work experience and higher levels of knowledge. Iranzo and Peri's (2009) study on educational attainment and earnings between 1960 and 2000 shows the declining value of basic education in tandem with rising importance of postsecondary education: in 1960, earnings rose steadily with each year of schooling beyond two completed years, but 2000 earnings were flat until high school completion and rose steadily in tandem with each year of postsecondary attainment. Similarly, Hansson's (2009) study of business skill development also found higher earnings among those with complex, high-level skills. Both Hansson (2009) and Peck's (2011) examination of shifts in employability at life-sustaining wages note that technical changes which gained momentum over five decades ago favor the high-skilled:

Increased power in computing technology paired with high-end customized analytical work benefits those with high-level cognitive and analytical skills and technical skills. These higher-order skills are increasingly in demand and at higher pay.

Georgetown Center on Education and the Workforce researchers Carnevale, Rose, and Cheah (2011) note that these high-value skills comprising higher-order cognitive skills, intellectual agility, and deeper content knowledge are learned mostly at postsecondary levels and in most depth at graduate levels. Therefore, the highest earnings gains derive from graduate education. With analysis reminiscent of the early-to-mid-20th-century studies by Friedman and Kuznets (1945), Mincer (1958, 1974), and Ben-Porath (1967) on a variety of demographic factors including earnings benefit of undergraduate and graduate degrees, Carnevale and his colleagues track lifetime earnings and educational attainment based on 2007-2009 data derived from the American Community Survey and their findings illustrate the 21st-century employer view of college degrees as baseline for consideration of candidates. College degrees are seen as a sorting mechanism and marker of self-discipline, as well as ability to achieve goals and persevere to the finished product. Many jobs are not open to non-degree holders, rendering the college degree even more crucial to job seekers: The baccalaureate's earnings premium is 82% above high school education, equating to an average of $2.8 million over the earner's lifetime. Doctoral and professional degree holders earn an additional 61% above baccalaureate levels. Data analysis reveals median earnings tiered by attainment of formal education: high school dropouts' earnings lifetime levels of annual earnings remain largely flatlined in the low $20,000s, while baccalaureate earners' median starting incomes are near $40,000 and rise to about $60,000. Master's level median earnings rise above $75,000, while doctoral degree-holders' earnings rise to above $100,000 and

professional degree holders' earnings rise to about $125,000 per year. While earnings up to the master's level peak between ages 45 and 49, doctoral and professional degree holders' earnings maintain their peak levels through these earners' working lives; doctoral and professional degrees yield the longest sustained upward earnings trajectory over working lifetimes.

Education and Employer Gains

While the effects of populations' educational attainment and the range and levels of populations' skills on nations' development trajectories, aggregate wealth, and education's returns to the individual in form of higher lifetime earnings are established tenets of human capital theory, an additional strand is the notion of employer gains from high skill levels in the workforce. In the early part of the 20th century, economist Marshall (1920) was among the first to observe that education and training build relevant skill sets which not only help individuals earn more but also propel industry to innovation and growth in business income. More recently, OECD researcher Hansson (2009) explored in depth the links between education and training, firms' performance measures, and the links between company investment in employee training and where these companies find their skill-to-wage equilibrium on the continuum between high-skill/ high-wage and low-skill / low-wage equilibrium. Although Hansson's research was concentrated on businesses in the Eurozone, the findings are relevant to other regions because sustained success of companies worldwide is heavily influenced by having the right skill mix on hand among the staff (Manpower Group, 2012). Hansson notes that employer-based training raises employees' skills in specific areas important to company needs. The increased knowledge raises the employees' value to the employer, enhancing both the employer's bottom line and the employee's compensation. His findings across a

wide range of industries from manufacturing to banking note positive links between employees' higher education and skills and their employers' higher performance. Training is a motivating force and has a powerful impact on both employee and customer retention: Employees with access to employer-sponsored training feel valued and spurred to higher performance, thereby enhancing customer experience. Employee longevity, especially longevity of high performers, gives repeat customers a sense of stability and increases customer confidence in the company. Employees feel validated, and this positive feedback loop contributes to retention of both employees and customers. Better skills improve businesses' bottom line, productivity, profitability, employee retention, customer retention, and – in the case of publicly traded firms – better stock performance. Additional benefits of employer training and higher employee skills are reductions in errors and scrap rates.

Although employer-sponsored training imbues employees with skills relevant to company specifics and can include transferable skills which spur some employee poaching by competitors, training nonetheless raises employees' value to the company (Hansson, 2009). Some companies – especially those in more isolated locations – view training as less of a priority. Such companies tend to settle into a low-skill / low-wage equilibrium which precipitates organizational stagnation and decline – the low skill base impedes moving forward with new innovations and maintaining competitiveness (Lacy & Stone, 2009; Ramcharan, 2004). In contrast to this low priority on training, two studies on proactive staff development by Davies and Kourdi (2010) and Hansson (2009) found that companies disposed toward human resource development, especially those in locations with higher density of firms in the industry, avoid fearing in-house skill enhancement as a mechanism for losing their talent to competitors and instead view idea

exchange across companies as a catalyst for innovation. Firms inclined toward staff development see training as a way to attract and retain quality employees, thus enhancing their business performance. Such companies gravitate toward high-skill / high-earnings equilibrium. The returns on investments in training and education appreciably benefit a wide spectrum of the employer's performance measures. Enhancement of skill is worthy of investing organizational resources, as human capital development creates value.

Talent Management

In a world with many low-skilled and few very high-skilled people, the competition for talented workers with the needed skill sets is fierce on a global scale (Brown & Tannock, 2009), driving employers with skill shortages to resort to hiring from abroad for the needed skills (Manpower Group, 2011b, 2012, 2013). Particularly in the oil-rich Arab Gulf nations, skilled expatriates widely perform the bulk of the skilled work in these countries while some host countries, particularly Qatar (*Qatar*, 2013) and the United Arab Emirates (*United Arab Emirates*, 2013), are decidedly building systems for educating and training their own citizens with a view toward diversifying and raising their economies for the long term. Immigration policies in favor of in-migration of high-skilled foreign workers are widely embraced as an expedient mitigation of immediate skill shortages in the short term. Highly developed economies, including Australia, Canada, and the United States, import technical workers with high science skills (Dumont, Christophe, Spielvogel, & Widmaier, 2010; UNCTAD, 2012; World Bank, 2011). As organizations face labor shortages in key areas, the staffing firm Manpower Group (2011b) recommends strategic migration as a way to match idle specialized labor with demand for these skill sets in other countries.

Talent management aims to refocus from global labor migration and competition for finite talent to raising and refining skill levels in the existing workforce in order to broaden the available talent pool. Researchers Davies and Kourdi (2010) focused their inquiry on businesses' skill needs and talent strategies. The authors interviewed and surveyed over 100 businesses in order to glean best practices for cultivating the skill base needed to operate and move their businesses forward. The authors found more productive solutions in looking beyond the traditional concentration on grooming the top 10% performers who show promise for high potential and executive development and moving toward a broader approach of developing the core group comprising the large middle who perform the bulk of the productive work. A broader talent management strategy devoted to raising the aggregate skill base within the existing workforce benefits the organization two-fold by enlarging the pool of potential candidates for leadership succession and by also increasing the refinement and heightening of specialized know-how in high-skill areas. As the talent pool is broadened through employer-based training and staff development, the organization gains more options for filling needed positions. At the same time, workers seeking career growth and skill development find more options in-house. The organization gains greater staff retention, as the training signals to employees that growth can be found with their present employers. The organization benefits from growing its own talent pool and reduces the need for competing for finite talent in the open marketplace against other businesses needing similarly-skilled workers; the study's authors also recommend close collaboration and intellectual partnerships between functional managers and human resources to forge a cohesive strategy toward home-grown skill-base enhancement. Hansson's (2009) study on the positive business effects of education and training corroborates the overriding value of strategic talent

development: Although the risk of talent poaching after organizational investment in training does exist, the greater risk to the organization stems from lacking the sufficient skill base to meet its operational needs. Weinstein's (2011) study focuses on the value of mentoring in retaining the accumulated knowledge of long-term employees and in acclimating new employees: Mentoring long-term employees grows vast stores of company knowledge and organizational memory. Mentoring develops junior-level and new employees. Mentoring also helps keep leaders and long-term employees stay engaged and give back to the organization by serving as mentors to new employees.

Within the area of talent management, Hansson's (2009) study also emphasizes the future-oriented strand which focuses on the importance of human capital management skills. The lack of leadership skills in organizations exacerbates skill gaps and points to the urgency of developing organizational capability. Developing superior skills in managing human capital is of strategic importance: While skill in itself is certainly important, the organization of work is crucial. Managers must be able to effectively oversee human resources and deploy workers' skills in the most logical ways. Skills do not evolve without strategy; good planning and execution at the helm is the underlying driver of better skills cultivated through meaningful training which in turn is driven by skillful human capital management. Along the same lines, Weinstein's (2011) study on mentoring and talent retention posits that astute human capital management commits to continuing to challenge established leaders to make competitors' poaching attempts less tempting. Wise human capital management envisions a long-term trajectory of talent development to keep its brain power in the company. Brain drain and turnover is reduced through a combination of wise management and continued opportunities for the seasoned to contribute to the firm.

Summary

Human capital theory recognizes education and skills as an engine for economic growth, as a skilled workforce spawns innovations which raise business and individual earnings which in turn elevate nations' aggregate wealth and facilitate higher quality of life, cultural and civic engagement, and improved societal cohesion (Becker, 1994; Marshall, 1920; Onsomu, Ngware, & Manda, 2010; Ramcharan, 2004). Income rises sharply with postsecondary attainment; graduate and professional degrees carry the highest the skill premium (Carnevale, Rose, & Cheah, 2011; Friedman & Kuznets, 1945; Iranzo & Peri, 2009; Juhn, 1993; Mincer, 1958; 1974; Peck, 2011; Turner, Tamura, Mulholland, & Beier, 2007). Conversely, weak education and training create critical skill shortages which bring competitive disadvantages to business and nations (Manpower Group, 2012, 2013; Schwab & Sala-i-Martín, 2012, 2013), while skill obsolescence and worker displacement spawn social and economic decline (Belfield & Levin, 2007; Peck, 2011; Ramcharan, 2004; Torraco, 2007).

Business-survey findings on skill shortages and talent strategies (Manpower Group, 2013) corroborate the importance of talent development (Davies & Kourdi, 2010; Hansson, 2009) and retention (Weinstein, 2011). The World Economic Forum's *Global Competitive Report* (Schwab & Sala-i-Martín, 2013), the *Least Developed Nations Report* (UNCTAD, 2012), and several OECD studies (Friedman, 2012; Kuczera & Field, 2012; OECD, 2013; Schleicher, 2012) portray in practical terms how nations' strong education and skill development mechanisms boost their native populations' educational attainment and thereby strengthen societal and economic conditions, while low educational attainment and skill levels spawned by weak education and training mechanisms undermine their respective nations' social and economic wellbeing.

CHAPTER THREE

Educational Perspectives on Human Capital Formation

Introduction and Overview

While human capital is of interest to economists, employers, and policymakers, the expertise in the actual work of developing human capital rests with educators and trainers. Educators see human capital in terms of shaping human beings imbued with the knowledge and skills needed for full participation in their nations' economies and societies. Without education and training, human capital development is impossible; therefore this chapter examines educational perspectives on developing the skills and knowledge required for sustained employability and for fulfilled human potential.

Human Capital Formation through Education: Theory and Related Research

While economists and business scholars view human capital in terms of skill sets to meet the needs of a larger system such as organizations, national economies, and society, educators view human capital through the lens of developing human beings who are able to learn and participate fully in their nations' economies and societies. In economics, education is viewed as the engine which helps propel a nation forward on its developmental path by supplying the skill sets needed for operational functioning, innovation, and rise in living standards. In education, the emphasis is on empowering individuals with the knowledge to understand the world and make sense of it – key building blocks for self-determination and participation in society. Current research on education as a vehicle for social and economic inclusion (Brennan & Powell, 2010;

Carnevale, Rose, & Cheah, 2011; Gerver & Robinson, 2011; Jacobs, 2011; Wagner, 2010, 2012) emphasizes the importance of learning outcomes spanning content knowledge and tangible competencies, higher-order cognitive skills, social and collaborative skills, and ethical sensibilities. This combined aim in learning outcomes is rooted in earlier seminal education scholarship: Early-20th-century psychiatrist and educator Montessori viewed education as the pathway to fulfilling human potential (Montessori, 1912, 2007); Piaget saw education in light of cognitive growth and knowledge structures (Piaget, 1977), while Vygotsky saw education in light of learning in community (Vygotsky, 1978). Dewey considered education the conduit for growing the moral, intellectual, and knowledge development necessary for individuals' constructive interface with the world and for the preservation of a democratic society (Dewey, 1916). Froebel (1895), founder of kindergarten, and Steiner (1996), founder of Waldorf schools, stressed social and moral development of the whole person and shared Montessori's approaches of unstructured self-directed learning activities to foster initiative, self-directed productive activities, creativity, and social skills – a skill mix recurring as a common refrain in today's 21st-century skills movement (Jacobs, 2011; Wagner, 2010). American psychologist Bloom (1956) stressed higher-order cognitive and affective development. Brazilian educator Freire (1970) saw literacy as the gateway to learning and making sense of one's place in the world – with a view to improving one's life chances and circumstances by deploying skills elevated through education.

Education: Liberating and Transformative Force

Current understanding of education as a force for self-determination and transformation is rooted in the work of Freire (1970) who saw literacy as the gateway to further learning and understanding the world. Today literacy continues to be recognized

as the gateway to further learning, intellectual growth, and skills (OECD, 2012). Literacy thus fosters individual self-sufficiency, which ultimately benefits society as more people are lifted to higher life chances (Subramanian, 2008). Broader implications of education were already considered at the early part of the 20th century by American educator and philosopher Dewey (1922) who observed that human beings have the distinct capacity for thinking, moral reasoning, scientific exploration, growing in knowledge and understanding, and shaping their lives by force of will and strategic action – an observation later shared by Brazilian educator Freire (1970, 1976, 1997) who sought to empower self-improvement through literacy and knowledge. Influenced by his contemporary society's steep inequality, high illiteracy rate, and pervasive poverty, Freire saw education as a liberating and transformative force, empowering individuals to make sense of their lives, to develop consciousness of social systems, to see their own lives in context, and take action toward self-determination. Examination of Freire's approach to education as the fuel to propel people to higher life chances would be incomplete without acknowledging the influence of liberation theology in Freire's contemporaneous Brazil where Archbishop Câmara (2009) led the Catholic Action Movement which focused on helping uplift the rural poor through education, self-awareness, as well as making sense of the world and of themselves in a broader context. The movement aimed at broadening the poor parishioners' vistas by instilling a sense of the right to self-determination, the right to pursue a better life, and empowerment to aim higher. Latin American liberation theology sought to assist poor people through tangible service and to help poor people improve their lives by empowering the individuals with skills for self-improvement, rather than expecting them to passively accept their bottom-rung lot in life. By extension, Câmara supported literacy for the poor as a gateway to

knowledge and skills which could then help them improve their lives. Freire (1970, 1976, 1997) saw education as a liberating catalyst for empowerment and self-determination through literacy, knowledge, and skills – building blocks for making sense of the world, developing analytical skills, setting aspirational goals, and working toward self-improvement and upward mobility.

Today's research affirms the importance of literacy, numeracy, and problem-solving (OECD, 2012), intellectual agility to make sense of the world's complexities (Suárez-Orozco, 2007), as well as character (Wilson, 2005), moral reasoning (Rothstein, 2007), and engaged and informed citizenship (Howe & Covell, 2009).

To Reach Full Human Potential: Education and Relevant Learning in Context

Current notions of fulfilling human potential draw from Dewey (1915, 1916) and Montessori (1912) who saw education as a vehicle for cultivating reason, knowledge and skill mastery, intellectual growth, self-determination, informed citizenship, moral sensibilities, and the behavioral and social skills needed for successful community integration. Fulfilled human potential spanning community integration, meritocratic opportunity, and employability requires educational attainment, content knowledge and skill mastery, higher-order cognitive skills, as well as behavioral skills and values.

Social Inclusion and Mobility. The combination of social inclusion and mobility implies life chances, access to education, and support systems mitigating socioeconomic barriers to academic attainment and skill-building (Gillies, 2008; Martins & Veiga, 2010). Cultural literacy enables learners to understand their societies' narratives – a foundation for productive and socially included lives (Hirsch, 1988), while understanding human nature and the rights and duties of citizenship enables individuals to participate in their respective societies (Dewey, 1897, 1915, 1916; Howe & Covell, 2009).

Educational Attainment. Educational attainment is key to full economic participation, opportunity for self-improvement, and social mobility (Freire, 1970; Suárez-Orozco, 2007). In meritocratic societies in which employability translates into fulfilled human potential through life-sustaining earnings and career paths enabling personal growth, full attainment of knowledge foundations requires graduating from education and training programs, not merely enrolling and dropping out (Carnevale, Rose, & Cheah, 2011; Kis, 2010a, 2010b; Yorke & Knight, 2006).

Educational Quality. Access to quality education provides pathways to necessary skills (Klein, Rice, & Levy, 2012); educational quality with a view to pupils' wellbeing is crucial for preparing students with the necessary skills and knowledge to navigate the realities of the world and work (Gibbons & Silva, 2010).

Knowledge Taxonomies: Defining Skill Domains. Scholars' aims at defining knowledge and learning levels are grouped around three major domains: The *cognitive domain* is defined as understanding of concepts; levels of learning range from memorization and recall on the lowest end to creating new knowledge by synthesizing from multiple knowledge areas on the highest end (Anderson, Krahtwohl, Airasian, Cruikshank, Mayer, et al., 2000; Bloom, 1956). The *affective domain* signifies emotional, psychological, interpersonal, social skills, motivations, values, and behaviors. Skill levels range from the base tier of listening and receiving instruction to the highest tier of internalizing values by demonstrating integrity, self-motivation, and teamwork paired with a high degree of personal, emotional, and social adjustment (Krathwohl, Bloom, & Masia, 1973). The *psychomotor domain* encompasses motor skills, physical movement, and coordination including eye-hand coordination and technical expertise in areas such as computer work, and precision work in the sciences, arts, and design. Skill levels range

from a beginner tier of perception, awareness, and understanding of cues, imitation, and reflex movements to the highest level evident through origination and new-application creation, advanced mastery in technical skill or body movements as in dance or sport, design, development, and interpretation (Dave, 1975; Harrow, 1972; Simpson, 1966). These definitions of skill families and hierarchies of expertise levels continue to influence skill-need categorizations today.

Key Skills for Human Potential. Learners need solid academic foundations, literacy and numeracy, skill mastery, tangible competencies, and ability to apply knowledge in practical situations (Dewey, 1897; Montessori, 1912; Onsomu, Ngware, & Manda, 2010) and work settings (Brennan & Powell, 2010; Fadel, 2012; Onsomu, Ngware, & Manda, 2010; Schneeberger, 2006); qualities include work ethic and teamwork (Manpower Group, 2012, 2013); making sense of the world and navigating its complexities requires analytical skills, ability to synthesize, and intellectual agility (Suárez-Orozco, 2007; Thornburg, 2002; Wagner, 2010), adaptability (Schneeberger, 2006), creativity and imagination (Robinson, 2011; Fadel, 2012), and future-oriented problem-solving (Richard, 2010), a spirit of inquiry (Gerver & Robinson, 2010 Hofmann, 2008), as well as lifelong learning and continuous upskilling (Jacobs, 2011; Manpower Group, 2012; Pohl, 2000; Yorke, 2004). Participation in a democratic society and the very preservation of a democratic society require a reasoned, informed, thinking, and engaged citizenry (Dewey, 1897, 1915, 1916; Maclure & Davies, 1991), as well as independent thought and free-flowing inquiry without preconceived notions (Thomas, 2009). Building the trust needed to maintain a cohesive social fabric requires individual character, morality, and virtue (Wilson, 2005), self-control, moral reasoning, courtesy,

tolerance and respect for others, empathy, and the social skills to fruitfully interact and collaborate (Froebel, 1895; Montessori, 1912; Rothstein, 2007; Steiner, 1996).

Skill Families in Context: Globally Cited Talent Shortages. While the above-described skill families are key to developing full human potential and boosting individuals' life chances, these skill families are by extension important to organizational operations and national competitiveness. Together, the *Talent Shortage Survey* administered by the Manpower Group (2012, 2013) and the World Economic Forum's 2012-2013 and 2013-2014 *Global Competitive Report*'s Executive Opinion Surveys (Schwab & Sala-i-Martín, 2012, 2013) polled a combined number of over 104,000 executives in 148 nations. While the Manpower Group mostly focused on advanced countries, the World Economic Forum examined countries ranging from least developed to highly advanced. Complaints about short supply of important hard and soft skills repeatedly gravitated toward inadequate education and high rates of illiteracy in developing countries; advanced countries cited population pockets with low literacy, weak numeracy, and low mathematical reasoning. Additional skill shortages were reported in higher-order cognitive skills and abstract reasoning, ability to analyze and synthesize, creative problem-solving and ability to innovate, industry-specific skills and technical competencies, oral and written communication, teamwork, leadership, etiquette and social skills, and values such as work ethic, professionalism, and civic engagement.

Toward Successful Human Capital Formation

Successful human capital strategies encompass staying abreast of skill needs which evolve as necessitated by changing times and identifying operational best practices conducive to population access to relevant skill development.

Skill Movements in Education and Business Research

While content knowledge, conceptual grasp, literacy and numeracy, as well as oral and written communication skills continue to form important foundations, success in navigating the modern world's complexities also requires higher-order cognitive skills such as abstract reasoning, interdisciplinary thinking, analysis, synthesis, creative problem-solving skills, creativity, social and collaborative skills, intellectual persistence and task perseverance, and a commitment to continuous learning (Ballanca & Brandt, 2010). The four current skill movements showcased here – 21st-century skills; STEM to STEAM; employability; learning to think, thinking to learn – exemplify the research focus on higher-order skills for academic and workplace success.

21st Century Skills. The 21st-century skills movement emphasizes higher-order skills dubbed *the four Cs* by the American Management Association (*Critical Skills Survey*, 2010, 2012) and the *seven survival skills* by education professor Wagner (2010). 2,115 executives polled in the 2010 *Critical Skills Survey* expressed the need for skills above and beyond the traditional *3 Rs* of literacy and numeracy: Additionally needed skills encompass *the 4 Cs* of critical thinking, creativity, collaboration, and communication. The survey defined *the four Cs* as follows: (1) *Critical thinking and problem-solving* represents ability to make decisions, solve problems, and take actions appropriate to the situation at hand. (2) *Creativity and innovation* together are defined as ability to see beyond the obvious and immediately present and to make something happen. (3) *Collaboration and team-building* encapsulates the ability to work effectively with others, including those different from oneself, diverse groups, and people with opposing views. (4) Effective *communication* signifies the ability to synthesize and transmit ideas orally and in writing. The survey respondents stressed the importance of

developing these skills in schools and colleges to ensure that students are equipped with the knowledge and skills necessary to succeed in the knowledge economy and evolving workplace (*Critical Skills Survey*, 2010). When the survey was conducted again two years later, the 768 who responded reiterated *the 4 Cs'* importance to workplace success (*Critical Skills Survey*, 2012). In education professor Wagner's (2010) phrase, these higher order cognitive skills are the *seven survival skills* comprised of (1) problem-solving and critical thinking, (2) collaboration across networks, (3) adaptability, (4) initiative, (5) effective oral and written communication, (6) analyzing information, and (7) a spirit of inquiry, imagination, and intellectual curiosity. Current education scholars (Gerver & Robinson, 2010; Robinson, 2011; Suárez-Orozco, 2007; Thornburg, 2002) also agree on the modern globalized world's complexities as a driver of the need for skills in analysis, synthesis, and critical thinking to enable making sense of new knowledge, a spirit of inquiry and the ability to assess occurring changes and the agility to adapt, interdisciplinary learning and the ability to tie together concepts across disciplinary lines, cultural intelligence comprised of global awareness and cross-cultural understanding, creativity and innovative mindsets, problem-solving skills, and habits of mind such as active commitment to lifelong learning.

STEM to STEAM. STEM (science, technology, engineering, math) to STEAM (science, technology, engineering, arts, mathematics), aims to integrate the arts in science education. Proponents of STEM to STEAM consider the arts an important component of educating well-rounded persons, fostering critical thinking, and enabling connection-building across multiple disciplines (Erickson, 2013; Piro, 2010). Scientific and artistic creativity complement each other; the arts and sciences share a focus on discovery. Art skills enhance STEM skills: Art education builds skills in observation, intuition, and

working with materials – crucial building blocks for scientific inquiry and problem-solving (Root-Bernstein & Root-Bernstein, 2013; Sousa & Pilecki, 2013).

Learning to Think, Thinking to Learn. The first modern-era conceptualization of society-wide commitment to ongoing pursuit of knowledge was published in 1968 as *The Learning Society*. Its author Hutchins (1968) extolled the ideal of knowledge pursuit and envisioned technology proliferations which would seed a future of global communities for knowledge exchange and free up individuals' leisure time to devote to lifelong learning in the mold of classical liberal education and continuous pursuit of new skills. More recent decades' research around learning mindsets, metacognition, and critical thinking gained momentum in the 1980s and its intellectual footprint is visible in current research on thinking and learning. The US report *A Nation at Risk* (1983) emphasized the importance of the learning mindset both to the long-term intellectual enrichment of individuals and the long-term cohesion of society-at-large. Learning how to learn and learning how to seek out knowledge builds in individuals a foundation for a life of self-initiated continuous growth in skills and knowledge. OECD's 1989 Centre for Educational Research and Innovation (CERI) Conference (Maclure & Davies, 1991) echoed the importance of learning how to think in order to learn: Learning how to think entails critical thinking, examination, conceptual grasp, analysis, and synthesis in the service of reaching informed conclusions. Thinking skills and educated inquiry are also key to informed citizenship and form a societal buffer against "politics by slogan" (Maclure & Davies, 1991, p.5) holding sway over a passive populace rendered vulnerable by its lack of thinking skills. Commitment to learning requires intellectual persistence to make the knowledge base one's own (Dweck, 2006; Yarnall & Kafai, 1996). Thinking propels knowledge acquisition, processing of ideas and concepts, integrating new

knowledge in the previously-existing knowledge, thereby elevating cognitive skills (Pohl, 2000). Metacognition – learners' awareness of the learning process and intellectual journey from idea exposure to full understanding, along with ability to identify knowledge gaps and craft a strategy to increase one's knowledge – is an important ingredient in thinking and learning (Suárez-Orozco, 2007; Tergan, Gräber, & Neumann, 2006; Wagner, 2010). The combined impacts of globalization and technological proliferation have increased the world's complexity – factors which magnify the ever-increasing importance of cultivating thinking in order to enhance learning (Pohl, 2000; Schneeberger, 2006): A spirit of inquiry, a mindset of self-initiated and self-directed learning, and commitment to lifelong learning are crucial for long-term success in the workplace and in navigating the contemporary world's complexities and ongoing shifts (Drucker, 1994; Hofmann, 2008). Employers worldwide repeatedly cite habits of mind such as continuous learning, lifelong learning, and the ability to learn and grow among crucial competencies for success in the workplace (Manpower Group, 2012, 2013).

Employability. The employability movement, widespread in the United Kingdom and philosophically compatible with school-to-work aims in the United States (*School-to-Work Act*, 1994), is centered on a complex range of traits comprising industry competencies and technical skills, content knowledge, and reasoning skills. Academic skills and good learning habits are a crucial foundation (Yorke, 2004; Yorke & Knight, 2006), while work-based training is the most viable conduit for instilling the important job mastery combined with tangible and practical skills (Aamodt & Havnes, 2008, Bray, 2010; Huq & Gilbert, 2009). Higher-order cognitive skills, as well as behavioral skills and values are also a common refrain across numerous research findings: Of key importance are intellectual grasp, work ethic, teamwork (Taylor, 2005), focus on

customers and service, self-containment (Schneeberger, 2006), and a temperament for learning and growth (Manpower Group, 2012, 2013).

Operational Best Practices Conducive to Successful Skill Development

Researchers worldwide converge on the importance of synergies and partnerships between education, business, and societal stakeholders, research and development partnerships between businesses and educational institutions, investing in education at all levels, strong academic foundations, curricula and training plans, hands-on work-based training, and talent development strategies (Schwab & Sala-i-Martín, 2013). In developing countries, where high illiteracy rates and low skill levels are widespread (UNCTAD, 2012), researchers observe the need to broaden educational access and attainment in order to build the intellectual foundations for understanding specialized work skills (Onsomu, Ngware, & Manda, 2010).

Decentralized Structures for Education and Training. Decentralization provides autonomy for designing problem-solving strategies tailored to local situations and opens the door for creative solutions best suited to local needs. Decentralized structures promote sensitivity to local human capital development needs and greater agility in high-priority responses to localized needs than what is possible under top-down centralized systems. Human capital development functions, particularly career education, operate at their best when decentralized and when there are meaningful links between education and the private sector (Kuczera & Field, 2013). Free-flowing dialogue among all stakeholders strengthens synergies and collaborations (Wallenborn, 2010).

Stakeholder Synergies. Synergies between education, business, and societal stakeholders are a recurring theme among best practices conducive to fostering skill mastery and knowledge development: Academic learning and work-specific training

provide complementary bodies of knowledge and skill sets. Job mastery and quality of work performance rely on intellectual grasp which draws substance from undergraduate university learning and on work ethic which is strengthened through real-world on-the-job learning. Linkages between undergraduate studies, on-the-job learning, and achieving job mastery and quality of work require synergies between classroom-based and work-based learning components (Aamodt & Havnes, 2008). Flow of information between education and business is equally crucial to the development of relevant skills. While education places importance on test scores, business viability depends upon real-world performance, quality of work, and ability to innovate. Strong collaboration between business and education is needed to define and develop a relevant skill base and increase graduates' employability (Bray, 2010). While such symbiotic alliances arise in many advanced countries with strong education / business collaboration including Germany (Hoeckel & Schwartz, 2010), Austria (Hoeckel, 2010), Norway (Kuczera, Brunello, Field, & Hoffman, 2008), and the United States (Kuczera & Field, 2013), many developing countries have yet to develop traditions of spontaneously arising synergies (Schwab & Sala-i-Martín, 2013; UNCTAD, 2012). Such situations illustrate the value of government sponsorships and incentives for private-sector industry participation in developing policy measures for training and skill development strategies as a catalyst and enhancer of dialogue and flow of information between business and education (Onsomu, Ngware, & Manda, 2010).

Education-Business Partnerships. Public-private-sector partnerships between businesses, non-profit service organizations, and government offer targeted solutions for meeting skill needs. Partnerships between businesses and educational institutions help articulate the knowledge necessary for workplace success and broaden the perspectives

for defining employability skills (Bray, 2010). Cooperative efforts include support for apprenticeships, multiple types of arrangements for placing students in real-world work-based training, and ad-hoc design of special-purpose education and training exposures, thereby broadening the experiences available to students (Friend, 2010). At a higher level, education-business partnerships include science parks with the synergistic effects of research and development collaborations between higher education and industry and area economic development (Onsomu, Ngware, & Manda, 2010; Schwab & Sala-i-Martín, 2012, 2013). Financial support from stakeholders and beneficiaries of an educated and trained workforce helps strengthen the education and training institutions' infrastructures and effectiveness through funding for state-of-the-art instructional supports (Wallenborn, 2010). Partnerships between education and business also increase students' career opportunities when partnerships include mechanisms for work-based training: Student placement and immersion in hands-on work imparts work-relevant skills and thus augment the more theoretical classroom learning (Friend, 2010).

    Hands-on Real-World Work Training. Work-specific skills can realistically only be imparted in the actual work environment (Yorke, 2004). Hands-on learning in actual real-world work settings imparts real-world practical work skills, through a variety of measures including apprenticeships, internships, and service projects and placements linking academic study with practical work learning (Hoeckel, 2010; Kuzcera & Field, 2010; Kuzcera & Field, 2013; Levesque, Laird, Hensley, Choy, Cataldi, & Hudson, 2008; Onsomu, Ngware, & Manda, 2010). Work placements immerse students in real-world work in businesses and non-profit organizations, thereby imparting practical skills and connections with the academic curricular content (Huq & Gilbert, 2009; Laughton, 2011; Smith, Clegg, Lawrence & Todd, 2007).

Skill Rubrics as Curriculum and Training Roadmap. Kenyan scholars Onsomu, Ngware, and Manda (2010) note that developing countries facing the task of establishing skill-building infrastructures from the ground up would benefit from defining knowledge outcomes needs. The authors propose creating a national skill inventory and needs assessment by looking to the International Labor Office (ILO)'s *International Standard Classification of Occupations* (ILO, 2012) as a rubric for defining skills and as a launch pad for creating learning outcomes objectives sensitive to their own nations' contexts. Only then is it possible to craft meaningful strategies, as development of relevant curriculum and training content and enhancing the effectiveness of vocational and technical education through apprenticeships and development and expansion of certification programs should be tied to known strategic needs (Onsomu, Ngware, & Manda, 2010).

Open Systems with Flexible Study Pathways. OECD researchers of advanced countries point to the benefits of open academic and career education systems which allow multiple pathways to rigorous education and skills. Several European countries' practice of separating pupils after elementary school into mutually exclusive academic and vocational tracks results in locking students into career levels at very early points in their lives without options to switch tracks. Countries with such tracking traditions include Germany (Hartmann, Knust, Loroff, & Stamm-Riemer, 2009; Hoeckel & Schwartz, 2010), Belgium (Kis, 2010a), Ireland (Kis, 2012b), and Hungary (Kis, Ferreira, Field, & Zwick, 2008). By contrast, in the United States' open schooling and training paths, the comprehensive high school serves as a foundation for students' choice of college or career training; students are free to choose their postsecondary paths

without the pressures of European-style deterministic tracking early in their schooling (Kis, 2011; Kuczera, 2011; Kuzcera & Field, 2013).

Teachable Fit As Talent Pipeline Strategy

Best practices for strategic skill development extend beyond the classroom into business settings. Business research affirms the importance of in-house talent development and succession planning (Davies & Kourdi, 2010; Hansson, 2009). Rising skill mismatches accompanied the rise in hiring in the wake of economic revival and recovery from the 2008 financial crash (Manpower Group, 2010a, 2011a). Staffing researchers (Manpower Group, 2010b) advised firms to move from seeking a match on all position qualifications toward opting to hire a teachable fit in candidates who may not possess all the job-specific knowledge but are otherwise a good fit for the organization with potential for learning and growth. Soon after, the Manpower Group (2013) noted that businesses facing skill shortages have indeed adopted several flexible approaches to skill-raising: To overcome the talent shortages, 23% of the 38,618 worldwide employer survey respondents provide additional training and development to existing staff, 13% sharpen company strategies for succession management and identifying high-potential individuals for grooming and development, 7% redefine qualifying criteria to include individuals without the exact skills but the potential to acquire them, 4% develop clear career development opportunities during the recruitment phase, and 3% create interim roles for individuals with high-demand skills (Manpower Group, 2013). Of respondents to the 2012 survey, 12% reported looking for a teachable fit by employing candidates without all the requisite skills who exhibit learning and growth potential, and 7% partner with educational institutions to create curricula for developing the needed skills (Manpower Group, 2012). The rising but still relatively low percentage of businesses

opting for teachable-fit approaches prompted the Manpower Group (2013) to specifically recommend these strategies.

Best practices for staff development also take the form of university and training courses designed around specific industry skill development needs (Manpower Group, 2012, 2013) – delivered on-site in classrooms, in online learning formats, and hybrids between face-to-face and online learning (Mesh, 2010; Na-Songhkla, 2011).

Summary

Educators view human capital through the lens of preparing learners for full community integration and engaged citizenship, employability, and meritocratic opportunity (Dewey, 1897, 1915, 1916; Freire, 1970; Froebel, 1895; Montessori, 1912). Key skills spanning cognitive, affective, and psychomotor domains (Bloom, 1956) permeate current research on 21st century skills (Wagner, 2010), STEM to STEAM (Piro, 2010; Sousa & Pilecki, 2013), learning to think and thinking to learn (Hofmann, 2008; Hutchins, 1968; Maclure & Davies, 1991; Pohl, 2000), and employability (*Critical Skills Survey*, 2010, 2012; Schneeberger, 2006; Yorke, 2004; Yorke & Knight, 2006).

Best practices to elicit the needed skills include stakeholder synergies, education-industry partnerships, work-based learning, strategic skill rubrics as education and training roadmaps (Aamodt & Havnes, 2008; Onsomu, Ngware, & Manda, 2010; Wallenborn, 2010), open and flexible study pathways (Kuczera & Field, 2013), as well as proactive organizational in-house talent strategies (Davies & Kourdi, 2010; Hansson, 2009; Manpower Group, 2010b) and teachable-fit recruiting (Manpower Group, 2013).

CHAPTER FOUR

Human Capital Challenges and Strategies in the United States

Introduction and Overview

Human capital development in the United States is among the world's most

advanced and diversified. Study and training in the United States cover a vast range of

academic subjects and career fields, spanning preschool through university graduate

programs and work-related instruction in educational, employer-based, non-profit, and

community-based settings. Compulsory education and highly developed schooling

infrastructures ensure primary and secondary education's comprehensive population

reach, and the nation has one of the world's highest rates of secondary and postsecondary

attainment (Kuzcera & Field, 2013). Yet despite the nation's high global competitiveness

rankings, the United States is not immune to a series of difficulties stemming from

macroeconomic shifts and skill mismatches. This chapter presents research on US skill

shortages and learning outcomes needs, a catalog of human capital challenges, and

strategies for addressing the challenges.

US Employer Surveys: Skill Gaps and their Impacts

Skill shortages are the outgrowth of education and training shortfalls and

ultimately themselves manifest in shortages of qualified workers. Research confirms that

skill shortages negatively affect organizations' ability to carry out their core activities

and serve their clients. According to the Manpower Group's (2013) *Talent Shortage

Survey*, 39% of US employers surveyed in 2013 experienced difficulties in filling vacant

positions owing to unavailability of necessary skill sets among candidate pools. Although

this is less than half the world's highest rate reported by Japanese employers at 85%, US

skill-shortage-driven hiring difficulty is four percentage points above the global average

of 35% and thirteen times the lowest rate reported by Ireland where only 3% employers

report inability to fill positions owing to skill shortages. The chart below depicts US

employers' hiring difficulties in global context for each year from 2006 to 2013:
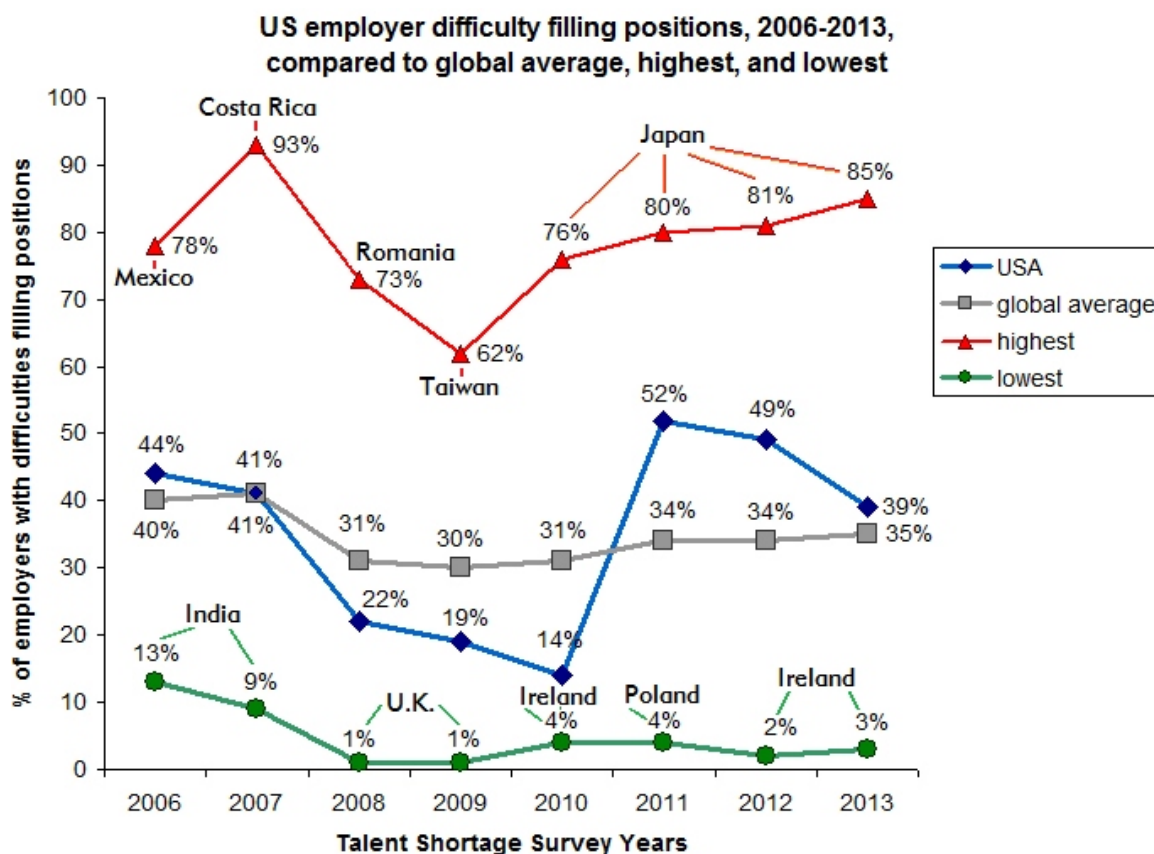
Figure 1. US employer difficulty filling positions year-by-year, 2006-2013.

Since Manpower's 2006 start of tracking its global employer network's hiring

difficulties, the rate of US employers reporting difficulty filling positions has reflected

broader economic conditions: Starting at 44% in 2006, 41% in 2007, the rate dropped to

nearly half in 2008 with the financial crash and ultimately bottomed out at 14% in 2010

in the depth of the recession spawned by the financial crisis. As economic recovery

translated into renewed hiring, the proportion of employers with hiring difficulties jumped to 52% in 2011 as companies faced emerging needs for forensic accountants and specialized financial skills related to winding down toxic assets (Manpower Group, 2011a) – developments reflected in accounting and finance professionals' repeated ranking as the fifth most difficult-to-fill US vacancies each year since 2011 (Manpower Group, 2008, 2009, 2010, 2011a, 2012, 2013).

What drives the pervasive difficulty in filling positions? OECD education researchers Kuczera and Field (2013) observed high US incidence of weak literacy, numeracy, and basic skills, along with weak foundations for gaining work-relevant skills. OECD's findings are echoed by US employers. To ascertain which skill shortages pose the greatest hiring obstacles, the Society of Human Resources Management (SHRM) teamed up with the *Wall Street Journal* to survey the SHRM member organizations' managers in December 2007. Of the 407 respondents, 58% stated that within ten years workers would lack the competencies necessary for workplace success (SHRM, 2008).

Ten surveys conducted between 2008 and 2013 polled a combined total of 8,492 US employers: The Society of Human Resources Management's 2008 *Critical Skills Needs and Resource for the Changing Workforce Survey Report* gleaned 407 employers' responses (SHRM, 2008). South Carolina's survey on skill-based impediments to hiring and retention interviewed 328 employers in 46 focus groups (Nagle, 2010). 302 US businesses with at least 25 employees responded to Hart Research Associates' (2010) employer survey. The Partnership for 21st Century Skills' 2010 *Critical Skills Survey* surveyed 2,115 employers (*Critical Skills Survey*, 2010). The American Management Association's 2012 *Critical Skills Survey* yielded 768 employer responses (*Critical Skills Survey*, 2012). North Carolina's 2012 *Closing the Gap* survey gleaned 1,152 employers'

responses (*Closing the Gap*, 2012). The Executive Opinion Survey in the World

Economic Forum's (WEF) 2012-2013 *Global Competitiveness Report* (Schwab & Sala-i-

Martín, 2012) interviewed 450 US employers; the WEF's 2013-2014 Executive Opinion

Survey (Schwab & Sala-i-Martín, 2013) gathered responses from 670 US employers. The

Manpower Group's 2012 *Talent Shortage Survey* analyzed responses from 1,300 US

employers (Manpower Group, 2012) and its 2013 survey polled 1,000 US employers

(Manpower Group, 2013). The author-compiled chart below shows the ten surveys' total

responses to each specific type of skill shortage:

Number of US employers reporting each skill shortage
Ten surveys of combined total of 8,492 employers

Value	Skill shortage
2,237	critical thinking
2,030	technical / industry-specific competencies
1,833	communication skills
914	collaboration / teambuilding / teamwork
878	work ethic / professionalism
787	interpersonal skills / etiquette
681	global competency
664	creativity / innovation
564	average # of employer reports of a skill shortage
557	ethics / integrity
547	leadership / management skills
338	civic engagement / good citizenship /democratic values
290	cultural intelligence / cross-cultural understanding & teamwork
284	follow instructions / conform to organizational policies
227	adaptability / flexbility
219	numeracy / math skills / statistical understanding
211	scientific literacy / grasp of science & technology concepts and new developments
159	literacy / reading comprehension / writing skills
153	foreign language proficiency
134	information technology competency & application
124	learning mindset / capacity to grow on the job / self-direction / self-motivation
94	personal health responsibility
76	inadequate education / weak foundations & skills
53	personal financial responsibility
41	entrepreneurial mindset

Figure 2. Ten surveys' total number of US employers reporting each skill shortage.

These ten surveys' 8,492 US employer responses revealed considerable consensus

regarding the most pressing skill shortages: the top ten concerns in descending order are

(1) critical thinking and analytical reasoning, (2) hard skills such as technical and industry-specific competencies, (3) effective communication skills, (4) collaboration and teamwork, (5) work ethic and professionalism, (6) interpersonal skills and etiquette, (7) global competency, (8) creativity and innovation, (9) ethics and integrity, and (10) leadership and management skills. These skill shortages broadly fall into the three categories of tangible competencies, higher-order cognitive skills, and behavioral skills and values (*Closing the Gap*, 2012; *Critical Skills Survey*, 2010; 2012; Hart Research Associates, 2010; Manpower Group, 2012, 2013; Nagle 2010; Schwab & Sala-i-Martín, 2012; 2013; SHRM, 2008).

The shortfalls across these above-cited skill families bring concrete consequences of unfilled positions stemming from shortage of qualified workers. The 2013 *Talent Shortage Survey*'s US employer responses reveal the top ten most difficult-to-fill positions in descending rank order: (1) skilled trades workers, (2) sales representatives, (3) drivers, (4) IT staff, (5) accounting and finance staff, (6) engineers, (7) technicians, (8) managers and executives, (9) mechanics, and (10) teachers (Manpower Group, 2013).

While numerous industry sectors are adversely affected by talent shortages, likewise the US military suffers from skill shortages among potential recruits (Klein, Rice, & Levy, 2012). Several recent studies identify lack of knowledge foundations as a major threat to national security as the lack of requisite skills renders many potential recruits ineligible for military service (Klein et al, 2012; *Our Troubled Education System*, 2012): Low military test scores in critical thinking, problem-solving, literacy, and mathematics indicate shortages in the verbal, written, numeracy, and conceptual skills which are fundamental to competent service in today's technology-infused and analysis-dependent military, echoing the above-described hiring obstacles reported by industry.

According to research conducted by retired military officers (*Ready, Willing, and Unable to Serve*, 2009), undereducation disqualifies 75% of 17- to 24-year-olds from service in the military. Of all potential recruits, 24% have not graduated from high school, 27% are physically unfit due to overweight and obesity, and 32% have a variety of physical and mental health impairments which render them ineligible for service. Of young men eligible for service, 33% are in prison. Only 10% of America's youth are eligible to serve in the military without special waivers.

Learning Outcomes Needs: Education and Business Research

Education research findings echo and complement the skill families reported as crucial by the skill-dependent business and military communities in the aforementioned surveys on talent shortages and important competencies (Klein, Rice, & Levy, 2012; Manpower Group, 2012, 2013). These skill families fall into the two major groupings of hard skills and soft skills. Hard skills comprise content knowledge, technical skills, and industry-specific competencies. Soft skills oft-cited as crucial yet frequently lacking fall into the realms of higher-order cognitive skills such as analysis and behavioral skills and values including professionalism, work ethic, etiquette, and social skills.

Hard Skills: Content Knowledge, Tangible Competencies

Content Knowledge and Tangible Competencies. Education and business research repeatedly confirms basic skills, academic foundations, content knowledge, industry competencies, and technical skills among high-need skill families. Academic foundations and subject mastery are of universal concern (Hirsch, 1988; 2007; Schwab & Sala-i-Martín, 2012, 2013), while employer surveys repeatedly state the need for pertinent work experience, industry certifications at professional and skilled trades levels,

and technical competencies (Dahl, 2012; Manpower Group, 2012, 2013). Applied

mastery through practical application of knowledge and practice is also highly valued:

The ability to apply knowledge in real-world settings through internships or other hands-

on experiences is cited by employers (Hart Research Associates, 2010) and observed by

education scholars (Thornburg, 2002).

Literacy. Literacy skills including reading, comprehension, and writing are

frequently cited as a basic foundation for learning and successful functioning in work and

society (Hart Research Associates, 2010; Kuczera & Field, 2013; OECD, 2012).

Numeracy. Mathematics undergird many logical structures; mathematical skills

are therefore crucial in business, technology, and military contexts. Not surprisingly,

education, business, and military studies reveal far-reaching consensus on the importance

of math skills (*Critical Skills Survey*, 2010; Klein, Rice, & Levy, 2012; Kuczera & Field,

2013; Nagle, 2010; OECD, 2012; *Our Troubled Education System*, 2012; Preston, 2010).

Employers polled in surveys describe this family of needed skills as mathematical

reasoning (*Critical Skills Survey*, 2010; Manpower Group, 2012), applied measurement

(Nagle, 2010), and the ability to work with numbers and understand statistics (Hart

Research Associates, 2010).

Soft Skills I: Cognitive and Cultural Competencies

Communication. Effective oral and written communication is among the skill

needs most heavily cited by employers and identified by education scholars (Wagner,

2010). Some research uncovers separate emphases specifically on writing skills, basic

English competency, language and speaking skills (Nagle, 2010), and verbal skills

(Klein, Rice, & Levy, 2012; *Our Troubled Education System*, 2012). Other studies report

communication as the totality of ability to synthesize and transmit ideas orally and in

writing (*Closing the Gap*, 2012; *Critical Skills Survey*, 2010, 2012; Hart Research Associates, 2010; SHRM*, 2008*).

      Information Literacy. Education researchers and employers identify discernment of information sources (Jacobs, 2011; Manpower Group, 2012; Suárez-Orozco, 2007), while employers want colleges to instill in future workers an ability to locate, organize, and evaluate information from multiple sources (Hart Research Associates, 2010).

      Scientific Literacy. Employers also cite the importance of understanding the concepts and developments in science and technology (Hart Research Associates, 2010).

      Critical Thinking. Critical thinking, the ability to examine assumptions and grasp underlying factors, is crucial for in-depth understanding. Research repeatedly identifies this competency among high-value skills (*Closing the Gap*, 2012; *Critical Skills Survey*, 2010, 2012; Hart Research Associates, 2010; Klein, Rice, & Levy, 2012; Manpower Group, 2012; Nagle, 2010; *Our Troubled Education System*, 2012).

      Analysis. Education scholarship and employer surveys note the importance of analysis and abstract reasoning skills. Employers refer to this skill as analytical thinking (*Closing the Gap*, 2012), analytical reasoning, and ability to analyze (Hart Research Associates, 2010). Education scholars refer to this competency as higher-order reasoning, conceptual and abstract reasoning, and pattern recognition (Gerver & Robinson, 2010; Jacobs, 2011; Robinson, 2011; Scott, 2009; Suárez-Orozco, 2007; Thornburg, 2002), as well as analyzing information (Wagner, 2010).

      Synthesis. Education scholars note the importance of the ability to pull together and logically bridge knowledge from multiple knowledge areas and situations (Gerver & Robinson, 2010; Jacobs, 2011; Scott, 2009; Suárez-Orozco, 2007; Thornburg, 2002), to apply new information, and to apply knowledge to new situations (Wagner, 2010).

Interdisciplinary Thinking. Interdisciplinary learning and connecting information from several disciplines are crucial to problem-solving (Wagner, 2010).

Problem Solving. The importance of problem-solving is widely noted in education, business, and military circles. Some researchers refer to the ability to solve problems and devise solutions (*Closing the Gap*, 2012; *Critical Skills Survey*, 2010, 2012; Nagle, 2010; SHRM, 2008; Wagner, 2010), while others note the need for complex problem-solving skill and ability to analyze and solve complex problems (Hart Research Associates, 2010), creative problem-solving, and the skills to solve problems independently and collaboratively (Gerver & Robinson, 2010, Jacobs, 2011; Klein, Rice, & Levy, 2012; *Our Troubled Education System*, 2012; Robinson, 2011; Scott, 2009; Suárez-Orozco, 2007; Thornburg, 2002).

Innovation. In light of the growing importance of innovation to economic competitiveness, employers rank the ability to innovate and a creative mindset as crucial (Hart Research Associates, 2010; Manpower Group, 2012; Schwab & Sala-i-Martín, 2012, 2013). Innovation is also linked to creativity as the ability to see what is not there and to make something happen (*Critical Skills Survey*, 2010, 2012).

Creativity. Creativity, spark, and imagination are frequently identified in education research (Jacobs, 2011; Robinson, 2011; Scott, 2009; Suárez-Orozco, 2007; Thornburg, 2002) as well as employer surveys (*Critical Skills Survey*, 2010, 2012; Gerver & Robinson, 2010; Hart Research Associates, 2010).

Decision Making. Employers value the ability to assess a situation, make decisions, and take actions appropriate to the situation at hand (*Critical Skills Survey*, 2010; Nagle, 2010).

Global Awareness. Employers value an understanding of the role of the US in the world, an informed grasp of the global context of situations and decisions, understanding of global issues and developments and their implications for the future (Hart Research Associates, 2010), and proficiency in a foreign language (Hart Research Associates, 2010; Manpower Group, 2012).

Cultural Intelligence. Cultural intelligence comprises awareness of cultural diversity in America and in other countries, the ability to collaborate with others in diverse group settings, and ability to get along with different groups (Hart Research Associates, 2010; Nagle, 2010). Cross-cultural consciousness encompasses an understanding of various cultures' idiosyncrasies, ability to see issues from the perspectives of other cultures and to bridge across cultural differences, and the skill to communicate effectively across cultures (Plum, Achen, Dræby, & Jensen, 2008). Cultural intelligence also entails global awareness and understanding international affairs (Jacobs, 2011; Manpower Group, 2012; Suárez-Orozco, 2007).

Good Citizenship. According to education scholar Hirsch (1988), education should impart cultural literacy and understanding of US common culture through shared knowledge – an assessment corroborated by employer survey responses citing the importance of civic knowledge, citizen participation, community engagement, and commitment to democratic institutions and values (Hart Research Associates, 2010).

Soft Skills II: Professionalism and Values

Character and professionalism form the cornerstone of this key group of soft skills. Centered on values, ethics, integrity, empathy, and social skills, the below-detailed behavioral skills and values consistently rank at the top of US employers' lists of key skills needed but often lacking in employees and candidates:

Values and Character. Research identifies integrity (Nagle, 2010), loyalty (Nagle, 2010), the ability to connect choices and actions to ethical decisionmaking (Hart Research Associates, 2010), and moral reasoning (Gerver & Robinson, 2010; Robinson, 2011) among important qualities for success in work and society.

Professionalism. Desirable qualities include work ethic, perseverance to task completion, intellectual persistence (*Closing the Gap*, 2012; Gerver & Robinson, 2010; Hofmann, 2008; Nagle, 2010; Robinson, 2011; Schwab & Sala-i-Martín, 2012), enthusiasm and motivation (Manpower Group, 2012), initiative and implementing or presenting ideas (Nagle, 2010; Wagner, 2010), on-time attendance and dependability, accountability and meeting deadlines (*Closing the Gap*, 2012; Nagle, 2010), reliability, attention to detail, and professional appearance (Manpower Group, 2012).

Flexibility. Flexibility entails adaptability (Manpower Group, 2012; Nagle, 2010; Wagner, 2010), agility, dealing with ambiguity and complexity (Manpower Group, 2012), an ability to assess changes underway, and ability to adapt (Thornburg, 2002).

Social skills. Employer surveys elicit the importance of interpersonal skills, communication, customer service skills, and business etiquette (*Closing the Gap*, 2012; *Critical Skills Survey*, 2010, 2012; Manpower Group, 2012; Nagle, 2010).

Self-Awareness. Employers value self-knowledge, along with awareness and mindfulness of how one comes across (Manpower Group, 2012).

Collaboration and Teamwork. Collaboration and teamwork skills entail collaboration across networks and working effectively with others, including people different from oneself and with opposing views (*Critical Skills Survey*, 2010; 2012; Hart Research Associates, 2010; Manpower Group, 2012; Nagle, 2010; Wagner, 2010).

Leadership Skills. Leadership and managerial skills are cited in numerous employer surveys, along with spearheading ideas (*Closing the Gap*, 2012; Manpower Group, 2012; Nagle, 2010; SHRM*,* 2008), as well as collaboration and team-building (*Critical Skills Survey*, 2010; 2012).

Learning Mindset. Modern complexities and shifts require a mindset of lifelong learning and the intellectual curiosity conducive to continuous skill development. Education scholarship and employer surveys agree widely on the importance of lifelong learning and habits of mind such as imagination and a spirit of inquiry (Gerver & Robinson, 2010, Hofmann, 2008; Jacobs, 2011; Manpower Group, 2012; 2013; Pohl, 2000; Robinson; 2011; Suárez-Orozco, 2007; Thornburg, 2002; Wagner, 2010).

A Catalog of Human Capital Challenges

The United States shares many of the advanced world's human capital challenges including global macro shifts, the drift toward higher-skill work paired with erosion of lower-skilled work (Lindsey, 2013), as well as population pockets with weak skills and elevated dropout rates which stymie non-completers' life chances and exacerbate shortages of higher-level skills (Kis, 2011; Kuzcera, 2011; Kuzcera & Field, 2013).

Raising the Bar: Macro Shifts and Higher Skill Threshold

Five decades of accelerating proliferation of technologies and the globalization of commerce have precipitated declines in US manufacturing and economic shifts as their outgrowth: Offshoring of mass production and routine work, traditionally performed by low-to-middle-skilled workers, has eroded these workers' opportunities for life-sustaining earnings (Peck, 2011). Concurrently, US industries' shifts toward greater sophistication and technology infusion have spawned the need for ever-higher skill levels

to qualify for the new and evolving types of work (North Carolina Commission on Workforce Development, 2007; Torraco, 2007). Between 1963 and 1989, real earnings for the least skilled declined by 5% while rising by 40% for the most skilled (Juhn, 1993). In 1960, incomes rose steadily with each additional year of schooling beyond the first two completed years, but in 2000 earnings remained flat until 12 years of schooling and only after high school did earning rise steeply and steadily with each postsecondary year (Iranzo & Peri, 2009). These trends illustrate the growing importance of postsecondary credentials and ever-higher skill levels as prerequisites for life-sustaining earning power and career paths (Brennan & Powell, 2010; Carnevale, Rose, & Hanson, 2012; Kuczera & Field, 2013; Lindsey, 2013). Yet despite the increasing importance of postsecondary credentials, public policy support for higher education has steadily diminished and postsecondary education costs are borne by the enrollees themselves. Students attempting to self-fund their educations are increasingly indebted while returns on these credential-seeking investments vary with the divergent fortunes of various industries (Kuczera & Field, 2013).

Education and Training Gaps

Schooling Gaps. Inadequate education is at the heart of concern in education, business, military, and policy circles in whose estimation the factors of inadequate education and the risks of national decline are linked (Klein, Rice, & Levy, 2012; *A Nation at Risk*, 1983; *Our Troubled Education System*, 2012). Factors contributing to inadequate education in the United States include dropping out of school (Tyler & Lofstrom, 2009), insufficient attainment of academic foundations (Hirsch, 1988, 2007; Klein, Rice & Levy, 2012), outmoded schooling approaches (Thornburg, 2002), as well as vast disparities in local funding levels linked to starkly contrasted public school

resources and learning opportunities (Kis, 2011; Klein, Rice, & Levy, 2012; Kuzcera, 2011; Kuzcera & Field, 2013). The predominant pairing of lectures with passive listening emphasizes test preparation through memorization (Suárez-Orozco, 2007) – a basic skill at the bottom of the knowledge hierarchy in Bloom's taxonomy (Bloom, 1956). Prevailing instructional strategies are largely frozen in a time of industrial-era focus on preparing future employees for repetitive tasks (Thornburg, 2002). Overemphasis of on-demand recall crowds out targeted development of higher-order skills in students: Memorization-intense test preparation and focus on repetition neglects the fostering of broader thinking skills, analysis, and synthesis (Gerver & Robinson, 2010; Jacobs, 2011; Scott, 2009; Suárez-Orozco, 2007; Wagner, 2010). Management professor Cappelli (2011) notes that recession-driven program cuts in the arts and physical education – combined with reduced class-related reading, writing, and problem-working – contribute to diminished student outcomes in reading comprehension, written communication, mathematical reasoning, problem-solving skills, creativity, task persistence, and inquiry. Hall's (2009) study on job training and economic opportunity for lower-skilled workers found that career education can be similarly over-focused on theory or narrow skill sets to the exclusion of the broader competencies needed to ensure sustained employability over the long term. Even at college levels, learning can be limited. Sociologists Arum and Roksa (2010) examined over 2,000 students' four-year progress between 2005 and 2009 in twenty top-tier undergraduate institutions. The authors found that during the first two years of college 45% of the assessed students achieved no major gains in critical thinking, analysis, problem-solving, and writing skills. Even after four years of college, 35% of the students in the longitudinal study showed no significant gains in these skills. The authors attribute these low gains in higher-order skills to the erosion of the learning-

centered compact between students and faculty: Lack of rigor in college instruction is a culmination of underlying factors including lower faculty expectations of students, growing demands on faculty time which interfere with instruction and academic guidance, as well as students' low levels of effort seen in behaviors such as foregoing extensive readings and shortening their study time in favor of leisure and social activities.

Career Preparation Gaps. Intertwined with educational inadequacies is a training gap: Potential workers and students who have yet to become workers need work experience for viable employability; they need practical training to give them a start. Cappelli's (2011) research found that company training is in short supply as a result of shareholder pressures to minimize expenditures; employers look for employees to hit the ground running without needing ramp-up time and specialized company-specific on-site training for new employees. The diminished provision of vocational training in secondary schools and the considerable distance of theoretical classroom education from the practical world of work further exacerbate the training gap. In recent US career and technical education approaches, OECD researchers who examined the US state of Texas (Kis, 2011) found weakly developed quality assurance in the career-specific component of vocational preparation. They also found career education marginalized in school counseling and noted that not all students have access to high quality and meaningful career guidance. An OECD team researching US-wide characteristics (Kuczera & Field, 2013) noted the logistical impracticality of a nationally standardized career and technical education and training system owing to the US' sheer size and divergent local needs.

Retooling and Worker Reintegration Gaps. Underdeveloped school-to-work bridges are accompanied by lack of systematic retooling mechanisms for workers at risk of displacement in the wake of waning industries and ensuing skill obsolescence (Peck,

2011). This gap is not new: Decades ago, educator and economist Blinder (1987) pointed out the need for work-based learning and comprehensive strategies to help workers retool and develop skills relevant to new and evolving types of work. Now nearly three decades since Blinder's (1987) assessment, society's challenge of crafting comprehensive retooling assistance remains unresolved: The automation-away and offshoring of low-to-middle-skilled routine tasks has continued to displace many workers from thus-declining and vanishing industries, while higher-end new creative and analytical work requires higher levels of skill (Lindsey, 2013). The gulf between existing skills and the knowledge requirements for burgeoning career fields cannot be bridged without worker training and development (Blinder, 1987; Peck, 2011). Yet training and support infrastructures for workers facing vocational displacement have not kept up with recent decades' growing levels of upskilling and retooling needs (Cappelli, 2011; Kis & Field, 2013).

Resource Pressures, Weak Commitment, Quality Shortfalls

Local Funding Disparities, Divergent Learning Outcomes. Underinvestment and ambivalent policy commitment exert pressures on the effectiveness of schooling and training, thereby weakening competitive skill development over the long term. Although compulsory education saturates the entire school-age-population with primary and secondary schooling, the quality and range of learning opportunities vary widely with local wealth and socioeconomic factors, as public schools are largely funded through local property taxes. OECD researchers of education and career preparation in the United States (Kuczera & Field, 2013) and the US state of South Carolina (Kuczera, 2011) note that school funding's dependence on localities' wealth levels and property value assessments leads to disparate funding; high poverty thus sows the seeds for academic underachievement. These OECD findings are corroborated by US-based research

examining the links between education, business, economics, and national security: Through blighted area schools' inability to prepare their assigned pupils for a skill-intensive future, the pupils are at risk of being locked into the bottom rungs of society (Klein, Rice, & Levy, 2012). Plagued with numerous combinations of outdated learning resources, constrained curricular offerings, less qualified teachers and high teacher turnover, structurally unsound buildings and a general state of disrepair, underresourced schools add to the academically detrimental effects of pupils' pre-existing dysfunctional home environments, food insecurity, and unsafe neighborhoods (*Corridor of Shame*, 2005; Sachs, 2012; Stiglitz, 2012).

Underinvestment in Education. Ambivalent policy support for education manifests itself in form of schooling not sufficiently equipped to prepare students for skill-intensive working lives. Following the patterns identified in Ramcharan's (2004) study of education and training investment commitments levels' impact on whether nations' economies gravitate toward high-skill / high-income or low-skill / low wage equilibrium, US learning outcomes and economic trajectories toward high or low skills and incomes vary with individual US states' levels and long-term stability of education investments (Kis, 2011; Kuczera, 2010; Kuczera & Field, 2013). To exemplify the impact of low education investments, a study by Lacy and Stone (2007) focused on the US state of South Carolina's development trajectory since 1950. They authors found that the state's relative inattention to future-oriented human capital strategies has kept the state's per-capita income ranking at 48th of 50 states, thereby placing the state at risk of falling into low-skill / low-wage equilibrium. Although South Carolina benefitted from earlier waves of US manufacturers' relocations from other US regions in pursuit of low labor costs, manufacturers' subsequent departures for low-wage countries in search of

even lower labor costs have left a void in life-sustaining earning opportunities for low-to-middle-skilled workers. The study's authors warned that excessive reliance on low-wage low-skilled work has the potential to depress the state's standard of living if no future-oriented skill-raising strategy is adopted. Although the technical college system is strong, academic education is weak and the state has no strong university research base. Traditionally unwilling to pay for skill acquisition, South Carolina policy has viewed strategic education and job training as speculative and unguaranteed to yield results. Chronic underinvestment in education hinders the full formation of a well-educated and productive workforce; the resulting lack of skills and technical knowledge impedes economic development by deterring the in-migration of companies seeking skilled local workforces (Lacy & Stone, 2007). The World Economic Forum's 2013-2014 *Global Competitiveness Report* (Schwab & Sala-i-Martín, 2013) echoes these findings at the national level: US business leaders cite lackluster public policy commitment to long-term investments in education and skill-development strategies as a root cause of skill shortfalls and decline in global competitiveness. Asked to consider the strength of US education and training in comparison to the other 148 nations in the study, the 670 US executives polled for the 2013-2014 *Global Competitiveness Report*'s Executive Opinion Survey gave only middling ratings to schooling: On a seven-point scale where 7 is best, primary education was rated as 4.6, math and science education as 4.4 and the quality of overall education as 4.7.

Training: Casualty of Business Cost Pressures. Cappelli (2011) notes that workplace training is constricted by financial tensions arising from shareholder pressure to maximize business profits and by price competition from same-industry businesses. In the quest for operating-cost reductions, labor costs are often the only budget element

deemed flexible. As a result, companies have divested of in-house training and do not commit to on-site staff development on any relevantly large scale, thereby failing to grow their own talent while simultaneously expecting unrealistically high degrees of completely ready-made workers to emerge from educational systems. In reality, recent graduates do not yet have work experience; firms' unwillingness or incapacity to address knowledge specifics deprives companies of potential skill sets and would-be work-team contributors of the opportunity to develop practical work skills. When recovery from the global financial crisis began to revive hiring and businesses reported spikes in skill gaps (Manpower Group, 2011a), researchers advised firms to strengthen their own in-house staff development programs to fill in company-specific skills for employees otherwise a good fit (Davies & Kourdi, 2010; Manpower Group, 2011b).

Weak Foundations, Low Skills

Weak skills impede business operations (Manpower Group, 2013), economic competitiveness (Schwab & Sala-i-Martín, 2013), and national security (Klein, Rice, & Levy, 2012). Concurrently, low-skilled individuals face stunted life chances and relegation to the economic margins of society (Peck, 2011; Torraco, 2007). OECD researchers Kuczera and Field (2013), who explored US education and training, uncovered weak basic academic skills, low literacy, and low numeracy among US high school students compared to peers in other developed nations. These weak basic skills provide insufficient foundations for higher learning and specialized training. In two individual US states, OECD researchers found high levels of functional illiteracy and low math skills among adults in South Carolina (Kuczera, 2011) and considerable prevalence of low levels of basic academic skills among young people in Texas (Kis, 2011). US business leaders' responses to the Executive Opinion Survey in the World Economic

Forum's 2013-2014 *Global Competiveness Report* (Schwab & Sala-i-Martín, 2013)
voiced concerns about the weak skills spawned by the mediocrity in primary and math /
science education. Recent military readiness studies (Klein, Rice, & Levy, 2012; *Ready,
Willing, and Unable to Serve, 2009*) found that the 24% of 17-24-year-olds who have not
graduated from high school considerably reduce the pool of young people eligible for
military service. Another severe consequence of US high school dropout rates fluctuating
between 22% and 25% is the grim prospect of stunted life chances for non-completers
whose weak foundations bring reduced employability (Tyler & Lofstrom, 2009).

Weak foundations also haunt members of the low-to-middle-skilled workforce,
particularly those whose qualifications are rooted in narrow skills tied to waning
industries and who lack the transferable skills and academic foundations needed for
transitions into new and evolving work (Peck, 2011). Workers facing displacement from
declining industries are at risk of losing their place in the labor force altogether (Lindsey,
2013), as the evolving makeup of work is poised to leave behind those for whom
upskilling avenues are either unavailable or financially out of reach (Torraco, 2007).

Brain Drain: Area Talent Flight, High-Skill Retirements

Talent exodus in the United States afflicts economically depressed locales in
blighted urban areas, rural poor areas, and low-skill/low-wage regions within the United
States whose ambitious bright minds leave for other areas with greater economic and
educational opportunities **(**Carr & Kefalas, 2010; Domina, 2006) – a pattern similar to
brain drain in countries ill-equipped to provide opportunities for their talented (Schwab
& Sala-i-Martin; 2013). The United States also faces a graying of the high-skill base: As
many of the most highly-skilled workers age out of the workforce, their large-scale
retirements constitute a form of brain drain as their skills sets are lost to workplaces.

Younger workers and workforce entrants lack the skills to sufficiently continue the high-skilled work left vacant by retirements in high-expertise areas – a pattern spawning a high-skill vacuum which is poised to harm operations across many industries (Lindsey, 2013; North Carolina Commission on Workforce Development, 2007; Torraco, 2007).

Addressing Human Capital Challenges: Strengths and Strategies

The United States has a strong research base, and research-derived information provides broad-based support for inquiry and data-informed innovations (Kuzcera & Field, 2013). A US strength is its cultural tendency toward decentralization; strategies include synergistic innovations, local initiatives, and problem-focused policy measures.

Open Systems, Flexible Study Pathways

In contrast with European practice of pupils' early separation upon entering secondary school into deterministic and mutually exclusive academic or vocational tracks (OECD, 2013) – in particular Belgium (Kis, 2010a), Ireland (Kis,2010b), Hungary (Kis, Ferreira, Field, & Zwick, 2008) – some as early as ten-year-olds as in Germany (Hartmann, Knust, Loroff, & Stamm-Riemer, 2009; Hoeckel & Schwartz, 2010) and Austria (IBW, 2011) – the US education system refrains from this deterministic tracking approach and students are free to move between academic and vocational education provided their academic skills facilitate such mobility (Kuczera & Field, 2013)

Decentralization and Local Flexibility in Higher Education and Training

While education and business researchers point to fragmentation and absence of national standardization of education and training (Cappelli, 2011; Kuczera & Field, 2013), the same OECD researchers (Kuczera & Field, 2013) acknowledge the strengths of the US's cultural tendency toward decentralization and open education and training

systems: Although the basic structure of pre-compulsory preschool, compulsory

elementary, middle, and high school, and post-compulsory higher education from

subbaccalaureate certificates through doctoral programs is shared throughout the nation

(Levesque, Laird, Hensley, Choy, Cataldi, & Hudson, 2008), the culture of

decentralization and local control provides flexibility for community-sensitive synergies

responsive to local needs (Kuczera & Field, 2013). While programs' adherence to key

knowledge milestones is ensured through academic and profession-specific

accreditations, high degrees of state-to-state and local autonomy provide the freedom to

develop context-sensitive approaches. Stakeholder synergies in local areas are

particularly prevalent in postsecondary career education (Kuczera & Field, 2013). For

OECD's *Learning for Jobs* series, researchers of US education and training visited South

Carolina (Kuczera, 2011) where they found career and technical education embedded

within high schools and technology centers and a strong technical college system in

South Carolina, while another team visited Texas (Kis, 2011) and there noted a strong

university and community college system. Both states offer flexible pathways to

becoming career and technical educators including part-time teaching options for full-

time career practitioners, thereby bringing current career field knowledge to the

classrooms. In South Carolina (Kuczera, 2011), the OECD researchers found career

guidance and counseling with clear objectives and involving many stakeholders;

employers are actively engaged in articulating skills to be developed. In Texas (Kis,

2011), statewide uniformity and consistency in career and technical education standards

simplify transfer across regions while retaining earned credits; solid data help monitor

progress toward that state's vision of higher attainment. These OECD researchers (Kis,

2011; Kuczera, 2011) observed that postsecondary settings are stronger than K-12 school

settings in defining skill needs and developing learners' competencies. Similarly, the 670

US executives who responded to the World Economic Forum's Executive Opinion

Survey in its 2013-2014 *Global Competitiveness Report* (Schwab & Sala-i-Martín, 2013)

rated postsecondary offerings in the United States markedly more highly than the

primary, secondary, and math and science education ranked only middling in quality. The

ratings reflect the effectiveness of higher education's relative autonomy and flexibility to

address local needs: On the survey's 7-point scale where 7 signifies the best, the extent of

staff training scored 5.0 and ranked 12th of the 148 nations examined in the survey.

Quality of management schools scored 4.2 and ranked 12th; access to research and

training was rated 5.6 and ranked 9th globally.

Voluntarism and Context-Sensitive Synergies

The United States has a strong tradition of voluntarism and targeted initiatives

paired with a culturally ingrained drive for continuous improvement and innovation. This

action-orientation and cultural inclination toward problem-solving comes to life in the

plethora of non-profit organizations and volunteer initiatives, public-private partnerships

targeting specific challenges, and college students' service projects functioning as

interventions specific to education and training needs of all age groups. An example of

voluntarism, Winthrop Gentors is a volunteer homework clinic established by college

men who mentor male minority middle school students in success strategies such as

conduct, good habits, and academic persistence (McFadden, 2013). A local philanthropic

synergistic problem-solving approach is Michigan's Kalamazoo Promise (Miller-Adams,

2010): Established in 2005, this place-based scholarship initiative was established by

wealthy community members who in 2006 began anonymously paying for Kalamazoo

high school graduates' college tuition at any of Michigan's state colleges. Rooted in

concerns over economic decline and high dropout rates among its students, the idea was brought to fruition as a long-range human capital and economic development strategy through boosting young people's skills to seed Kalamazoo's next generation of high-skilled, creative working adults (Fishman, 2012).

Numerous initiatives to mitigate low-income students' underattainment of academic foundations and skills have been developed to address the needs of specific communities. Several initiatives help blighted neighborhoods' children through academic and social support in safe settings. Three examples are Washington DC's SEED School, a weekday boarding school with an academic boot camp and support structures to improve students' life skills ("SEED Public Charter School", 2009), Chicago's Urban Preparatory Academy, an all-male high school emphasizing academic rigor, etiquette, and emotional support for its neighborhood-traumatized students (Igbinedion, 2010; King, 2011; Williams, 2010), and New York City's Harlem Children's Zone which combines academic rigor with teaching life skills to the schoolchildren's parents (Brooks, 2009; Robelen, 2009; Whitehurst, 2010). Growing recognition of summer learning loss between school years fueled by low-income children's isolation from educative activities during summers has spurred community-based summer programs designed to engage low-income pupils in a variety of immersive nature-based learning experiences (Deschenes & Malone, 2011; McCombs, Augustine, Schwartz, Bodilly, McInnis, Lichter, & Cross, 2011).

College-age young adults' learning needs and working-age adults' upskilling needs also receive the attention of locally designed initiatives. Enstitute, based in New York City, is an apprentice program designed as a university alternative centered on hands-on development of high-level skills for technology work. Its structure is rooted in

the premise that hands-on work experience is key to workplace success (Seligson, 2013). Similar focused on developing technology skills, IT-ology, based in Columbia, South Carolina, was established through a partnership between the University of South Carolina, the technology company IBM, and the health insurer BlueCross BlueShield. The organization leads a variety of events and activities including technology workshops and university-led courses, corporate events, IT manager development, and K-12 summer camps centered on technology (Buell, 2009; Wilkinson, 2011).

Research and Solution-Oriented Policy Measures

Within the last twenty years, several nationwide policy measures and standards have aimed to improve learning outcomes. The 1995 Educate America Act, also known as *Goals 2000*, envisioned knowledge standards and learning outcomes such as grade-level proficiency in reading, math, and science, safe learning environments, and strong professional development venues for teachers (*Goals 2000: Educate America*, 1994; "Goals 2000", 1995). The federal No Child Left Behind Act envisions standardized test scores as an objective measure of academic achievement and progress (*No Child Left Behind*, 2002), while *Race to the Top* legislation awards grants for local school districts to support data-informed assessments and creative solutions to learning-outcomes voids (*Race to the Top*, 2009). The notion of shared goals regarding what every American should know (Hirsch, 1988; Klein, Rice, & Levy, 2012) and the need for a roadmap toward reading, writing, and math proficiency are articulated in the 2010 Common Core curriculum standards (*Common Core Standards for English*, 2010; *Common Core Standards for Mathematics*, 2010).

Legislation also aims to broaden access to postsecondary education and training. First enacted in 1965, the Higher Education Act (HEA) established parameters for

supporting colleges and universities and its Basic Educational Opportunity Grant provision under Title IV sought to open higher education for "high school graduates of exceptional financial need, who for lack of financial means ... would be unable to obtain such benefits without such aid" (*Higher Education Act*, 1965, 79 Stat. 1232). HEA's 1972 reauthorization introduced the concept of direct federal financial assistance (*Basic Educational Opportunity Grants*, 1972), now known as Pell Grants (Cervantes, Creusere, McMillion, McQueen, Short, Steiner, & Webster, 2005). Legislation governing career education has shifted from its early 20th century focus on career preparation formulated around narrow industrial and agricultural education on a trajectory distinct from academic education (*Smith-Hughes Act*, 1917). Its 1963 successor legislation set out to broaden the range of training and expanded its scope to include retraining for adult workers displaced by technology (*Vocational Education Act*, 1963) and in 1984 vocational education was still primarily defined as work-skill preparation (*Carl D. Perkins Vocational Education Act*, 1984). The school-to-work movement concerned with cultivating the skills for employment and career advancement and the academic foundations necessary for further learning spawned the *School-to-Work Opportunities Act* (1994) which emphasizes synergies between classroom and work-based learning to help develop tangible skills and career preparedness. Postsecondary career education's goals were broadened in 1998 (*Carl D. Perkins Vocational and Technical Education Act*, 1998) and again in 2006 (*Carl D. Perkins Career and Technical Education Improvement Act*, 2006) by augmenting the traditional definition of career and technical education as practitioner-oriented skill-building with the added stipulation of links to strong academic foundations.. Career academies linking corporate engagement and secondary schools and the integration of career instruction and academic foundations are a practical outgrowth

of this legislation (Brand, 2009; Hyslop, 2009), while links between academic foundations and vocational skills now permeate career education at postsecondary levels (Levesque, Laird, Hensley, Choy, Cataldi, & Hudson, 2008).

Summary

The Manpower Group's (2013) *Talent Shortage Survey* found that 39% of the polled US employers reported unfilled positions resulting from skill shortages. Key skills widely reported as important but in short supply span content knowledge and tangible competencies, critical thinking, communication and interpersonal skills, and character traits such integrity and professionalism (*Closing the Gap, 2012*; Hart Research Associates, 2010; Nagle, 2010; Wagner, 2010).

US skill gaps have arisen from macroeconomic trends away from low-to-middle-skilled work toward higher-skilled analytical, technology-infused, and creative work (Lindsey, 2013), as well as skill voids poised to arise from imminent mass retirement of high-skilled professionals (North Carolina Commission on Workforce Development, 2007) and lagging skill development and upskilling opportunities (Cappelli, 2011; Torraco, 2007). Skill shortages are further exacerbated by growing impediments to postsecondary attainment such as rising costs, relatively weak skill-building and knowledge development in primary and secondary schooling (Kuczera & Field, 2013), and weak math and science education (Schwab & Sala-i-Martín, 2013).

US strengths in addressing human capital challenges include a strong research base supporting data-informed strategies, open education systems with flexible study pathways, voluntarism and synergistic initiatives responsive to local needs (Kuczera & Field, 2013), a history of policy measures aimed at schooling standards (*Goals 2000*,

1994; *Race to the Top*, 2009), and solution-oriented policy measures: Need-based direct federal student funding assistance aims to broaden access to postsecondary study (Cervantes, Creusere, McMillion, McQueen, Short, Steiner, & Webster, 2005). Changes to legislation governing career education reflect recognition of changing needs: Legislation concerning career education has shifted from its initial focus on narrow skills (*Smith-Hughes Act*, 1917; *Vocational Education Act*, 1963; *Carl D. Perkins Vocational Education Act*, 1984) toward stipulating links between career skills and academic foundations in order to strengthen students' knowledge, skills, and career paths (*Carl D. Perkins Vocational and Technical Education Act*, 1998; *Carl D. Perkins Career and Technical Education Improvement Act*, 2006; *School-to-Work Opportunities Act*, 1994).

CHAPTER FIVE

Constructivism

Introduction and Overview

Constructivism offers unique instructional strategies characterized by emphasis on active learning, social interaction and peer mentoring, and reflection. Such multi-dimensional engagement with the learning content deepens understanding, cements conceptual grasp, and fosters a plethora of higher-order cognitive and socioemotional skills. This chapter presents constructivism's theoretical foundations, followed by current research on constructivism in a variety of new settings.

Constructivism: Theory and Related Research

Constructivism's intellectual underpinnings stem from epistemology, the branch of philosophy focused on the study of knowledge and perception (LeJeune, 2011; Ültanir, 2012), Socratic dialogue as teaching tool (DePierro, Garafalo, & Toomey, 2003; Elder & Paul, 1998), and 18th-century philosopher and educator Vico's (1990) emphasis on the importance of imagination and ability to make interdisciplinary connections (Maiullari, 1994; Perkinson, 1962; Peterson, 2012). The theoretical foundations of constructivism's modern conception arose from late 19th - and early 20th-century advances in early childhood education and cognitive development (Brewer, 1933) and emphasize learners' inner world of cognitive and perceptual development (Piaget, 1929), purposeful hands-on learning activities (Dewey, 1997), and the importance of environment and social interaction to learning and growth (Bruner, 1977; Montessori, 1912; Vygotsky, 1978).

Piaget's Knowledge Structures: Meaning and Mental Mapping

One of constructivism's key features is centered on learners' inner work of actively constructing knowledge and assembling knowledge structures in their minds (Piaget, 1929, 1977). While the teacher is decidedly in charge of introducing and sequencing knowledge concepts as building blocks for students' learning progression (Bruner, 1977), the learner is empowered to take active ownership of knowledge acquisition and the intellectual work of constructing meaning from the new knowledge. Late 19th- to mid-20th-century Italian physician, child psychiatrist, and educator Montessori (1912) noted that the mind seeks order and therefore aims to organize the knowledge pieces into a cohesive whole. She observed children to be active learners and seekers of knowledge striving to make sense of the world around them in order to understand how encountered information and concepts interrelate. Her contemporary, Swiss biologist and developmental psychologist Piaget (1929) gleaned similar observations. He studied the cognitive development of children between the ages of 2 and 15 years, questioned them about numerous concepts and natural phenomena to ascertain the maturity and complexity of their grasp, and scrutinized their child language for clues regarding the degree to which his young learners had internalized information and made logical connections between numerous areas of knowledge. He observed that as children increased in age, they outgrew their egocentric perceptions, became increasingly susceptible to information inputs from adults, and their understanding progressively increased in complexity. Piaget (1977) further noted that learners are actively engaged in the mental-mapping processes of building knowledge structures based on new learning and experiences, prior knowledge, and logical connections between the old and the new. Influenced by biology, Piaget viewed children's processes of internalizing knowledge as

analogous to an organism's interaction with its external environment and adaptation to its influences: When new information comes to a child who does not yet understand the new information, the child tries to construct an overall meaning of the new knowledge's context in order to create an information architecture as a framework to assist in gaining an understanding of the new information. As the learner's knowledge negotiation seeks order and knowledge equilibrium, the influx of new knowledge presents disequilibrium. To regain equilibrium, the child assembles a mental map of information, creates ordered mental structures between information components, places the new information in context, considers the new information both in light of old knowledge and new conclusions reached through the new range of understanding, and ultimately assimilates the new knowledge. Assimilation of the new knowledge entails assessing previously held knowledge in light of the new, evaluating long-held perspectives, at times rethinking old perspectives and replacing them with the new and at other times integrating the new information in the broader context of pre-existing knowledge.

Piaget's Legacy: Cognitive Structures, Mind Maps, and Concept Mapping

      Cognitive Structures. The notion of the learner's inner cognitive structure as a key element in organizing knowledge and facilitating cognitive skills endures. Bisland's (2008) study on visual literacy among elementary school students in New York City highlighted the importance of prior knowledge in equipping students to meaningfully interpret visual images and the scenes depicted therein. The study's goal was to cultivate students' understanding of the ancient Silk Road's trade routes, places, peoples, activities, and objects by having them examine several book illustrations and apply their own prior knowledge and experiences to the visual information observed in the pictures. The activity enlisted a group of elementary school teachers' use of vividly colored and

detailed illustrations from two children's books on 13th-century China and the Silk Road.

Images of cities featured busy urban hubs of social and commercial activities, people in

the era's typical dress of China, Mongolia, Central Asia, and India, as well as

merchandise and foods. Pictured architectural features included houses, temples, shops,

outdoor eating areas, and a city wall with emphasis on one of its imposing gates.

Illustrations of the Silk Road included trade caravans traveling through Central Asian

landscapes, animals for transport and food, tents, and people with the features and dress

of several Central and East Asian countries. The students were asked to study the

illustrations broadly and in detail and then list the depicted people, objects, and activities,

followed by making three inferences and asking questions raised in the pupils' minds

based on prior experiences. The students' responses varied not only by age and pre-

existing content knowledge, but also by prior personal experiences: Students in the lower

grades were literal in their listing of people and objects, except for one immigrant first-

grader who inferred that the pictured caravan travelers were migrating in pursuit of a

better life. Several second- and third-grade students confused the illustrations' ancient

China with Chinatown – a connection attributed by the study's teachers to the inclusion

of ancient traditional architectural shapes in the buildings of New York's Chinatown

which the students had personally experienced. The fifth- and six-grade students

observed nuanced details such as facial expressions of mood, ethnic features, customs,

period dress, class distinctions. They also noted spices, traditional animals, and the

importance of vibrant cities. Prior document-interpreting experience and knowledge

from prior Silk Road studies illuminated and deepened the older students' picture

interpretations. The study's group of teachers found that the younger, lower elementary

students needed simpler instructions and initial encouragement to spur thoughtful

engagement. The teachers extrapolated from the older, upper elementary students's picture-analysis responses that these students' understanding could be deepened through strategies such as enhancing the picture-analysis activity with a follow-up reflective writing assignment or including the picture-analysis activity in a Silk Road study unit.

Mind Maps. Visual mind mapping of students' inner knowledge structures resulting from constructivist instruction in an English-language science unit on magnetism was explored by Dhindsa, Makarimi-Kasim, and Anderson (2011). Their study comprised six classes totaling 140 students ranging between 13 and 15 years of age in a co-educational secondary school in Brunei. Half of these 140 students received the constructivist lessons; the other half the traditional lecture-based instruction: The experimental group receiving the English-language magnetism instruction in a constructivist format comprised three classes totaling 70 students (41 boys and 29 girls). The instruction entailed a cycle of students' viewing of a multicolored mind map of the previous lesson's materials at the onset of each new lesson, the teacher's Powerpoint presentations and in-class discussion, students' group work to prepare a mind map based on the newly learnt material, individual mind-map production, and students' take-home update of their individual mind maps to activate prior knowledge and incorporate further learning. Before each new lesson, students reviewed their mind maps from the previous lesson, created new mind maps based on the new content, and then combined the new lessons' mind maps into a cumulative whole. The study's control group encompassed the other three classes totaling 70 students (40 boys and 30 girls) who were taught the same magnetism material in the school's long-established traditional lecture-based format with overhead projections in absence of group activity. The study's three objectives were to compare both student groups' perceptions of constructivist learning through students'

responses to the Constructivist Learning Environment Survey (CLES), to compare extensiveness and complexity of cognitive structures between the constructivist and traditional learning groups, and to compare extensiveness and complexity of cognitive structures between the male and female students in the constructivist and traditional learning groups. The CLES survey items covered students' perceptions of personal and out-of-school relevance of the material covered in the magnetism lessons, uncertainty and changes in scientific understanding over time, a classroom climate of openness to students' expression of opinions and questioning, students' shared control over their learning activities, as well as student collaboration and idea exchange. After the course unit on magnetism, CLES responses by both instructional style groups' students indicated that the constructivist teaching approach was linked to higher student engagement, interaction, and collaboration, higher sense of participation in planning their learning activities, and a heightened sense of the students' critical voice and questioning. Only the element of magnetism's personal and out-of-school relevance was comparable across both groups – attributed in large part to both teachers' efforts to link the lessons to students' lives. To answer the researchers' questions about the differences in cognitive structures between the two learning groups following the magnetism lessons, the students were asked to write an essay before, immediately after, and ten days after the study's last lesson. Each essay was evaluated with a flow map: Each statement was recorded for evaluation in the order presented by the student, then coded with statements and principles shown as nodes and linkages as lines. The flow maps visually depicted the relationships between concepts, basic successive principles, linear linkages between successive principles, complex linkages between non-successive statements representing multiple applications of principles, and focal points formed by multiple complex

linkages. The researchers counted each essay's concepts, statements, linear and complex linkages, and focal points, incorrectly linked concepts, and calculated the relative predominance of complex to linear linkages. At the study's onset, no significant differences between the two learning groups were found, but the constructivist approach yielded considerably greater complexity, breadth, and range in students' cognitive structures immediately after the magnetism instruction. Although both groups gained greater understanding of concepts' complex interrelations when tested again ten days after the last lesson, the differences between the two groups held and the constructivist learning group's cognitive structures remained more robust than those of the traditional learning group. To ascertain whether these learning outcomes differed by gender, the authors also compared boys' and girls' flow-mapped essays. They found that these differences in learning outcomes from constructivist and traditional instruction held across gender: When the essay evaluation data were separated into boys-only and female-only data, the constructivist learning group's stronger cognitive results occurred within each gender group, pointing to constructivist mind mapping approaches' instructional effectiveness regardless of students' gender. For all students, the mind map exercises helped the students visualize the magnetism lessons' concepts and their interconnections, which contributed to more thorough grasp of the instructional content.

Concept mapping. Concept maps are a visual tool of presenting knowledge components and their interrelations. Tergan, Gräber, and Neumann (2006) posit that concept mapping visually assists learners in their inner work of absorbing and integrating knowledge - a cognitive task which is easily hindered by the abstract nature of assembling new and pre-existing knowledge into a cohesive architecture of conceptual interrelations in the mind's eye. The memory-intensive task of taking in the new

information and working to make sense of it overloads the capacity to absorb new information, particularly as learners are overwhelmed by newness of the content paired with the difficulty of choosing from the multitude of information resources in light of their still-fledgling comprehension of the new knowledge. To illustrate concept maps' assistance to the learners' continuous work of building and updating knowledge structures, the authors identify six phases of knowledge management: *Knowledge identification and knowledge evaluation* entails analyzing the learning task, identifying knowledge gaps, assessing needs and setting learning goals, as well as the learner's self-assessment. *Information search* entails the search for content-related information through published and online resources. *Knowledge generation* entails the cognitive processes of integrating new and prior knowledge, realigning and reorganizing to accommodate new information as well as rethought prior perceptions, and linking the knowledge elements of concepts, content, and topic-appropriate information resources. *Knowledge representation and organization* is the key step of making sense of knowledge and arranging it in a cohesive structure in a manner which not only reflects the concepts' interconnections but makes the knowledge architecture adaptable to restructuring with the influx of new knowledge as well as accessible for recall and use. *Knowledge communication* entails the teacher's work of instilling knowledge to students, knowledge sharing and idea exchange among students, and students' demonstration of knowledge to teachers. *Knowledge use* is the application of knowledge to practical tasks and new contexts in ways appropriate to the situation at hand. Appropriate knowledge use requires learners' content- and association-rich mental knowledge structures sufficiently established to identify concepts relevant to the task at hand their for situation-appropriate applications. Concept mapping ameliorates the overwhelming complexity of these

learning phases. By harnessing humans' highly developed visual acuity, concept mapping fosters spatial learning strategies for the inherently abstract task of associating concepts and their interrelations. Visual representation of the interrelations assists learners with mapping the concepts in their minds, while also visually aiding in the communication and grasp of concepts and their interconnections. The authors also suggest the use of digital tools for the creation of enhanced concepts maps allowing for interlinking of related and subordinate knowledge structures, collaborative updating of concept maps in group work, and embedding links to online learning resources appropriate to specific conceptual components in order to help guide students' inner knowledge-structure building and concept-appropriate information seeking without overwhelming them with the combination of new information and abstract tasks of knowledge management.

Experiential Learning and the Spiral Curriculum

Experience and purposeful hands-on learning activities in intellectually stimulating environments are at the heart of constructivism. Learning experiences, personal experiences, as well as cultural and social factors comprise a powerful array of influences on conceptions of the world, on cognitive and social development, and on the trajectory of knowledge growth (Montessori, 1912; Piaget, 1929; Vygotsky, 1978). Students learn by doing rather than passive observation and absorption of lectures. Students are empowered to take ownership of the knowledge base through active engagement in purposeful hands-on educative activities and active construction of knowledge (Dewey, 1997; Montessori, 1912; Piaget, 1929). Through hands-on immersive activities, students learn practical application of knowledge and gain a sense of interrelations across discrete areas of knowledge (Bruner, 1977); repeated hands-on practice and effort build mastery (Dweck, 1999, 2006; Montessori, 1912).

Influenced by the Piaget's (1929, 1977) notion of knowledge expansion through connecting new information to prior knowledge and by Dewey's (1997) notion of experiential learning, Bruner's (1977) concept of the spiral curriculum exposes students to the knowledge content through a variety of activities and access points. This variety of experiences exposes students to the material from multiple vantage points, thereby offering multiple opportunities to grasp the concepts and progress in understanding. For example, Trotter (1995) posits that mathematics learning comes alive in active hands-on projects such as planning a field trip which immerses students in mapping out the itinerary, budget, and logistics. The field trip itself brings the students' efforts to real-world fruition and thereby enlivens the abstract theory in practical application. Content-area learning also comes to life through application of a variety of learning activities in immersive settings, as illustrated in recent school practice (Cetrone, 2011): To teach Depression-era history, a Fort Mill middle school teacher teamed up with other subject teachers to create a project in which students lived in simulated deprivation for nine days. The students built Hooverville-style shantytowns from donated cardboard boxes in the school's courtyard and lived in them in groups of four. The students created rules for living and sharing facilities. They used rudimentary materials to design a simple game for entertainment, managed meager budgets, wore layers of clothing to simulate the Depression-era experiences of moving around, ate only soup, and lived with the simulated reality of rationed potatoes in order to gain the first-hand experience of living with hunger. In math, the students researched Depression-era living costs with today's inflation-adjusted prices and wrote journals detailing budgets and strategies outlining how they would have navigated Great Depression conditions. In another series of lessons on World War I organized by the same teacher, students read a novel about WWI

battlefield conditions, the teacher's laser pointer signified wartime enemy fire, and the students then crouched under desks and along the classroom wall to simulate soldiers writing home about their experiences. The graded assignment required students to crawl on the floor to turn in their classroom battlefield letters to the teacher. These purposeful multisensory immersive learning activities deepened the students' sense of conditions in the historical eras at the focal point of their studies.

Learning Environments and Development

Current perceptions of intellectually stimulating, accountability-infused, and psychologically safe environments' impact on learners' development of success habits and knowledge (Beisser & Gillespie, 2003; Dobbie & Fryer, 2009; Dweck, 2006; King, 2011; Mitra & Dangwal, 2010; King, 2011; Millman, 2011; Mitra & Dangwal, 2010; Reed-Woodward, 2008; Tough, 2008; Wagner, 2010, 2012; Whitman, 2008; Willey & Burke, 2011; Zhang, 2008) traces back to several historic early-childhood educators whose seminal work systematized the foundations for current understanding:

Bruner's (1977) notion of the enactive phase in the early stages of childhood learning emphasizes the importance of intellectual stimulation through physical manipulation of objects and observing the effects; access to such manipulatives and exploration is key to environments conducive to learning. Kindergarten conceptualizer Froebel's (1895) building blocks, Montessori's (1912) didactic two- and thee-dimensional shape puzzles and her child-sized light-weight movable furniture, and both educators' tutorial gardens exemplify environments supplied with the didactic tools and learning spaces to spur exploration. Waldorf education founder Steiner (1996) considered toys and objects which children could manipulate and improve upon to be more effective than elaborate but static toys for stimulating intellectual activity and creativity.

Environment is also considered with regard to the broader mission of preparing learners for constructive participation in society by fostering social skills, tangible skills and competencies, mastery, and the confidence which springs from mastery (Montessori, 1912). Fitness for society also requires informed citizenship (Dewey, 1916; Maclure & Davies, 1991) and moral and spiritual development (Froebel, 1895; Steiner, 1996). Froebel (1895), Montessori (1912), and Steiner (1996 concur that learning environments conducive to learning and growth are also characterized by an environment of acceptance, respect, empathy, and civility: A climate of acceptance is a powerful motivator which spurs schoolchildren to delve into the work necessary for catalyzing their academic growth and skill development, while moral guidance prepares learners to lead ethical lives. An atmosphere of freedom to choose activities of interest sparks initiative, self-discovery, and builds self-discipline and task perseverance (Dewey, 1915; Montessori, 1912), while rewarding effort and allowing failure into the learning process motivates students to persevere toward mastery (Dweck, 1999, 2006; Wagner, 2010).

Montessori's Children's House. Late 19th-to-mid-20th-century Italian physician, child psychiatrist, and educator Montessori (1912) developed a comprehensive preschool method which was informed by her observations of the stunting effects of tenements' spatial configurations, overcrowding, pervasive crime and vice, as well as tenement dwellers' social and geographic isolation from constructive role models on intellectual and socioemotional development among these blighted areas' children. With support from a local philanthropic society, Montessori remodeled and upfitted a tenement in San Lorenzo, one of Rome's most blighted areas, as her strategy to address the totality of the children's living conditions. In addition to reconfiguring the living spaces to promote family privacy and adding more stairwells to reduce vice-conducive crowding in public

corridors, she repurposed a ground-floor building section with courtyard access and designed a state-of-the-art preschool for the tenement's children. The heretofore waste-strewn courtyard was repurposed into an outdoor learning space with tutorial gardens. Inside the building's school area, the classrooms' physical design emphasized beauty and order as a means of visually communicating a safe learning space. Following the renovation, Montessori personally moved into the tenement as the school's resident director and involved parents in the building upkeep, instituted parental engagement in their children's homework and hygiene, and established weekly teacher-parent meetings to promote a sense of parental ownership of their children's educations.

Montessori pioneered child-sized furniture sufficiently light-weight for the children to move at will, child-height countertops designed to serve as impromptu work spaces for educative activities, various learning supplies, and a cache of toy-like puzzles for matching shapes and colors. All toys and learning materials for indoor and outdoor activities were stored in their designated places where the children could easily access them. The pupils were encouraged to use the tools at will and were coached to put them back where they belonged after use – the children thereby learned self-initiated exploration, self-discipline, and organization. Montessori provided purposeful hands-on learning tasks in the classroom and outdoor space where the children learned how to care for the plants in the tutorial garden. The practical activities allowed students to see interconnections between the factors needed for task completion: Students learned persistence as they persevered to task completion; planning their work taught foresight, organization, and strategy. Montessori encouraged her pupils to independently engage in learning activities and allowed them the freedom to make errors in trying new educative tasks in order to learn from the flawed outcomes. She observed that pupils learned from

the cycles of trial and error and internalized the knowledge when they made errors and self-corrected by way of repeating their work as they reflected upon the reasons for the flawed outcomes. Pupils also collaborated in learning activities; older students helped younger students and thereby developed empathy and leadership skills while the younger students learned more quickly how to take care of themselves.

Academic progress, school readiness, and social skills attained were on par with wealthier children's preparatory outcomes. Following the successes of the San Lorenzo Children's House, Montessori trained additional school directors and the model was widely replicated in Italy (Montessori, 1912). Her legacy endures in schools worldwide where instruction is rooted in her approaches to developing students across knowledge and skill domains (Howell, Sulak, Bagby, Diaz, & Thompson, 2013; Loveless, 2012).

Montessori's Legacy: Environment and Academic Rigor. Montessori's (1912) legacy endures in current research and practice. The impact of children's social environments and the psychological effects of their surrounding neighborhood continue to set the tone for children's capacity for establishing a constructive place in the world. Current research notes connections between students' home and neighborhood environments and their capacity for developing solid self-knowledge, construction of self, sense of place in the world, and extent of career readiness. Usinger and Smith's (2010) longitudinal study of 60 adolescents residing in poor urban areas examined the students on the six self-concept aspects of (1) *self in the larger world*, (2) *self-creation*, (3) *self-absorption*, (4) *anger*, (5) *detachment*, and (6) *overwhelmed self.* All adolescents in the study were living in poor urban areas and had been influenced by the environment of economic disadvantage and the resulting stymied perspectives on life opportunities. Over a five-year period, researchers surveyed the students from 7th to 12th grades in

order to glean their sense of self and career exploration. The researchers found that the environmental influences of the economically disadvantaged urban areas psychologically constrained the students' development of career readiness and their sense of place in the world.

The Harlem Children's Zone, discussed in more detail in the later chapter on current practice, is a charter school in New York's Harlem neighborhood (Tough, 2008): Its design combines academic rigor in school and support systems beyond school for the students residing within the Harlem Children's Zone's area of 97 city blocks. Support systems beyond school for these low-income families include health services and teaching parents life skills and home activities to foster their children's intellectual development. Economics and public policy professors Dobbie and Fryer (2009) studied the Harlem Children's Zone by comparing reading and math achievement of neighborhood students not enrolled in the Harlem Children's Zone, those attending the Harlem Children's Zone school but residing outside the 97-block perimeter of the life-enhancing support networks, and those children residing within the 97-block area of the Harlem Children's Zone. The authors found that the combination of schooling's academic excellence with community outreach to parents was linked to the strongest student achievement gains: Student-supporting ecosystems in and beyond school thus created the comprehensive ecosystems necessary for students' academic gains and internalizing of success-conducive values such as learning mindsets, formulation and pursuit of goals, future-orientation, confidence, self-discipline, and perseverance.

Social Constructivism and Scaffolding Theory

Social constructivism emphasizes the influences of social interactions on learning (Vygotsky, 1978). Culture, living conditions and social conventions, role models,

knowledge leaders, and learning environments determine the range and depth of knowledge, intellectual sophistication, developmental guidance, expectations and aspirations, and moral standards to which learners will be exposed (Froebel, 1895; Montessori, 1912; Steiner, 1996). Social interaction, collaboration, conversation and questioning, and idea exchange foster cognitive and socioemotional growth, cement learning, and help deepen conceptual grasp (Bruner, 1977; Dewey, 1915; Montessori, 1912; Steiner, 1996; von Glasersfeld, 1996; Vygotsky, 1978). The social interactions taking place in school function as a mechanism of community integration and preparing learners for constructive participation in society (Dewey, 1915); young children learn social building blocks such as empathy and leadership skills through mutual assistance (Montessori, 1912) – observations also found in the current research presented later in this chapter as well as the next two chapters on constructionism and current practice.

Interactions, Collaborations, and Guidance. Knowledge expands through exposure to new ideas from others (Piaget, 1929) and by virtue of interactions, guidance and assistance, and exposure to role models and knowledge leaders (Vygotsky, 1978): Early-20th-century Russian developmental psychologist Vygotsky (1978) noted the importance of guidance and assistance from more knowledgeable peers: According to his theory of the zone of proximal development, students' learning cannot progress beyond their current level of mental ability and skill without additional help and guidance, but students' learning has the potential to rise beyond these limits with help from others. The zone of proximal development is the space between present levels of ability and potential levels of future skill attainable through assistance from teachers and more knowledgeable peers. Montessori (1912) similarly noted that mastery is achieved in part through contact with other people. As older children helped younger children with some work, the older

children learned empathy and leadership, while the younger children gained self-efficacy, independence, and confidence. Current research portrayed later in this and the next two chapters illustrates the enduring importance of interactions, collaboration, and guidance.

Scaffolding Theory. Bruner's (1977) scaffolding theory builds on Piaget's (1929, 1977) notion of the learner's inner work of constructing knowledge based on weaving together meaning from experiences (Dewey, 1997) and on Vygotsky's (1978) principle of the more knowledgeable peer. As a guide to students' active learning, the teacher assesses students' existing knowledge through instructive conversation and questioning and steers learners toward building connections between their existing understanding and new knowledge to be mastered (Bruner, 1977). Through adroit observation of learners' cognitive ability and knowledge progression (Montessori, 1912), the teacher exercises subtle skill in guiding students to the subject matter needed for their growth and knowledge expansion (Dewey, 1897) as well as identifying students' strengths and weaknesses and steering them into tasks to develop their skills (Nikirk, 2012).

Conversation. Classroom conversation helps cement language and thinking skills (Elder & Paul, 1998; Piaget, 1929) and serves as a scaffolding tool (Bruner, 1977; Vygotsky, 1978). Piaget (1929) used questioning to elicit children's knowledge grasp and spur their intellectual advancement toward higher levels of understanding. Montessori (1912) enlisted conversation as a tool to assess students' grasp of a given knowledge area and to spur further learning. Talk in school endures as an interactive conduit for instruction, ascertaining students' knowledge and understanding, spurring learners' inner work of knowledge construction (DePierro, Garafalo, & Toomey, 2003), and reflection through teacher guidance, feedback, conversation, and questioning (Mercer & Hodgkinson, 2008).

Current Research: New and Diverse Directions

Several newer studies build upon constructivism's above-described theoretical foundations and seminal research. The following current research highlights the links between learners' exertion of effort and achievement of mastery, work-based learning, and technology-infused learning communities.

Failure and Effort: Key Ingredients in Building Mastery

Psychologist Dweck's (1999, 2006) current research expands on Montessori's (1912) earlier observations of the importance of cultivating learners' capacity for working to overcome difficulty in the quest to achieve the learning goals of skill growth and mastery. Dweck (1999) observed in learners two distinct behavioral responses to difficulties and obstacles to achieving outcomes: One orientation is centered on the belief that intelligence is fixed and that innate talent is the key driver of successful learning and task outcomes. The other orientation is the belief that, rather than fixed, intelligence and ability are malleable and can be cultivated through targeted effort aimed at growing one's skill levels to meet the demands of challenging tasks at hand. Dweck found that those who believed in their innate talent and saw intelligence as fixed charged confidently toward tasks but became discouraged in the face of difficulty and shrank from the obstacle blocking easy success instead of rising to the challenge and working toward mastery. In contrast, those who believed that intelligence and ability could be developed approached difficulty and failure as part of the learning process, embraced the challenges, and exerted the learning effort of working to achieve mastery. Subsequently, Dweck (2006) further observed that when learners were praised for a desirable outcome such as high scores with comments on their innate talents, the learners saw their high marks as a result of their fixed innate abilities and were quickly discouraged in the face

of tasks they could not initially master as they were unaware of the outcome-influencing role of effort in successful task completion. In contrast, when learners were praised for their effort regardless of initial task outcomes, they grew to view encountered difficulties as temporary setbacks to be overcome through concerted effort and strategic learning in pursuit of mastery. Dweck's observations of effort-centered strategies' successes in developing the learner's self-discipline, self-correction capacity, concentration, effort, perseverance to task completion, and learning growth prompted her to recommend instructional strategies of rewarding effort rather than merely praising innate intelligence and talent in the quest to foster mastery. Education professor Wagner's (2012) findings on the hands-on practical learning's successes in developing creativity corroborate the importance of allowing failure into the learning process in order to develop learners' imagination, initiative, and motivation.

Work-Based Learning

Growing interest in employability skills has led to recent research on work placements as a curricular component: Huq and Gilbert's (2009) Australian university experiment examined the learning effects of incorporating a practical work-based hands-on component in a theoretical course about social entrepreneurship. The course-experience survey of 60 participating students revealed that the work-integrated learning module exposed the students to hands-on practical experience to augment their theoretical coursework. The students reported seeing first-hand the realities of working in non-profit environments as part of their social entrepreneurship course, learning first-hand the real-world aspects of financial constraints, evolving roles in society, managerial challenges, and macroeconomic impacts on the viability of the enterprise. The students' knowledge also deepened through developing hands-on practical skills, hands-on real-

world work, interaction and collaboration. The students also matured socioemotionally as observed in form of increased skills in teamwork and collaboration, empathy, emotional intelligence and communication skills, and the interpersonal skills necessary for building the social capital needed to succeed in a globally competitive and volatile economic environment. The experiment's authors found that the work-integrated learning augmented the theoretical foundations learned in the classrooms with practical entrepreneurial and problem-solving skills – an outcome not commonly achieved with theoretically oriented classroom study alone. Charland's (2005) study on practical art education noted that paid summer youth art apprenticeships, growing primarily in larger US cities, share work-based education's focus on gaining real-world exposure to complement classroom learning and individual art work. The hands-on engagement strengthens learning of the craft as well as forging bonds with other artists as fellow members of their craft. Students participating in art apprenticeships develop professionalism and take pride in their completed work, in addition to learning practical skills such as decisionmaking, practical solutions, social skills, learning workplace culture and deciphering organizational hierarchies and relationships.

E-Learning: Online Learning Communities

Online learning communities bring constructivism's social learning components to online and hybrid academic instruction and professional development. Combining social interaction and idea exchange enhances learning (Mackey & Evans, 2011). Enonbun's (2010) examination of web 2.0 for online education found that interactive web-based tools provide the teacher with a hub for placing course materials, quizzes, evaluation and feedback tools, and online critiquing and assessment tools. These virtual spaces also assist the teacher in charting course direction through educative conversations

aiming at spuring the students to think and explore. Web 2.0 tools facilitating interaction include wikis, blogs, forum boards, chat, podcasts, and virtual worlds. Online environments serve students and teachers alike as a virtual place for sharing data, research findings, and other materials related to learning goals. For students, the online hub facilitates synchronous and asynchronous conversation, a virtual space for collaboration, as well as interactive idea exchange and peer review of each other's work. The flexible pathways toward sharing in the online space also help democratize the process for individual engagement and for contributing and trying out ideas. Chapman, Ramond, and Smiley (2005) noted that the strong communities created in such learning environments deepen learning outcomes – findings echoed by Anderson and Dron's (2011) findings on constructivism in distance education pedagogy. Almala (2006)'s exploration of constructivism in distance education noted that online learning communities spur online collaboration; Enunbun (2010) found that online learning communities built into hybrid courses strengthened classroom collaboration because the online interactions in between face-to-face classroom sessions cemented relationships.

Studies on e-learning environments have found that the social interaction and collaboration strengthens learning outcomes for both academic study and professional development. Saab, van Joolingen, and van Hout-Wolters (2005) examined collaborative discovery learning in a secondary school environment by pairing 21 pairs of 10th-grade students ranging from 15 to 17 years or age. The study was designed to ascertain links between online participation and collaboration and the students' learning outcomes. The students worked in dyads on separate screens in a shared discovery learning environment and communicated with a chat box. The researchers found that communicative activities such as idea exchange, negotiating knowledge, conversation, and project discussion

occurred together with discovery activities and that the collaborative idea exchanges and activities strengthened students' learning.

Na-songkhla's (2011) study on professional development using e-learning and online communities followed 97 staff members who participated in a hybrid training program named *Essential English for Work* for twelve weeks. To encourage lifelong learning among staff, management supported daily study time during work hours, post-training certificates, and pathways to salary promotion. The twelve-week English language program consisted of three hours of face-to-face class time every three weeks in addition to nine weeks of online learning. The program combined elements of face-to-face and online activities in learning, social interaction, review, assessment, evaluation, and feedback. Eight online English-language mentors provided support for the participants during the entire twelve-week period. The social network environment and online mentors provided intellectual support, fostered idea and knowledge exchange, and strengthened the participants' motivation. Post-training assessments and course evaluations showed high learning achievement, while the participants themselves appreciated the social support and acknowledged the importance of continued learning.

Strong learning outcomes were also observed in Mesh's (2010) study of the University of Siena's Language Center's hybrid English language courses in which 297 adult professional learned general English, as well as intermediate and advanced medical English between April 2008 and June 2009. The course structures included online and classroom instruction to enhance writing, reading and speaking skills, and two four-hour written exams. Using Moodle, the online teacher and students interacted through written communications in the target language, a wiki facilitated peer critique and idea exchange, and blogs facilitated reflective writings in the target language. The learners gained

confidence, helped each other learn, and exchanged constructive critique. Most participants successfully completed their hybrid courses: 92% passed the final exam in basic English, 85% in intermediate English, and 91% in advanced English.

Hole-in-the-Wall Experiment: Communal Learning

A recent study designed by Mitra and Dangwal (2010) enlisted a computer from Hole-in-the-Wall, an organization which provides computer-based learning resources to very poor and remote rural students without adequate school support in India, Cambodia, and Africa. In India's remote village of Kalikuppam where schooling was limited, the authors set up a communal computer loaded with English-language instructional content in molecular biology as an information source and learning device. The researchers then invited 34 native Tamil-speaking children between the ages of 10 and 14 years to with the informal exhortation to *look at* the materials without formally asking them to learn and enlisted education-friendly adults as facilitators. The authors noted that the content-rich communal computer paired with encouragement to explore the content had harnessed the human tendency to explore and seek knowledge. The experiment ultimately wrought learning outcomes on par with those of schools with full curricular offerings: In their conversations with the children in the study, the researchers observed that the students had made conceptual connections between the curricular content and the purpose of the infection-fighting hygiene products which they saw advertised. The study was primarily designed as an experiment for delivering education to remote rural populations, and the study's children achieved learning outcomes comparable with those of structured schools with biology curricula. The researchers also noted that the children in the study spontaneously organized into small collaborative study groups. As the students spontaneously organized themselves into four- to five-member study groups,

they worked collaboratively and helped each other learn. Moreover, the social interaction and collaborative learning also taught leadership and communication skills: In particular, a 14-year-old girl emerged as leader. Highly motivated to master the material and to overcome the gender-based dismissive attitudes from the boys in the study, the 14-year girl worked to master the material and she achieved superior grasp. Through helping others study, she developed superior teaching skills which helped her gain acceptance as a respected leader and teacher by the other children – including the boys – in the study.

Summary

The learning theory of constructivism strives for the learning goals of moral and ethical reasoning, social competency, informed and engaged citizenship (Dewey, 1916; MacLure & Davies, 1991), incisive thinking, inquiry, academic foundations, as well as skills and mastery (Dewey; 1897; Montessori, 1912; Steiner, 1996; Wagner, 2010). Constructivism emphasizes active learning (Bruner, 1977) and the inner work of constructing knowledge and mental maps of information by integrating new and prior knowledge (Piaget, 1929; 1977). Instructional strategies include hands-on learning activities, open-ended exploration and guided discovery, reflection, social interaction and collaborative learning, conversation and idea exchange, subtle teacher guidance, and strategically prepared intellectually stimulating learning environments (Bruner, 1977; Dewey, 1897, 1915, 1997; Montessori, 1912; von Glasersfeld, 1996; Vygotsky, 1978).

Current research documents the strategic importance of task failure as part of the learning process to help instill perseverance to mastery and self-efficacy (Dweck, 1999, 2006) and cultivate creativity, initiative, and problem-solving skills (Wagner, 2010, 2012). Work-based learning provides important hands-on practical skill-building, professional

competencies, and social skills (Charland, 2005; Huq & Gilbert, 2009). E-learning

research (Enonbun, 2010) affirms the value of interactive tools and online learning

communities in fostering idea exchange, peer critique, boosting learner confidence, and

strengthening learning outcomes which were observed both in school (Saab, van

Joolingen, and van Hout-Wolters, 2005) and professional development (Mesh, 2010; Na-

songkhla, 2011) settings. Mitra and Dangwal's (2010) Hole-in-the-Wall experiment using

an information-rich communal computer illustrates the enduring effectiveness of

intellectually stimulating learning environments (Bruner, 1977; Montessori, 1912) and

collaborative learning (Vygotsky, 1978).

CHAPTER SIX

Constructionism

Introduction and Overview

Constructionism is a learning theory derived from constructivism. Constructionist methods are rooted in constructivism's instructional strategies which emphasize active learning, social interaction and peer mentoring, and reflection. Constructionism enhances these methods with its signature element of *learning by making*: Students create tangible items related to the learning content; often the artifact creation is accompanied by peer mentoring and mutual teaching. While centered on tangible design and creations as the mechanism for knowledge immersion, the learning outcomes of deepened understanding, conceptual grasp, and higher-order cognitive and socioemotional skills for which the root theory of constructivism is noted are also notable achievements of constructionism. This chapter presents constructionism's theoretical foundations, followed by current research on constructionism in a variety of new contexts.

Constructionism: Theory and Related Research

Constructionism combines knowledge representation through learners' creation of tangible knowledge artifacts with collaborative learning activities, idea exchange, peer mentoring, and peer critique.

Microworld: Computer-Aided Knowledge Immersion

Constructionism arose during the 1960s' burgeoning of computer science and computer-aided instruction. First conceptualized by MIT mathematician, educator and

Media Laboratory founder Papert (1993) and subsequently refined (Harel & Papert, 1990; 1991), constructionism began with teaching pupils to write computer programs to illustrate mathematical principles. Papert's (1993) instructional strategies were influenced by Piaget's (1977) knowledge structures; Papert saw the computer-aided learning environment – which he termed *Microworld* – as analogous to the learner's inner work of mentally mapping and assimilating a continuous influx of new knowledge gleaned through immersive learning experiences. A subject-related *microworld* furnishes a structured framework of assumptions about the knowledge base at hand which helps guide the schoolchildren's learning through their didactic computer programming activities. Papert designed the easy-to-learn programming software Logo for use by schoolchildren to write simple computer programs designed to present and impart mathematics knowledge to each other. The students writing the programs were immersed simultaneously in computer programming and mathematics: In tandem with learning about the structural aspects of presenting and sequencing information inherent in computer programming, the students' mathematical understanding deepened from thinking through the mathematical knowledge base and how best to design the programs to represent the knowledge (Papert, 1993, 1994). Expanding these principles to a pilot project in a Boston inner-city school, then-doctoral student Harel and her mentor Papert (Harel & Papert, 1990, 1991) engaged fourth-grade students in writing Logo computer programs to teach fractions to one another. In the same pattern as Papert's (1993) initial study, the pupils gained a deeper understanding of mathematics, developed computer programming skills in an applied context, and learned interface design. In honing their abstract reasoning skills by connecting the computer program's structure with logical presentation of fractions, the students considered their intended target users and learned

how to effectively communicate with others (Harel & Papert, 1990). Building on Harel and Papert's (1991) principles of collaborative design, educators Kafai and Resnick (1996) expanded the range of subject areas and creative works. Their pupils explored biology, mathematics, and technology and their knowledge creations included computer games, robots, and textile patterns. The student interactions driven by subject research and creative collaborations provided a safe setting for idea exchanges and peer critique. Moreover, the pupils' freedom to choose subject areas of personal interest spurred their creativity and motivation; the researchers also noted that the creative activities engaged students across multiple knowledge areas and strengthened their ability to make interdisciplinary connections.

Yarnall and Kafai (1996) expanded these methods into game design and collaboration between students of different ages. Their study tasked twenty fifth-grade students with designing a computer game as a didactic tool for teaching knowledge related to the ocean environment to younger students; a group of older, more experienced students functioned as classroom consultants. The researchers examined the learning outcomes as well as the interactions between the game learners and the more experienced students serving as classroom consultants. In designing the games, the students directed considerable effort at integrating content knowledge and ensuring that their game designs reflected the science-oriented nature of the environment-related computer game. The students initially set out by discussing the science content for game inclusion, but later discussion among the learners and student-consultants shifted its focus toward programming issues to represent the knowledge and teach it to the younger pupils whom the study had designated as the end users of the didactic game. The researchers also observed intensified commitment and motivation among the students. More recently,

Baytak, Land, and Smith (2011) similarly examined interactions between students of different ages: The authors observed the older students' process of designing computer games to teach nutrition to younger children. Using the Game Maker software, ten fifth-graders were tasked with designing a computer game over an eight-week period with the end purpose of teaching nutrition to sixteen first graders. Only two of the fifth-graders had previously used Game Maker. The software included example games for the benefit of novice students, a variety of images, and a library of games which could be modified. The study examined evidence of students' nutritional science knowledge permeating their game designs, programming strategies used by the students to develop their game over time, and the role of social interaction in the students' game design. The fifth-graders' collaboration was informal and interactive, and the idea exchange led to improvements in the games' designs. Students' social interaction around game design and computer programming strategies fostered increased learning. The researchers' fact-finding interviews with the fifth-graders after the project revealed that the game designers increased their own knowledge of nutrition, planned their games' learning objectives and pathways, learned the software to design their games accordingly, and learned about teaching content knowledge to others. Two of the fifth-graders informed their young target learners of their games' objectives and provided brief instruction messages. In the process of designing a game to teach others, the older schoolchildren organized their thoughts, examined the knowledge base to determine how to best structure its presentation – an intellectual step which deepened their own understanding of the knowledge of both nutrition and computer programming as they explored the game-design software's capabilities – and learned to translate between the structures of both nutrition knowledge and the software.

Technology-Infused Mentoring of At-Risk Youths

The mentor-mentee interactions which began in the context of older students writing computer games to teach younger learners about specific subject matter were brought into technology-infused mentoring of at-risk youth: Centered on two years of field work in a community technology center, a recent study paired 36 undergraduate liberal arts students with inner-city youths (Kafai , Desai, Peppler, Chiu, & Moya, 2008): The college students served as mentors to the adolescent mentees who designed, created, and built technology projects involving graphics, animation, video, and music. The researchers analyzed over 200 field notes on the college students' mentoring interactions and conducted exit interviews with the liberal arts students on their mentoring experiences. While the adolescents grew in creativity, interdisciplinary thinking, and practical knowledge application, the work of mentoring the youths in their creations increased the college students' knowledge as peers and mentors and also made them more effective facilitators, advisors, observers, teachers, and learners in their own right. Kafai and her fellow-researchers (Kafai, Peppler, & Chapman, 2009) further systematized this technology-infused approach for mentoring at-risk urban youth: They conceptualized the Computer Clubhouse which has so far been replicated in 20 countries. Framed in peer mentoring, the Computer Clubhouse is a technology-infused learning and mentoring hub for idea exchange and collaborative activities. This mix helps build social skills and leadership ability; the youths' creations include subject-area-related computer programming and interface design, video games, digital art projects, digital stories using a variety of software, web tools, and social media.

A more complex outreach to at-risk children was implemented in a juvenile prison. Stager (2001, 2005) designed the Constructionist Learning Laboratory (CLL) and

operated it from 1999 to 2002 at the Maine Youth Center, the state prison for 230 adolescent offenders ranging 11 to 21 years of age. CLL's educational activities grouped the learners by interest areas rather than traditional age groupings. A full-time teacher and a special projects leader helped students with their knowledge-related creations. Moreover, mini tutorials and occasional week-long seminars taught by subject experts and volunteers exposed students to a wide range of topics including film-making, radio journalism, video game design, electronics, African drumming, and career preparation. Additionally, impromptu *demo visits* from subject experts and professionals in the community were regularly arranged to offer students a conduit for demonstrating their work and opportunity to explain their learning. These seminars and demo visits also benefited the teachers and project leaders who gleaned valuable professional development and insights on teaching methods. For their creations, students drew from a mix of programmable Lego components, computing technologies, microscopes, books, and woodworking supplies: Examples of students' diverse creations included an ambient-temperature-sensitive soft-drink machine, an innovative luggage conveyor belt system, and a model vehicle designed to climb 110-degree inclines. The students presented their creations and documented their learning in demo visits, visual and written documentations, and creative expressions including robots, videos, newsletters, and photojournalism. Working individually and collaboratively, the students gained teamwork and communication skills, learned perseverance to task completion, and strengthened their subject matter grasp and learned how to make interdisciplinary connections. The youthful inmates also gained confidence in their ability to conduct serious intellectual work in the mold of mathematicians, engineers, and designers.

Current Research: New and Diverse Directions

Several newer studies highlight immersion in content through contraption-building and projects centered on students' creations of knowledge-related end products.

Teacher Education: Build-a-Contraption and Reflection

A project led by education professors Beisser and Gillespie (2003) applied a combination of Papert's (1993) constructionism, Piaget's (1977) knowledge-structure building, and Vygotsky's (1978) social constructivism to 20 first-semester undergraduate education students at Drake University in Iowa. The course project combined the goals of a traditional first-year college experience course with introducing freshman-year education majors to a learning theory. The project immersed students in constructionism through instruction in the theoretical foundations rooted in Papert (1993), Piaget (1929, 1977), and Vygotsky (1978), observation and instruction in the education school's computer lab, and instruction in computer programming. The course's final exam was a "build-a-contraption" challenge consisting of a semester-long group assignment to design and build a tangible artifact. The build-a-contraption challenge tasked the undergraduates with creating a functioning item with programmable Lego pieces and Logo software with additional choices of simple raw materials on hand including household items such as clothespins, cotton balls, thumb tacks, drinking straws, balloons, plastic lids, plastic bags, and cut-out-photos from magazines. The freshmen's "create a contraption" presentations were scored on originality, flexibility in the sense of new applications of existing norms and components, thoughtfulness of design, quality of craftsmanship, group membership and teamwork, naming of the contraption and logical reasoning in explaining its workings, and imaginative presentation. Final grades were based on contraption design, computer programming in functioning and movements, challenges overcome, learning

gleaned from the project, students' effort and engagement, students' collaboration, and creativity. The assessment rubric used a Likert scale ranging from 0 (worst) to 7 (best). Students also participated in the online class discussion forum and shared digital images of their contraptions. The students built individual projects with Lego pieces as a design strategy aimed at particular problems of their choosing, shared their work with others, observed young students learning this way, and worked in the education college computer lab using Logo software in tandem with programmable Lego pieces to follow the footsteps of Papert's (1993) Logo programming work done by his young students. The education students' immersion in Papert's learning theory was accompanied by seven writing-intensive reflective papers assigned to address each of the following: each students' technological autobiography, each student's critique of two peers' autobiographies, written response to two chapters of Papert's book *Mindstorms* (1993), a theory summary of Piaget's view on how children learn, analytical feedback on two peers' theory summaries, written response to two chapters of Papert's book *Children's machine* (1994), and each student's personal learning story. The *personal learning story* assignment instructed students to describe what they learned in the class, analyze their own learning, ponder whether they were constructionist learners, whether and why (or not) college and elementary school can be taught this way. The study's authors (Beisser & Gillespie, 2003) concluded that the learning activities' elements of problem-solving, collaboration, and reflection had considerably contributed to the undergraduates' metacognitive growth, as noted in the depth of thought exhibited in their students' essays.

Project-Based Learning as Subject Immersion Strategy

Geography learning through creation of human rights exhibits was the centerpiece of a study by Grant and Branch (2005) on the interactions between the learner and

learning environment as evidenced by the students' country-specific project creations. The study's authors selected five participants from among 61 eighth-grade geography students in a small private day school in the Southeastern US. They restructured the lessons from clusters based on world regions to topic clusters including population, famine, conflicts, and human rights. Textbooks were replaced with laptops linked to geography internet resources to encourage exploration. The researchers assigned students the open-ended task of creating an exhibit on their study of human rights in their respective countries of focus. The open-ended nature of the assignment encouraged students to inquire deeply into their topics, which contributed to their increased grasp of interconnections otherwise easily missed in modes of study where learning focus is compartmentalized to one country at a time and provides no opportunity to examine connecting threads. Students were creative in deciding how to design and structure their displays based on the breadth of materials, knowledge, and skills at the students' disposal. However, the authors noted several limitations in learning outcomes: First, the focused nature of the human-rights-specific assignment forced students to edit out considerable amounts of learning from their final projects. Second, the students' interdisciplinary reasoning was weaker than anticipated; for example, the students did not see the mathematical undercurrents of geography. Third, the students were unaware of their metacognitive processes and were unable to recognize how their own interests and skills contributed to the success of their completed projects – limitations attributed to the assignment's tight focus which confined the scope of students' exploration.

A British initiative to instruct children in the principles of citizenship took a constructionist approach to instilling the knowledge. Howe and Covell (2009) aimed to raise students' awareness of civic engagement and informed citizenship. The project was

designed to immerse the students in designing their own charter of school conduct. In the

process, the students were instructed to follow the format of the United Nations

Declaration of the Rights of the Child. Naming the initiative *Rights, Respect,*

Responsibility, or *RRR*, helped orient the students' work. Because the citizenship

project's starting point hinged on children's rights, the pupils were able to directly relate

the project to their own lives and to their individual feelings. The pupils could also

logically relate the project to the interactions in their personal lives, their school

interactions with each other, and to their burgeoning efforts to negotiate life in the

outside world. The students used their child-life perspectives as a guide and the UN

Declaration of the Rights of the Child as source of information and example of structure

for writing their document. By thinking through the implications of individual rights and

social responsibility through the lens of their own lives, the students found direct

relevance in the UN Declaration of the Rights of the Child and internalized the values

and conduct necessary for societal preservation of individual rights and social

responsibility. Employing this perspective honed the pupils' moral reasoning and

awareness of these citizenship principles' implications on individual lives: The pupils

produced a well-thought-through charter of school conduct, and they learned the rights

and duties of citizenship in the process.

Similarly, business professors Willey and Burke (2011) designed a class project

of creating a code of conduct as a conduit for teaching business ethics to college students.

The forty undergraduate students in a senior-level Business Ethics and Corporate

Responsibility course were tasked with the course project of developing a formal *Student*

Code of Professional Conduct. The participating majors in business administration,

accounting, and communication brought a variety of perspectives but limited professional

work experience. The class project therefore aimed at raising students' awareness of ethics by building on perspectives already familiar to them. The course assignment entailed the creation of guidelines conducive to a professional learning environment considering classroom etiquette, professionalism, and responsibility. In light of the undergraduates' limited experience in workplace settings, the project set out to build connections between the course participants' current obligations as students and their future obligations as professionals. Another goal was teaching them the ethical dimensions of decisionmaking and the importance of ethics in business and integrity in their daily lives. The course was segmented into lecture, discussion of student research and group work, and online work consisting of online quizzes and discussion board postings. Students were randomly assigned to workgroups. Within the workgroups, students inventoried their members' skills and divided up tasks accordingly, then gathered information by researching business codes of ethics, profession-specific codes of ethics, and university rules which they used as source material for ideas. They also incorporated material from lectures and readings and considered their own experiences and observations – such as, for example, complaints about the lack of decorum in modern society – in crafting a document to capture the dimensions of behaviors' impacts on group standards and on the experiences of individuals in the behaviors' paths. The document's chosen structure eventually included professional conduct in general terms, freedom of opinion, classroom conduct, academic honesty, advising, privacy and confidentiality, use of technology, community and the world, as well as sustainability and the environment. Students worked together in their groups, negotiating differences of opinion and using online collaboration tools for idea exchange and uploading project files. A formal *Work Group Evaluation* provided a mechanism for critiquing each other's

participation and contributions, thus helping hold each individual group member accountable. The students also worked cooperatively as a component of the entire class. In considering the ethical implications of their duties to their on- and off-campus communities, the students reflected upon their rights as individuals and from there extrapolated to their rights and duties as future professionals in work environments. They learned that conducting business is centered on people and the ability to work together. The *Student Code of Professional Conduct* project immersed the students in applying ethical principles to decisionmaking in matters of concern to students from which they extrapolated appropriate ethical business conduct.

Summary

Constructionism developed during the 1960s' early growth of computer science and computer-aided instruction (Papert, 1993, 1994) and began with teaching pupils computer programming (Harel & Papert, 1991) and game design (Baytak, Land, & Smith, 2011; Kafai & Resnick, 1996; Yarnall & Kafai, 1996) as a tool for teaching mathematical and scientific subjects, later branching out to broader ranges of creative works (Beisser & Gillespie, 2003; Grant & Branch, 2005; Stager, 2001, 2005).

Constructionism's emphasis on knowledge representation is rooted in Piaget's (1929, 1977) knowledge structures; learners' creation of tangible knowledge artifacts is rooted in Dewey's (1997) experiential learning. Its signature collaborative learning activities (Kafai , Desai, Peppler, Chiu, & Moya, 2008; Kafai, Peppler, & Chapman, 2009) are rooted in Vygotsky's (1978) social constructivism: Peer critique and peer mentoring, demonstrating knowledge artifacts to fellow-students foster communication skills while also helping cultivate knowledge and skill mastery (Stager, 2001, 2005).

CHAPTER SEVEN

Constructivism and Constructionism in Action: Current Practice and Core Tenets

Introduction and Overview

Constructivism and constructionism as described in the two preceding chapters permeate a variety of current instructional strategies. These learning theories also infuse several current initiatives designed to deepen learning and to help mitigate harmful life circumstances' detrimental effects on learning. This chapter presents current instructional approaches rooted in constructivism and constructionism, a survey of current initiatives rooted in these learning theories, and distills from constructivism and constructionism seven core components for further application.

Constructivist and Constructionist Legacies: Current Instructional Approaches

The Flipped Classroom

The flipped classroom reverses the standard model of teachers' classroom lectures to passive students and after-school homework and problem working (Mok, 2014): The after-school and at-home time is devoted to lectures and course readings, viewing of streaming lectures and instructional videos, and reading of print and online materials. Then instead of lecture, classroom time is used for active-learning strategies including problem-working, practical-content-related hands-on work, and student presentations. The teacher thus ascertains students' understanding and is present to intervene with corrective instruction and guidance to help students understand the material rather than struggle outside the classroom without the necessary academic

assistance and expert supervision (Roehl, Reddy, & Shannon, 2013; Vaughan, 2014). Increasingly implemented in settings as varied as mathematics class in a Fort Mill middle school (Southmayd, 2014) as well as college courses in computer systems (Davies, Dean, & Ball, 2013), history (Gaughan, 2014), and teacher education (Vaughan, 2014), the flipped classroom fosters purposeful hands-on learning and reflection, the social element of collaboration and mutual help, as well as strategic teacher guidance and learning environments designed to engage students in the knowledge base.

Case-Based Learning: Projects and Problem-Solving

Project-based learning and problem-based learning are designed to immerse students in the targeted knowledge base and thereby foster deep understanding of the knowledge and how to apply it to a variety of practical settings beyond the learning environment (Hung, 2013). Students also learn the important skill of self-regulation in the process of delving into the content knowledge with teacher guidance and persistence toward project completion (English & Kitstantas, 2013). Project-based learning engages students in the design and completion of a project tailored to an intended learning outcome. Projects are an integral part of the curriculum for developing students' perseverance and awareness of their learning progress (Grant & Branch, 2005; Tamim & Grant, 2013). Inquiry, discovery, perseverance in exploration and hands-on project completion strengthen critical thinking skills and promote a deeper understanding of the knowledge base (Krauss & Boss, 2013). Problem-based learning is designed around solving a particular problem. Students' active knowledge pursuit is applied to creating a solution to the stated problem, whereby students develop problem-solving skills (Hmelo-Silver, 2013). Learning is also cemented in collaborative learning where group creativity congeals around the problem-related research (West, Williams, & Williams, 2013).

Service Learning

Service learning connects the hands-on learning activities, inquiry, exploration, and deeper engagement with the knowledge base. Service learning enhances awareness of local and faraway issues and needs by linking theoretical knowledge and tools learned in the classroom to exploration and practical knowledge application in form of community service (Garcia & Longo, 2013). Ng's (2013) study of service learning in science education found that service organizations and the targeted populations they serve benefit from the students' practical work of contributing to the agencies' mission and from the students' application of knowledge and research to the concerns addressed by the service agencies. Concurrently, the students benefit as they see their knowledge and course-related research in practical application to real-world needs. Reflective writing and documentation assignments provide structure for examining the links between theory and application. Assessment of service-learning outcomes is built upon linking the activities and purposeful academic assignments (McDonald, 2012): By reflecting upon their observations of the needs addressed by the service organizations, how their work benefits the service agents and their clients, and how the observed needs inform their studies, students gain a deeper understanding of practical application of knowledge and see the real-world impact of their growing expertise.

Place-Based Education

Place-based education is a response to the overly abstract nature of classroom-based instruction and is centered on the premise of making meaningful connections between the curriculum and practical aspects within the students' home locations (Smith & Sobel, 2013; Sobel, 2006): Local landscapes, nature characteristics, historical sites, and ongoing community projects and concerns are harnessed as a real-life learning

backdrop. Field trips to local mountains, woodlands, beaches, riverbanks, glacial landscapes, and other local natural features, teacher-encouraged examination of local plant and animal life brings biology and geography learning to life as students see concrete examples of the studied concepts. Relating school projects to current community issues by, for example, applying biology knowledge and research to addressing invasive species or developing business concepts around existing community needs serve the students through deepened learning and assist the communities through students' intellectual engagement in meeting a tangible need, thereby forging stronger community bonds and fortifying students' appreciation for their local area environments.

Farm-Based Education

Farm-based education takes concrete hands-on learning to the specialized environment of the farm where students learn the science behind crops, animal husbandry, farm management and production methods, and connections between farm and food (Chen, 2010): Similarly to place-based education, farm-based education immerses students in hands-on learning through practical farm work along with lessons on the science behind the work. Students see first-hand food production, agriculture, and nature-based food sources; through participating in guided farm activities, they develop hands-on skills and awareness of the intricacies of ecosystems ("Chicago students visit the farm", 2008; Graham, 2012). Knowledge transfer is strengthened through students' hands-on activities side-by-side with those on the farm and students develop mentoring relationships with farm residents. In addition to imparting a variety of science, agriculture, and environmental knowledge, immersive farm-based learning also connects the students with their regional heritage and culture (Chen, 2010; Simescu, 2009). Examples of farm-based education include Kellogg Farm, a Chicago-area pig farm where

students see both birthing piglets and an on-site pork-production facility ("Chicago students visit the farm", 2008) and a week-long farm camp at Broadturn Farm in Scarborough, Maine where students tend to chickens and learn about agricultural sciences and sources of fresh food (Graham, 2012). The U.S. Virgin Islands Youth Heritage Farm Excursion, a year-round youth training program in agricultural sciences and naturalist arts teaches hands-on skills and also connects the island residents with their heritage and culture (Simescu, 2009).

Outdoor and Nature-Based Education

Louv (2005, 2012) and Weston (2009) note the importance of outdoor activities to cognitive and socioemotional development. Educators emphasize principles in nature-based learning to hone observational and cognitive skills (Chen, 2010; Krodel, 2003), curricular approaches to integrating nature-based education (Gray & Martin, 2012), practical details (Bowden, 1989; Meier & Sisk-Hilton, 2013), and place-based opportunities for nature education in students' home communities (Fleming, 2012; Sobel, 2006) to help guide educations in putting nature-based and outdoor education into action. Outdoor and nature-based education offer structured education through hands-on projects and informal learning through hiking and exploring ("Outdoor education", 2012): Exposure to natural environments provides open-air laboratories for the study and teaching of a wide-range of nature-related topics including ecology, biology, botany, photosynthesis, food plants, agriculture, soil science, animal sciences, seasonal outdoor safety, and art. Students learn hands-on by taking and analyzing soil and water samples; informal teaching methods include content-related conversations, we well as songs and dances related to the nature scenes to pique younger children's interest and strengthen their observational skills. Nature functions as an outdoor learning lab conducive to a mix

of problem-based learning, purposeful hands-on activities, exploration and inquiry, interaction and collaboration, and idea exchange. These exposures increase students' observational skills, contribute to boosting cognitive skills, increase social and collaborative skills, hone the skill of perseverance to task completion, and strengthen pupils' understanding of nature, food sources, and ecological interconnections.

<div style="text-align:center">Current Constructivist Initiatives</div>

Several noteworthy interventions for at-risk schoolchildren are rooted in constructivist principles. Three such initiatives are showcased below.

SEED School: Boarding School as Safe Haven and Academic Boot Camp

Washington D.C.'s SEED School is the nation's only public boarding school and is located in Greenway, a blighted urban neighborhood in Anacostia, a high-poverty, high-crime area of Washington, D.C. ("SEED Public Charter School", 2009): Designed as a college preparatory boarding school, this school serves seventh- through twelfth-graders; students live in its dorms Monday through Friday and spend weekends with their families. Many of the students' single-parent home lives are marred by high poverty, family dysfunction, neighborhood violence, and lack of guidance and role models for constructive adult participation in society. The SEED School's instruction emphasizes academic rigor and integrity, study skills, and high expectations – facets encountered by many of its students for the first time in their lives. During the week of boarding, after-hours residential Life Skills Coordinators help the students with their homework, teach them life skills including individual personal cleanliness and grooming, tidiness in maintaining their living spaces, respectfulness in their shared dorm rooms, as well as social skills in their interactions and collaborations in and out of the classroom.

Interactions and collaborations, as well as emphasis on academic integrity foster self-discipline and perseverance. Standards of conduct therefore teach the boarding school students mutual respect and consideration; students grow emotionally and intellectually (Whitman, 2008). The mutually reinforcing tenets of academic rigor and safe living environment during the entire week provide the SEED students prolonged exposure to the principles of success in education and in life as their horizons expand from short-term survival to long-term planning for college and fruitful lives as adults (Wingert, 2004).

Urban Preparatory Academy: Young Men, Formality, and Academic Rigor

Urban Preparatory Academy, the nation's first all male public charter school, is an inner-city school for boys in the South Side of Chicago modeled after private preparatory academies (Ellis, 2010). Similarly to Washington, DC's SEED School, Urban Prep is designed on the premise that environments influence learning and behavior and that values are imparted through environments of high standards (Igbinedion, 2010). King (2011), the school's headmaster, explains Urban Prep's strategies for mitigating the effects of its pupils' blighted and dangerous neighborhood: The Englewood neighborhood which surrounds Urban Prep is troubled with drugs, poverty, high crime, single-mother-led households. As a strategy to combat the erosive influences of the neighborhood's troubles on its schoolchildren, Urban Prep established a culture of high expectations and standards: students wear uniform shirts, ties, and school blazers; students are addressed formally by surname. Faculty and staff serve as positive role models in the students' lives by establishing trust and respect. The school's *Swords and Shields* approach uses the analogy of *swords* for academic content knowledge and solid skills. Many of the students need remediation and work in intensive writing and teachers help fill in the knowledge gaps by leading students from their present knowledge to

higher levels. The teachers must be adept at assessing strengths and weaknesses in students' knowledge in order to tailor meaningful individualized catch-up strategies. The *shields* symbolize psychoemotional strengthening and coping skills – many of the students must overcome dysfunctional home lives, traumatic experiences, hunger, violence, and abandonment. Through trust and conversation, school faculty and staff help students develop a well-rounded and positive sense of self, as well as an ability to reflect on their life trajectories in a positive way (Banchero, 2010). The school's environment is designed for both academic and intellectual development and socioemotional strengthening of the students (Igbinedion, 2010; King, 2011). College acceptance rates are high, as students successfully internalize high academic standards, perseverance, and long-term goal-setting (Paulson, 2010; Williams, 2010).

Harlem Children's Zone: Academic Excellence, Teaching Parents Life Skills

The Harlem Children's Zone is a charter school in New York's Harlem neighborhood and shares the SEED School's and Urban Prep's sense of mission to close the achievement gap between high-income and low-income children and to provide children from high-poverty, blighted urban neighborhoods with academically rigorous education and a solid foundation of life skills. Tough (2008) describes the Harlem Children's Zone's multi-prong strategy combining academic rigor and parents' life skills including understanding of young children's developmental needs. The Harlem Children's Zone's underlying philosophy that environment influences learning permeates its strategy of incorporating the teaching of life skills to parents of at-risk children in its intake area in New York's Harlem neighborhood. The Harlem Children's Zone serves poor children whose dysfunctional homes do not provide support structures or teach values, respect and etiquette, work habits and perseverance, study skills, and habits of

mind. The children also come to school lacking exposure to family brainstorming on how to plan their lives: Their home lives have not conditioned them for aspirations, and they have not been taught how to set goals for themselves. The environment of the Harlem Children's Zone fills this void by focusing on behavior and high expectations, paired with high academic standards and rigorous content. Its design also takes a community education approach by engaging both the students and the parents in order to improve the children's home lives. In school, pupils learn study skills and goal formulation, perseverance, and success habits through rigorous discipline, order, and a climate of high expectations. This climate of high expectations instills in the children values of work ethic, perseverance, pursuit of excellence, and love of learning – conditioning designed to build foundations for learning. As the students' consciousness rises above short-term survival and crisis mode to long-term planning, they begin to see learning in the context of broader life trajectories. The pupils grow to see the value of learning and applying themselves as they learn to connect their school days with the broader context of life's long-range path. The Harlem Children's Zone also targets the improvement of the schoolchildren's lives beyond school by teaching their parents life skills including parenting, nutrition, reading, and teaching them to view their children as human beings to be continually developed through after-school at-home intellectual engagements. An additional outreach to parents is *Baby College*. This community education initiative instructs parents in babies' developmental needs. Baby College also instructs parents in attentiveness toward their babies for their intellectual growth through reading and conversation in order to boost the babies' vocabularies and cognitive growth. According to Kirp (2010) and McLester (2011), these combined measures successfully boost the pupils' academic achievement and socioemotional development.

Current Constructionist Initiatives

Noteworthy initiatives for at-risk populations are built on constructionism's signature approach of *learning by making*. Two examples are showcased below.

Little Black Pearl: Students Learn Creative and Business Skills in a Cultural Refuge

Little Black Pearl Art and Design Academy, located in Chicago's Kenwood/Oakland neighborhood, is an arts-centered public high school in Chicago designed around arts, design, creative writing (Phillips, 2014). Originally founded in 1994 as a community arts center for at-risk schoolchildren (Benson, 2004; Griffin, 2002) with the mission of providing an artistic and cultural refuge for children set back by the effects of neighborhood blight (Reed-Woodward, 2008), Little Black Pearl teaches students the business and creative sides of art and how to present themselves as professionals (Trice, 2012). The range of instruction includes creative writing, technology including gaming and animation, music, and a variety of visual arts including photography, painting, and glassblowing; its glassblowing studio is one of Chicago's two. The pupils work through neighborhood traumas through creative writings, art, and designs in numerous media (Phillips, 2014). Students develop perseverance through artistic creative work in the studio and learn business skills related to marketing their works in gallery-hosted art shows and the school's shop: Pupils receive course packets containing play money, credit cards, and checks to help them learn budgeting. Students also learn broader business, planning and organizing, and negotiating skills through the student-managed *Kid Biz Expo* where students sell their artistic creations (Benson, 2004). The hands-on arts-centered approach imparts creative and practical skills, socioemotional growth, and keeps students motivated (Phillips, 2014).

Silver State Industries: Nevada Prisoners Apprentice in Restoring Vintage Cars

Silver State Industries, an intervention aimed at adults, is a prison work program in Nevada which teaches inmates how to restore vintage cars and employs them in this craft (Millman, 2011): Through this hands-on training program, participating prison inmates learn a skilled trade with high niche demand. The success of this program is rooted in its combination of intellectual challenge and the prestige of a highly valued niche skill. The rehabilitation program's elements include hands-on work, immersion in the métier and the knowledge inherent in the craft consisting of artistry, materials, as well as structural and mechanical aspects of cars. Collaboration also factors strongly in the process of rebuilding antique cars: Social interaction and peer collaboration centered on the knowledge base and skill areas strengthens the individuals' restoration expertise and hone their teamwork and social skills. The program instills values such as work ethic, perseverance, attention to quality and artistry, and continued learning. As an outcome of the Silver State Industries program, inmates gain pride in workmanship, self-respect, and a viable in-demand skill.

Seven Core Tenets Distilled from Constructivism and Constructionism

Core tenets focus on educating the whole person and the learner's inner work of constructing meaning through guided discovery, intellectual stimulation, and interaction.
The Whole Person: Character, Cognition, Psyche, Intellect

Educating the whole person encompasses fitness for society (Montessori, 1912), informed and engaged citizenship (Dewey, 1916), and full economic participation through viable skills (Dewey, 1915): Skill goals span academic foundations, skills and mastery (Dewey, 1897; Montessori, 1912), a spirit of inquiry and imagination (Gerver &

Robinson, 2010; Wagner, 2010), self-discipline and perseverance (Dweck, 2006;

Montessori, 1912), social and collaborative skills (Gerver & Robinson, 2010; Vygotsky,

1978), civic engagement (Dewey, 1916) and moral reasoning (Steiner 1996).

Knowledge Structures: Integrating New and Prior Knowledge

Learners take an active role in the inner work of making sense of new information

and constructing meaning from encountered knowledge (Dewey, 1997; Montessori,

1912; Piaget, 1929). Learners continually absorb and examine new knowledge,

assimilating the new information either by integrating the new with the old or by

determining the old as obsolete and replacing the old with the new. Learners thus

continually rebalance their overall mental construct of knowledge and their conception of

the world (Piaget, 1977). This inner work of knowledge management comprises learners'

cognitive-structural efforts of identifying and evaluating existing knowledge and learning

tasks, information-seeking, organizing knowledge in a cohesive mental map of

conceptual interrelations, applying the newly integrated knowledge (Dhindsa, Makarimi-

Kasim, & Anderson, 2011; Tergan, Gräber, & Neumann, 2006), and drawing upon prior

knowledge to make sense of new information (Bisland, 2008).

Strategically Prepared Learning Environments

Intellectually stimulating learning environments such as Montessori's child-

friendly furniture, didactic materials, indoor and outdoor learning spaces (Montessori,

1912), tutorial gardens (Froebel, 1895), computer-based learning resources (Mitra &

Dangwal, 2010; Grant & Branch, 2005), and thoughtfully prepared virtual spaces with

online knowledge resources, assessment and evaluation mechanisms, and interactive

tools (Almala, 2006; Chapman, Ramondt, & Smiley, 2005; Enonbun, 2010) create an

atmosphere of learning and appeal to the human instinct to explore, interact, and learn.

Classroom visits from experts and mentors provide learners with practical perspectives and opportunities to communicate ideas and knowledge (Stager, 2001, 2005).

Setting the tone and standards for conduct is equally important. Learners' confidence and mastery are cultivated in a climate of acceptance (Montessori, 1912; Steiner, 1996) and accountability for individual effort and conduct (Beisser & Gillespie, 2003; Dweck, 1999, 2006; Montessori, 1912; Willey & Burke, 2011; Zhang, 2012). Buttressing mechanisms such as academic boot camp, teaching success strategies, and teaching life skills to pupils' parents help provide support for overcoming impediments outside of learners' classrooms (King, 2011; Montessori, 1912; Whitehurst & Croft, 2010; Whitman, 2008).

The Teacher: Expert Guide and Subtle Facilitator

As facilitator of students' individual and collaborative active knowledge-seeking, the teacher subtly guides students by astutely observing learning progress and needs (Montessori, 1912), conversation (Bruner, 1977; dePierro, Garafalo, & Toomey, 2003; von Glasersfeld, 1996) and questioning (Piaget, 1929) to ascertain students' existing understanding and advance their learning (Bruner, 1977), steering students toward learning tasks aimed at honing weak areas (Nikirk, 2012), and strategic guidance toward higher levels of understanding (Dewey, 1897; Montessori, 1912; Vygotsky, 1978). The teacher also sets a tone of acceptance (Steiner, 1996) and accountability (Beisser & Gillespie, 2003) by encouraging individual effort and persistence to develop knowledge and skill mastery (Dweck, 1999, 2006; Montessori, 1912; Wagner, 2010, 2012).

Experiential Learning: Doing, Discovery, Making

Cumulative experiences in and beyond the classroom continually augment and reorganize learners' mental maps of knowledge and understanding (Dewey, 1916, 1997).

Experiential learning emphasizes purposeful hands-on educative activities, open-ended discovery through exploration and observation (Bruner, 1977; Cetrone, 2011; Froebel, 1895; Montessori, 1912; Nikirk, 2012), individualized personal learning contracts as discovery avenues within established course objectives (Chng & Coombs, 2004), and creation of tangible artifacts related to the knowledge content. Example of tangible creations include contraption design related to curricular content (Beisser & Gillespie, 2013; Stager, 2001, 2005) and historical items' physical restoration (Millman, 2011), didactic computer programs (Harel & Papert, 1991; Kafai & Resnick, 1996; Papert, 1993) and games (Baytak, Land, & Smith, 2011; Yarnall & Kafai, 1996); as well as themed displays (Grant & Branch, 2005), creative multimedia expressions (Kafai , Desai, Peppler, Chiu, & Moya, 2008), and works of art and creative writing (Phillips, 2014).

Social Interaction and Collaborative Learning

Learning is influenced by others' ideas (Piaget, 1929), culture and social environment, interaction with more knowledgeable peers, and strategic guidance from teachers (Bruner, 1977; Vygotsky, 1978), social interaction and collaboration, conversation (dePierro, Garafalo, & Toomey, 2003; Mercer & Hodgkinson, 2008; von Glasersfeld, 1996), the combination of sharing ideas and negotiating divergent perspectives, critiquing each other's work, and helping each other learn (Harel & Papert, 1991; Mitra & Dangwal, 2010; Stager, 2001, 2005), learning from more knowledgeable peers such as teachers (Bruner, 1977; Vygotsky, 1978), field experts (Nikirk, 2012; Stager, 2001, 2005) and more advanced students (Baytak, Land, & Smith, 2011; Yarnall & Kafai, 1996), as well as peer mentoring and serving as mentors (Kafai , Desai, Peppler, Chiu, & Moya, 2008; Kafai, Peppler, & Chapman, 2009) – tenets equally powerful in online learning communities (Chng & Coombs, 2004; Mesh, 2010; Na-songkhla, 2011).

Reflection: Making Sense of Encountered Knowledge

Related to learners' building of knowledge structures, reflection is an inner work of processing encountered knowledge and experiences (Garcia & Longo, 2013; McDonald, 2012; Smith, Clegg, Lawrence, & Todd, 2007). Reflection built into instructional strategies encourages students to mentally process their learning. Students reflect in the process of creating knowledge artifacts as they work through the intellectual process of pondering how to best represent a given subject matter as they deliberate on the meanings and interrelations of numerous relevant knowledge areas (Baytak, Land, & Smith, 2011; Harel & Papert, 1991; Howe & Covell, 2009; Willey & Burke, 2011). Reflection also occurs through students' thoughtful documentation of their learning through various communications including reflective writings (Beisser & Gillespie, 2003), demonstration of their creations (Stager, 2001, 2005), social media, filmmaking, exhibits, and creative expressions (Kafai , Desai, Peppler, Chiu, & Moya, 2008), and creating charter documents as a tangible product of pondering the implications of the knowledge base studied (Howe & Covell, 2009; Willey & Burke, 2011).

Summary

Current instructional methods based on constructivism and constructionism include the flipped classroom (Roehl, Reddy, & Shannon, 2013), project-based (Tamim & Grant, 2013) and problem-based learning (Hmelo-Silver, 2013), service learning (Garcia & Longo, 2013), place-based (Smith & Sobel, 2013), farm-based (Graham, 2012), nature-based (Fleming, 2012), and outdoor education (Gray & Martin, 2012).

Current constructivist interventions to mitigate inner-city children's risk factors include Washington, D.C.'s SEED School, a week-day boarding school (Whitman,

2008), Chicago's Urban Preparatory Academy, an all-male inner-city charter school modeled after private preparatory academies (King, 2011) and the Harlem Children's Zone, a charter school combining academic rigor and teaching life skills to parents (Tough, 2008). Among constructionist examples, Chicago's Little Black Pearl Art and Design Academy teaches creative, practical, and socioemotional skills through the arts (Phillips, 2014); Nevada's Silver State Industries teaches prisoners the skilled work of restoring vintage cars and instills pride of workmanship (Millman, 2011).

The seven core tenets distilled for further application are: *The whole person* (Dewey, 1897; Gerver & Robinson, 2010; Montessori, 1912; Steiner, 1996; Wagner, 2010), *knowledge structures* (Montessori, 1912; Piaget, 1929, 1977), *strategically prepared learning environments* (Montessori, 1912; King, 2011; Mitra & Dangwal, 2010), *the teacher as expert guide and subtle facilitator* (Montessori, 1912; Nikirk, 2012), *experiential learning* (Bruner, 1977; Cetrone, 2011; Chng & Coombs, 2004; Dewey, 1997), *social interaction and collaborative learning* (Mesh, 2012; Na-songkhla, 2011; Vygotsky, 1978), and *reflection* (Howe & Covell, 2009; Smith, Clegg, Lawrence, & Todd, 2007; Willey & Burke, 2011).

CHAPTER EIGHT

The Application of Constructivism and Constructionism to Work-Related Training in Service of Enhancing Human Capital Formation in Postsecondary Education Settings

Introduction and Overview

The present investigation was designed to answer the question, "What components of constructivism and constructionism might be logically applied to work-related training in the service of enhancing human capital formation in postsecondary education settings in the United States?" The results of the critical analysis of theory and current research suggest seven core elements of constructivism and constructionism which are especially compatible with postsecondary work preparation: The aim to develop the whole person across cognitive and affective realms, learners' inner work of building knowledge structures, strategically prepared learning environments, the teacher as expert guide and subtle facilitator, experiential learning, social interaction and collaborative learning, and reflection. Together these components immerse learners in a mix of purposeful educative activities, interactions, and exposures to real-world settings with practical skill applications conducive to career competencies and skill mastery.

Human Capital, Constructivism, and Constructionism

Theory and current research affirm the importance of knowledge and skills to the economic and social health of nations (Becker, 1994; Schwab & Sala-i-Martín, 2013), sound functioning of organizations (Hansson, 2009; Manpower Group, 2013), and to individuals' full economic participation and social inclusion (Carnevale, Rose, & Cheah, 2011; Carnevale, Rose, & Hanson, 2012; Iranzo & Peri, 2009; Montessori, 1912).

Solid education and skill-development strategies and commitments are key determinants of achieving vibrant high-skill / high-income economies (Hansson, 2009) or settling into low-skill / low-wage economies marked by decline and obsolescence (Lacy & Stone, 2009). While economic fortunes of countries worldwide rise and fall with skill levels available in the population (Onsomu, Ngware, & Manda, 2010; Ramcharan, 2004; Schwab & Sala-i-Martín, 2013), economic and societal soundness in the United States is similarly tied to meaningful cultivation of skills conducive to advancing innovation (*Critical Skills Survey*, 2010, 2012; SHRM, 2008; Wagner, 2010) and enabling individuals to earn life-sustaining wages (Brennan & Powell, 2010; Carnevale, Rose, & Cheah, 2011; Carnevale, Rose, & Hanson, 2012; Kuczera & Field, 2013; *A Nation at Risk*, 1983; Torraco, 2007). Because prevalence of innovation-conducive skills depends on effective cultivation of individuals' skills on a society-wide scale (OECD, 2013; Schwab & Sala-i-Martín, 2013), the learner-centered focus of constructivism (Bruner, 1977) and constructionism (Harel & Papert, 1991) is well-suited to helping individuals acquire the tangible and cognitive skills necessary for full economic participation (Gerver & Robinson, 2010; Montessori, 1912) and developing a workforce with relevant skills (Thornburg, 2012; Wagner, 2010, 2012).

Economic competitiveness research (Schwab & Sala-i-Martín, 2013) and employer surveys (Manpower Group, 2013; Nagle, 2010; SHRM, 2008) document the importance of a broad spectrum of workforce skills. Because constructivism and constructionism emphasize the cultivation of intellectual agility (Baytak, Land, & Smith, 2011; Gerver & Robinson, 2010; Kafai, Desai, Peppler, Chiu, & Moya, 2008; Kafai & Resnick, 1996; Wagner, 2010), tangible skills and their practical application (Wagner, 2012), as well as behavioral skills and values (Nagle, 2010), the application of these

learning theories is well-suited to meeting the nation's need for a relevant skill base (Hart Research Associates, 2010; Manpower Group, 2013; Wagner, 2010) and individuals' need for relevant skills to access economic opportunity (Peck, 2011).

Skill Movements in Business and Education: Applications for

Constructivism and Constructionism

This study's earlier chapter on educational perspectives on human capital formation identified four current skill movements in business and education research. These skill movements articulate the types of competencies needed for successful participation in societies and economies.

21st Century Skills

This skill movement focuses on the higher-order cognitive skills deemed crucial for success in navigating the complexities of the modern workplace and globalized world. Employers repeatedly report to the American Management Association's *Critical Skills Survey* (2010, 2012) the need for *the four C's* of critical thinking, creativity, collaboration, and communication. Education professor Wagner's (2010) *seven survival skills* encompass problem-solving and critical thinking, collaboration across networks, adaptability, initiative, effective oral and written communication, analyzing information, as well as a spirit of inquiry, imagination, and intellectual curiosity. Other education scholars (Gerver & Robinson, 2010; Robinson, 2011; Suárez-Orozco, 2007; Thornburg, 2002) concur on the importance of interdisciplinary thinking, intellectual agility, and knowledge-seeking habits of mind – skills effectively elicited through constructivist and constructionist approaches including brainstorming and idea exchange, peer mentoring and peer critique (Baytak, Land, & Smith, 2011; Kafai & Resnick, 1996; Vygotsky,

1978), conversation (DePierro, Garafalo, & Toomey, 2003; Piaget, 1929; von Glasersfeld, 1996), and collaborative projects (Beisser & Gillespie, 2003).

STEM TO STEAM

The STEM to STEAM movement argues for augmenting sciences and math education with instruction in the arts as an additional conduit for cultivating creativity. Artistic and scientific creativity complement each other through infusion of hands-on activities and discovery learning. Art hones observational skills and finesse in working with materials – skills crucial to science (Root-Bernstein & Root-Bernstein, 2013; Sousa & Pilecki, 2013) and key to educating well-rounded individuals capable of interdisciplinary learning and critical thinking (Erickson, 2013; Piro, 2010). Because constructivist and constructionist methods focus on active learning, the signature elements of hands-on creations of tangible contraptions (Beisser & Gillespie, 2003) and multimedia (Kafai, Peppler, & Chapman, 2009), content-based documents (Howe & Covell, 2009; Willey & Burke, 2011), knowledge displays (Grant & Branch, 2005), and art (Phillips, 2014) hone creativity and discernment (Gerver & Robinson, 2010).

Learning to Think, Thinking to Learn

Learning to think and thinking to learn is a two-prong movement emphasizing on one hand the ability to analyze, synthesize, ponder veracity of information, and make sense of disparate strands of information to form a cohesive whole (Maclure & Davies, 1991) and, on the other hand, emphasizing cognitive growth paired with learning and seeking out knowledge (Pohl, 2000) to elevate the intellectual tenor of society (Hutchins, 1968). These thinking and learning skills are directly supported by constructivism's and constructionism's core tenets of knowledge structures and reflection: Learners' inner work of integrating old and new knowledge (Beisser & Gillespie, 2003; Piaget, 1977) is

strengthened by reflective learning assignments designed to spur students to make sense of observations, practical assignments, and new knowledge (Beisser & Gillespie, 2003; Kafai, Desai, Peppler, Chiu, & Moya, 2008; Smith, Clegg, Lawrence, & Todd, 2007).

Employability

The employability movement is concerned with the combination of practical work skills, academic foundations and learning habits (Yorke, 2004; Yorke & Knight, 2006), as well as higher-order cognitive skills (Manpower Group, 2012, 2013) and behavioral competencies (Schneeberger, 2006). This well-rounded bevy of skills is effectively fostered by way of several constructivist and constructionist core tenets: Hands-on purposeful learning activities (Gerver & Robinson, 2010; Montessori, 1912; Wagner, 2012), collaborative learning with built-in accountability mechanisms to encourage integrity, social skills, and work ethic (Beisser & Gillespie, 2004; Zhang, 2012), as well as work-based learning (Aamodt & Haavnes, 2008; Bray, 2010) are powerful tools for imparting key skills across the spectrum of content knowledge, higher-order reasoning, social and collaborative skills, and professionalism (Huq & Gilbert, 2009).

Human Capital Best Practices: Applications for Constructivism and Constructionism

Current research suggests that the most successful human capital development strategies share elements of openness and flexibility conducive to meeting individual learners' needs – characteristics with which constructivism's and constructionism's learner-centered instructional strategies are directly compatible.

Decentralized Structures for Education and Training

The local control inherent in decentralization provides the autonomy and flexibility needed to develop context-sensitive educational strategies tailored to specific

needs in the local community (Wallenborn, 2010). The learner-centered approaches of constructivism and constructionism provide instructors with the flexibility needed to develop individual learners' weak areas through targeted learning tasks (Nikirk, 2012) and empower learners to pursue areas of individual interest within learning goals determined by curricula and local needs (Chng & Coombs, 2004; Stager, 2001, 2005).

Stakeholder Synergies

Synergies between education, industry, and community stakeholders create an ecosystem for success and skill development (Kis, 2010b) and enhance learners' career opportunities (Friend, 2010). Stakeholder synergies create meaningful idea exchange and collaboration beneficial to their local communities' workforce and economic development (Kuczera & Field, 2013; Kuczera, 2011). Such symbiotic partnerships are logically compatible with constructivism's and constructionism's design around synergistic (Nikirk, 2012) and intellectually stimulating learning environments (Bruner, 1977; Mitra & Dangwal, 2010; Montessori, 1912) and hands-on learning experiences (Dewey, 1997) with a view to developing vocational mastery (Aamodt & Havnes, 2008).

Education-Business Partnerships

Partnerships between education and industry find numerous expressions including science parks (Onsomu, Ngware, & Manda, 2010), collaborative research and development (Schwab & Sala-i-Martín, 2013), and avenues for work-based learning placements which provide students with opportunities to connect their theoretical classroom learning with practical application in real-world settings (Aamodt & Havnes, 2008; Bray, 2010; Charland, 2005; Huq & Gilbert, 2009). In a climate of open communication and idea exchange, employers articulate skill needs, while postsecondary education providers engage in ongoing dialogue with employer communities and

thoughtfully evolve curricula and instructional strategies to meet shifting needs (Kuczera, 2011). Education-industry partnerships are directly compatible with the constructivist and constructionist core tenets of social interaction (Montessori, 1912), collaborative learning and mentoring (Kafai, Desai, Peppler, Chiu, & Moya, 2008; Mitra & Dangwal, 2010), and strategic guidance from more knowledgeable peers (Bruner, 1977; Vygotsky, 1978). Classroom visitors by career-field experts as guest lecturers and mentoring relationships between practitioners in the career field and career students (Stager, 2001, 2005; Nikirk, 2012) embody these constructivist and constructionist core tenets.

Hands-on Real-World Work Training

Actual work environments provide the most effective conduit for imparting work-related skills (Yorke, 2004). By exposing students to real-world organizational situations, work-based learning cultivates practical skills, problem-solving skills, and helps learners see the connections between their practical work-placement experiences and the curricular content of their courses (Huq & Gilbert, 2009; Laughton, 2011). The core tenets of experiential learning (Baytak, Land, & Smith, 2011; Beisser & Gillespie, 2003; Dewey, 1997; Stager, 2001, 2005) and reflection upon practical work-based experiences (Smith, Clegg, Lawrence, & Todd, 2007) are directly compatible with this human capital best practice of hands-on work training in real-world settings.

Skill Rubrics as Curriculum and Training Roadmap

Defining skill needs in using occupational classifications as a guide (ILO, 2012) and inventorying existing population skills is an important step toward crafting meaningful education and training objectives and strategies, particularly in areas in need of raising their economies by way of raising population skill levels (Onsomu, Ngware, & Manda, 2010). The constructivist and constructionist tenet of educating the whole person

is compatible with this practice, as the whole-person aim guides the instructor toward goals spanning relevant knowledge foundations and mastery in practical skills (Dweck, 1999, 2006; Montessori, 1912), higher-order cognitive skills (Gerver & Robinson, 2010; Wagner, 2010), as well as behavioral skills and values such as integrity and professionalism (Beisser & Gillespie, 2003; Willey & Burke, 2011; Zhang, 2012).

Open Systems with Flexible Study and Training Pathways

Open systems with flexible study pathways (Kuczera & Field, 2013; Kuczera, 2011, Kis, 2011) and second-chance programs offering adult learners opportunities for credential completion missed earlier in life (Kis, 2010a, 2010b; Kuczera, 2010) provide important multiplicity of pathways toward building and enhancing employability skills. Constructivist and constructionist emphasis on active learning, mastery, and practical skill application is compatible with fostering learnedness and employability skills: Contructivism's spiral curriculum (Bruner, 1977) with its multiplicity of content-centered learning activities (Cetrone, 2011) and constructionism's tangible design activities (Baytak, Land, & Smith, 2011; Harel & Papert, 1991; Kafai, Peppler, & Chapman, 2009; Stager, 2001, 2005), particularly in tandem with study of related background material (Beisser & Gillespie, 2003; Howe & Covell, 2009; Willey & Burke, 2011) immerse learners in the knowledge base and provide multiple avenues toward grasping the content and acquiring the necessary knowledge.

Teachable Fit As Talent Pipeline Strategy

Business research on the importance of teachable fit affirms both the importance of in-house talent development and succession planning (Davies & Kourdi, 2010; Hansson, 2009) and of hiring candidates who may not possess the exact position-specific skills but whose background knowledge enables them to grasp the specific tasks and

whose learning mindsets and attitudes otherwise make them a good fit for the organization (Manpower Group, 2013). Constructivist and constructionist aims to develop intellectual curiosity and commitment to learning (Wagner, 2010), work ethic, integrity, and collaborative skills (Beisser & Gillespie, 2003; Zhang, 2012), perseverance in working toward skill mastery (Dweck, 1999, 2006) through open-ended discovery (Montessori, 1912; Chng & Coombs, 2004) and collaborative learning (Baytak, Land, & Smith, 2011; Beisser & Gillespie, 2003; Mitra & Dangwal, 2010; Vygotsky, 1978; Zhang, 2012) are well-suited to equipping learners with the well-rounded skills conducive to employability as a teachable fit.

Linking US Skill-Development Goals With Constructivist and Constructionist Strategies

According to the literature, educators and employers have identified key skills for employability in the United States. These high-demand competencies span across hard and soft skills (Hart Research Associates, 2010; Wagner, 2010). Reminiscent of knowledge taxonomies which categorize skills into cognitive, affective, and psychomotor domains (Bloom, 1956), the recurring themes among crucial learning outcomes broadly congeal around tangible knowledge and competencies, academic foundations and basic skills, higher-order reasoning and analysis, communication, teamwork and collaborative skills, work ethic, interpersonal skills and etiquette, and moral reasoning (*Critical Skills Survey*, 2010, 2012; Kuczera & Field, 2013; Manpower Group, 2013; Nagle, 2010). Therefore, instruction should be multifaceted to ensure avenues for cultivating vocation-specific skills and mastery without neglecting the cultivation of broader cognitive and behavioral competencies (Laughton, 2011; Smith, Clegg, Lawrence, & Todd, 2007; Gerver & Robinson, 2010).

To meet the needs of postsecondary career participants who are either preparing to enter the workforce, pursuing career advancement, retraining or upskilling to meet professional requirements or for career change (Levesque, Laird, Hensley, Choy, Cataldi, & Hudson, 2008), application of constructivist and constructionist core components is made meaningful by matching them to skill families to be developed and for translating them into activities particularly suited to developing career-relevant competencies.

Hard Skills: Content Knowledge, Tangible Competencies. Hard skills comprise content knowledge and tangible competencies (Manpower Group, 2013; Schwab & Sala-i-Martín, 2013, literacy and numeracy (OECD, 2012), and solid academic foundations (Hirsch, 1988, 2007) on which rests the capacity to learn specialized work-related competencies (Onsomu, Ngware, & Manda, 2010). Literacy and numeracy are key building blocks for the progression of learning and employability-conducive skills (Freire, 1970; Kis & Field, 2013; Preston, 2010).

Figure 3. Hard skills and instructional strategies conducive to their cultivation.

Learning tasks to hone these skills should encourage reflection through reflective writings about reading materials and hands-on learning activities, creative and multi-media learning artifacts (Beisser & Gillespie, 2003; Kafai, Desai, Peppler, Chiu, & Moya, 2008), as well as design and problem-solving projects requiring calculations and mathematical analysis (Harel & Papert, 1991; Papert, 1993; Stager, 2001, 2005).

Workplace success requires technical skills and industry-related competencies (Manpower Group, 2013) and the ability to apply theoretical knowledge in practical settings (Hart Research Associates, 2010). Internalizing of knowledge is enhanced through immersive activities (Baytak, Land, & Smith, 2011; Dewey, 1997). Because skill and mastery are developed through hands-on repetition and experiences with failure and self-correction (Dweck, 1999, 2006; Montessori, 1912; Wagner, 2012), work-related training should include skill-building tasks tied to problem-solving in order to build students' grasp of practical application in realistic settings (Beisser & Gillespie, 2003; Charland, 2005; Grant & Branch, 2005; Huq & Gilbert, 2009). Content knowledge provides not only theoretical foundations for practical vocational skills, but also the fundamental knowledge base which is key to further learning (Hirsch, 1988; Onsomu, Ngware, & Manda, 2010; Ramcharan, 2004). Therefore, lecture and study of key knowledge milestones should be complemented by individual and collaborative practical learning projects and creative design, as learners' motivation to see their finished project in fruition drives them toward in-depth study of the underlying knowledge which in turn develops their expertise needed to complete the work (Hung, 2013; Ng, 2012; Stager, 2011, 2005). Equally important are opportunities to interact with experts and mentors in the professional community in order to translate growing knowledge into practical application and professional communication (Nikirk, 2012; Stager, 2001, 2005).

Soft Skills I: Cognitive and Cultural Competencies. Higher-order cognitive skills enable more complex understanding of theoretical knowledge and work-related skills, their implications, and their practical applications (Onsomu, Ngware, & Manda, 2010). Higher-order reasoning entails inquiry and examination of underlying factors, analysis and abstract reasoning, synthesis and interdisciplinary thinking, creativity and innovative mindset, problem-solving and decision-making skills (*Critical Skills Survey*, 2010, 2012; Hart Research Associates, 2010; Nagle, 2010; Wagner, 2010).

Learning Goals:
Soft skills I: higher-order cognitive skills
- Communication
- Critical thinking
- Analysis
- Synthesis
- Interdisciplinary thinking
- Ability to apply knowledge in real-world settings
- Information literacy
- Problem-solving
- Innovation
- Creativity
- Decision-making
- Global awareness
- Cultural intelligence
- Engaged citizenship

- exploration & discovery
- hands-on learning & creative design
- collaborative learning
- peer mentoring
- project-related journaling & reflection papers
- multimedia documentation of learning & creations

Figure 4. Higher-order cognitive skills and instructional strategies conducive to their cultivation.

Because these skills require a refined capacity to grasp complexities and tie together disparate strands of thought and discrete knowledge areas across disciplinary lines, instructional strategies should include idea exchange and brainstorming, peer mentoring and peer critique (Baytak, Land, & Smith, 2011; Kafai & Resnick, 1996), questioning and conversation as a tool to spur thinking and inquiry (DePierro, Garafalo,

& Toomey, 2003; Elder & Paul, 1998; Piaget, 1929; von Glasersfeld, 1996; Vygotsky, 1978), and collaborative projects and simulations with a built-in end goal of solving a particular problem in an area spanning several disciplines (Beisser & Gillespie, 2003; Stager, 2001, 2005; Taylor, 2013; Yarnall & Kafai, 1996). Cultural competencies of importance emphasized by educators and singled out by US employers encompass cultural literacy (Hirsch, 1988), informed and engaged citizenship (Dewey, 1916; Howe & Covell, 2009), global awareness (Hart Research Associates, 2010), and cultural intelligence (Manpower Group, 2012; Nagle, 2010; Plum, Achen, Dræby, & Jensen, 2008). Because such cultural and citizenship competencies draw upon a diverse range of background knowledge and interpersonal skills, learning activities should include collaborative projects with social interaction and negotiation of divergent viewpoints (Baytak, Land, & Smith, 2011; Taylor, 2013; Vygotsky, 1978), service learning to apply knowledge toward meeting a need in the community (Garcia & Longo, 2013; Kafai , Desai, Peppler, Chiu, & Moya, 2008; Ng, 2012), as well as individual and collaborative production of creative expressions such as exhibits and displays (Grant & Branch, 2005), research-based charter documents or digital documentation surrounding cultural and citizenship topics (Howe & Covell, 2009; Willey & Burke, 2011), or creative expressions including multimedia works (Kafai, Desai, Peppler, Chiu, & Moya, 2008; Kafai, Peppler, & Chapman, 2009) and technical creations (Stager, 2001, 2005).

Soft Skills II: Professionalism and Values. Education research and employer surveys converge on the importance of behavioral skills and values encompassing individual qualities and interpersonal competencies conducive to effective social interaction. Values of integrity and ethics are at the heart of successful interactions in the workplace and broader community. Work ethic, reliability, task perseverance, quality-

consciousness, and timeliness are key skills often reported in short supply (Manpower Group, 2012, 2013; Schwab & Sala-i-Martín, 2012, 2013). Navigating complexity and change require adaptability, flexibility, agility, and a temperament suited to dealing with ambiguity (Hart Research Associates, 2010; Nagle, 2010; Wagner, 2010).

Figure 5. Character, professionalism, and instructional strategies conducive to their cultivation.

Instructional strategies for instilling these attitudes should therefore include individual and collaborative hands-on projects and tangible creation assignments with course-long completion periods designed to steer students into research and interactions in which they will encounter dead ends, changes in project focus and approaches, and negotiating ideas along the way (Baytak, Land, & Smith, 2011; Beisser & Gillespie, 2003; Harel & Papert, 1991; Kafai; Stager, 2001, 2005; Willey & Burke, 2011). Moreover, the learning environment and course structure should employ mechanisms for stressing academic integrity, holding students accountable for individual contributions, and rewarding effort

in order to spur confidence and honest effort toward mastery (Beisser & Gillespie, 2003; Dweck, 1999, 2006; Montessori, 1912). Rapid shifts in industry and knowledge require a learning mindset (Drucker, 1994; Gerver & Robinson, 2010; Manpower Group, 2012, 2013) which should be fostered through simulations requiring research on the current and historical factors driving shifts in the career field combined with reflections on adaptation strategies (Hedberg, 2009; Howe & Covell, 2009; Willey & Burke, 2011). Self-awareness and self-knowledge – valued but in short supply (Manpower Group, 2012, 2013) – should be cultivated through open-ended and guided discovery learning, creative design activities, and reflection (Beisser & Gillespie, 2003; Bruner, 1977; Harel & Papert, 1991; Hedberg, 2009; Howe & Covell, 2009; Montessori, 1912; Willey & Burke, 2011). Mindfulness of how one comes across is a key ingredient of fruitful interactions with others and building constructive workplace and customer relations (Manpower Group, 2012; Schneeberger, 2006). Social skills and the ability to collaborate are ranked highly by educators and employers alike (*Critical Skills Survey*, 2010, 2012; Gerver & Robinson, 2010; Wagner, 2010), along with leadership skills (Manpower Group, 2012, 2013). Instructional strategies aimed at imparting self-awareness and social skills should center on collaborative learning activities: Social constructivism's elements of mutual assistance, peer critique, idea exchange (Harel & Papert, 1991; Kafai , Desai, Peppler, Chiu, & Moya, 2008; Yarnall & Kafai, 1996), and negotiation of divergent views help develop communication skills (Kafai , Desai, Peppler, Chiu, & Moya, 2008), an ability to see issues from others' vantage points (Baytak, Land, & Smith, 2011), and self-assess how one comes across to others (Beisser & Gillespie, 2003; Willey & Burke, 2011). Peer mentoring fosters leadership skills and empathy with those less knowledgeable than oneself (Mitra & Dangwal, 2010; Montessori, 1912; Vygotsky, 1978).

Application of Constructivist and Constructionist Core Tenets to Work-Related Training

in Postsecondary Education Settings

The first two core tenets, the whole-person focus on developing learners across intellectual and psychosocial realms and the learner's inner work of constructing knowledge, emphasize learners' inner development and knowledge growth. These two core tenets are central to the comprehensive aims of learners' development. The next two components - the strategically prepared learning environment and the teacher as expert guide and facilitator of active learning - relate to the ecosystem needed to effectively support active learning. The remaining three core tenets - experiential learning, social interaction and collaborative learning, and reflection - comprise educative activities geared to eliciting the targeted learning outcomes in the context of postsecondary career preparation.

The Whole Person: Character, Cognition, Psyche, Intellect

The focus on the whole person provides the educator and trainer with a systematic master list of overarching learning outcomes to be cultivated. Constructivist and constructionist educational goals span across academic foundations and scholastic attainment, academic growth, mastery of tangible skills and their practical application, analytical and interdisciplinary reasoning, creativity, a spirit of inquiry and imagination, initiative, work ethic and task persistence, self-discipline and perseverance, social and collaborative skills, informed citizenship and civic engagement, and moral development (Dewey, 1915; Froebel, 1895; Gerver & Robinson, 2010; Montessori, 1912; Steiner, 1996; Wagner, 2010). This joint targeting of cognitive and intellectual growth, behavioral and social competencies, as well as moral reasoning in addition to tangible knowledge and skills is directly compatible with the hard and soft skills repeatedly

prioritized by educators and employers alike: The top ten most widely cited skill areas

are critical thinking and analytical reasoning, technical and industry-specific skills

communication, collaboration and team-building, work ethic and professionalism,

interpersonal skills and etiquette, global competency, creativity and innovation, ethics

and integrity, as well as leadership and management skills (*Closing the Gap*, 2012;

Critical Skills Survey, 2010, 2012; Hart Research Associates, 2010; Manpower Group,

2012, 2013; Nagle, 2010; Schwab & Sala-i-Martín, 2012, 2013; SHRM, 2008).
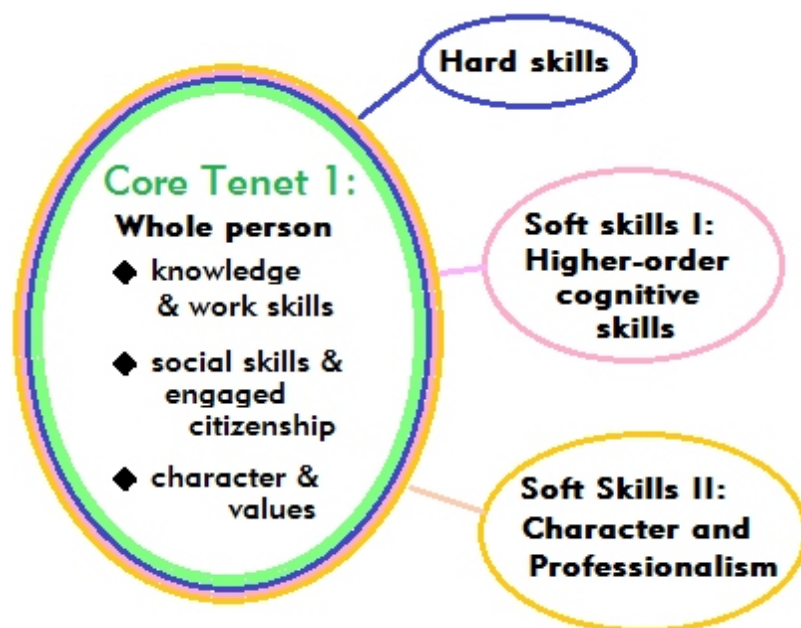
Figure 6. Core tenet 1: Educating the whole person is tied to all learning goals.

Although the spectrum of career fields and credential levels varies widely, a

shared element is career education's inherent orientation toward practical and applied

skills (Levesque, Laird, Hensley, Choy, Cataldi, & Hudson, 2008). Yet despite the

overwhelming importance of hard skills (Manpower Group, 2012, 2013), a dearth of soft

skills is a focus of growing lament in technical fields, as reflected in a recent study on IT

educational strategies to mitigate shortage of critical thinking skills, lack of

communication and people skills, and shortage of conflict resolution skills pervading the information technology field (Zhang, 2012). It is therefore recommended to raise students' social skills and collaboration, communication, and conflict resolution skills by including collaborative elements infused with idea exchange and accountability mechanisms through peer evaluation (Beisser & Gillespie, 2003; Yarnall & Kafai, 1996; Zhang, 2012). The virtues of moral reasoning and ethical decisionmaking, widely cited by educators and employers as important but lacking (Hart Research Associates, 2010; Nagle, 2010; Gerver & Robinson, 2010) should be targeted through simulations and reflective components to raise course participants' consciousness of the ethical and broader societal implications of honesty, quality, and the consequences of dishonesty and shoddiness in their professions (Baden, 2014; VanHise, Koeplin, & Whitty, 2013).

Knowledge Structures: Integrating New and Prior Knowledge

Similarly to the manner in which the whole-person aim (Montessori, 1912; Wagner, 2010) reminds the instructor of the full range of learning-outcomes goals, the learner's inner work of building knowledge structures through integration of new and prior knowledge (Piaget, 1977) and thinking through knowledge to be represented through computer programs (Harel & Papert, 1991) and game design (Baytak, Land & Smith, 2011) reminds the career instructor of the inner processes of knowledge acquisition and assimilation which must be accomplished if the learners are to be effactually prepared for workplace and career success.

The mental processes of augmenting understanding and inner knowledge structures observed in children by Piaget (1929, 1977) continue into career education, but career students bring broader pre-existing knowledge foundations and more advanced psychosocial maturation on which to build their new knowledge gleaned from the career

education. Young adults straight out of high school bring pre-existing academic

foundations; experienced workers aiming to advance or retool bring a base of prior

knowledge from their vocational experience (Levesque, Laird, Hensley, Choy, Cataldi, &

Hudson, 2008). Forging connections between theoretical foundations and practical career

skills is a crucial element in developing first-time career learners' and experienced

workers' ability to synthesize across multiple subject areas and grasp the

interconnections between theoretical knowledge and its practical applications (Aamodt &

Havnes, 2008; Charland, 2005; Huq & Gilbert, 2009). Learning how to forge such

connections also requires understanding how knowledge areas interrelate and how to

locate pertinent new information (Tergan, Gräber, & Neumann, 2006).

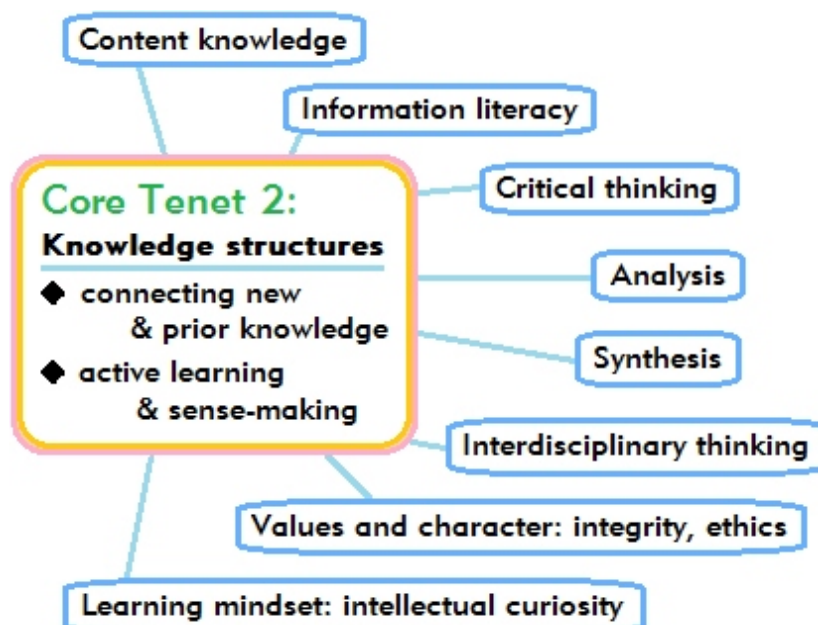*Figure 7.* Core tenet 2: Knowledge structures and cultivation of learning goals.

It is therefore recommended to include the learning goal of building connections

across disciplinary lines and discrete subject-based knowledge areas among the stated

learning objectives shared with students at the onset of the course (Baytak, Land, &

Smith, 2011; Beisser & Gillespie, 2003; Kafai & Resnick, 1996; Nikirk, 2012; Stager,

2001, 2005). It is also recommended to provide students with the cognitive learning task of seeking out, locating, and using new information related to the career-related knowledge area being studied (Tergan, Gräber, & Neumann, 2006).

Strategically Prepared Learning Environments

The strategically prepared learning environment is a knowledge ecosystem of information resources to support exploration and learning, equipment and supplies conducive to hands-on and explorative activities, learning-friendly classroom and virtual spaces, and an intellectually stimulating atmosphere to encourage pursuit of knowledge and skill. Together these factors provide the intellectual, physical, and virtual infrastructure conducive to inquiry and idea exchange, task perseverance, and effort in pursuit of mastery (Beisser & Gillespie, 2003; Bruner, 1977; Dweck, 1999, 2006; Millman, 2011; Mitra & Dangwal, 2010; Montessori, 1912; Stager, 2001, 2005).

Adapted to career education, the knowledge-rich learning ecosystem exposes learners to the field's theoretical foundations and their practical applications in work settings (Huq & Gilbert, 2009). Because career education prepares students for contribution of tangible skills in practical work settings, the appropriate sphere of the learning environment necessarily extends beyond the classroom into strategic partnerships with employer communities. Strong collaboration and open communication between business and education are crucial for defining and developing relevant skill sets, expansion of career students' learning opportunities, and thereby increasing graduates' employability (Bray, 2010; Friend, 2010; Kis, 2010b; Kuczera, 2011; Kuczera & Field, 2013). Such synergies become a critical avenue for work-based learning placements which provide students with opportunities to connect their theoretical classroom learning with practical application in real-world settings (Aamodt & Havnes,

2008; Bray, 2010; Charland, 2005; Huq & Gilbert, 2009). Education/industry synergies are also fertile ground for classroom visits by career-field experts as guest lecturers, sounding boards for students' questions and presentations, and mentoring relationships between practitioners in the career field and career students (Nikirk, 2012; Stager, 2001, 2005). Such employer/classroom synergies help acclimate career learners to the complexities, ambiguities, and challenges encountered in real-world work settings (Aamodt & Havnes, 2008; Bray, 2010; Cappelli, 2011; Friend, 2012; Manpower Group, 2013; Onsomu, Ngware, & Manda, 2010; Wallenborn, 2010).
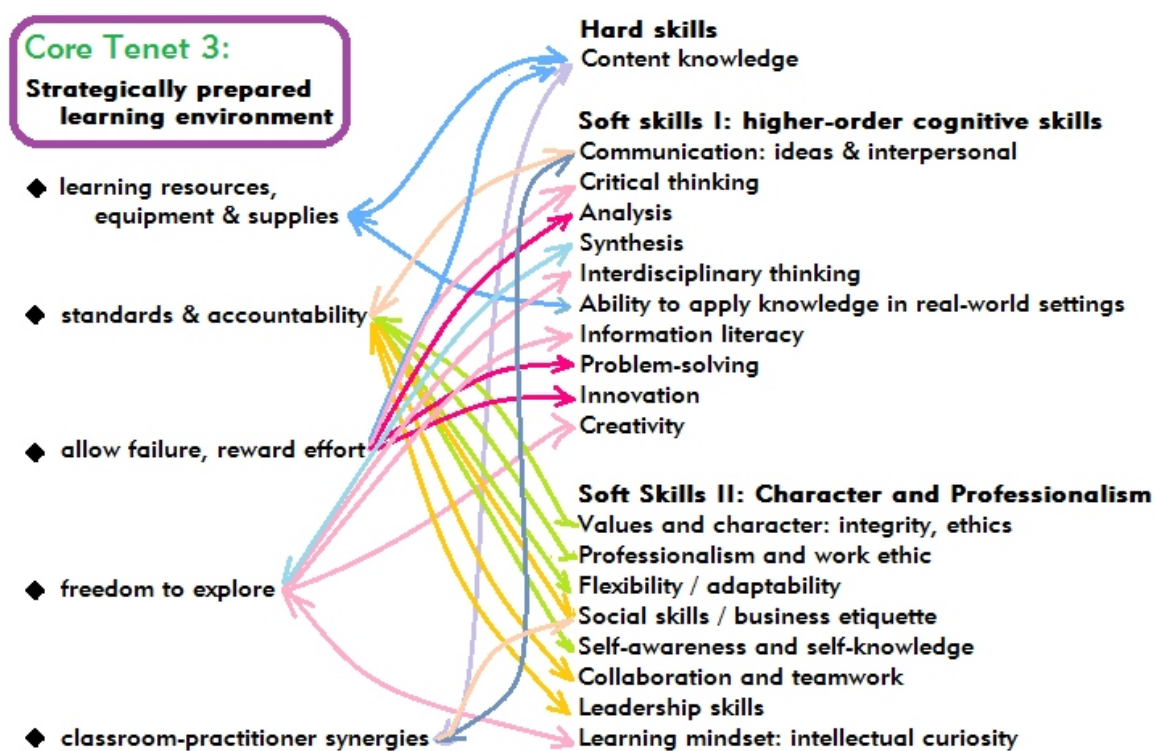
Figure 8. Core tenet 3: The strategically prepared learning environment and skill goals.

The strategic preparation important to the learning environment also translates into hybrid and online career education by providing tools for resource hubs and course interactions. The online environment functions as a teacher's hub for efficient pooling of course content, assignments, assessment and evaluation tools, and central space for posting course assignments. Instructors' uses of wikis, blogs, chat, as well as

synchronous and asynchronous online discussion as vehicles for interaction create community despite the physical dispersion of participants. For students, the online portal becomes a hub for participating in synchronous and asynchronous online course discussion, posting and showcasing papers and multimedia projects, as well as peer critique (Chapman , Ramondt, & Smiley, 2005; Anderson & Dron, 2011; Almala, 2006; Enonbun, 2010) and mutual support (Na-songkhla, 2011; Mesh, 2010). The importance of strategic partnerships between education and industry warrants arranging career-field experts' participation in scheduled online chats and question-and-answer sessions with career learners (Nikirk, 2012; Kafai , Desai, Peppler, Chiu, & Moya, 2008; Mesh, 2010).

The learning environment's atmosphere is equally important to ensuring learners' intellectual stimulation and knowledge acquisition: Freedom to explore topics of interest inspires and motivates students' in-depth pursuit of background knowledge (Beisser & Gillespie, 2003; Dewey, 1897, 1997; Montessori, 1912; Papert, 1993; Harel & Papert, 1991; Kafai & Resnick, 1996; Stager, 2001, 2005; Yarnall & Kafai, 1996). The importance of self-directed exploration warrants its adaptation to career courses despite their built-in constraints on scope governed by established course objectives (Chng & Coombs, 2004). Opportunity to learn from failure is an equally important environmental ingredient, as encounters with task failure and project setbacks (Steiner, 1996) promote problem-solving, creativity (Wagner, 2010), and perseverance toward skill mastery (Dweck, 1999, 2006), all of which are valued by employers (*Closing the Gap*, 2012; Manpower Group, 2012; Nagle, 2010).

A climate of acceptance of learners as persons of value builds their motivation to learn and confidence in exploring new skill areas; exploration, task failures and setbacks must occur in an accepting and psychologically safe learning environment or the learner

will shrink from further exploration and creative activity (Montessori, 1912; Steiner, 1996). High standards and accountability contribute to the safe learning environment and help develop character and individual responsibility (Beisser & Gillespie, 2003). It is therefore recommended to hold each career-course participant accountable through grading, group members' mutual evaluations, and reward structures designed to incentivize academic integrity, respectful interactions, participation in class and in group projects, and quality individual work, thereby reducing inappropriate conduct and opportunity to hide behind the group efforts' composite results (Beisser & Gillespie, 2003; Willey & Burke, 2011; Zhang, 2012).

The Teacher: Expert Guide and Subtle Facilitator

The constructivist and constructionist teacher's functioning as expert guide, learning coach, and facilitator of active learning through astute observation of learning progress (Montessori, 1912) and scaffolding (Bruner, 1977; Vygotsky, 1978) is compatible with career instruction and its inherent goals of fostering learners' self-sufficiency in occupational skills and workplace competencies (Hansson, 2009; Huq & Gilbert, 2009; Levesque, Laird, Hensley, Choy, Cataldi, & Hudson, 2008). It is recommended to steer course participants into learning activities aimed at mitigating observed areas of weakness as well as stretching skills (Nikirk, 2012).

The teacher fulfills a crucial role in setting the tone of the learning environment and it is recommended to establish a climate of freedom to explore (Chng & Coombs, 2004), acceptance (Steiner, 1996), and accountability with mechanisms built into the course's evaluation structure for holding students to standards for conduct, participation and contribution, and quality of work (Beisser & Gillespie, 2003; Zhang, 2012).

The teacher also creates the learning environment's atmosphere of intellectual stimulation by providing the learning tools and information resources needed to support active learning (Mesh & 2010; Mitra & Dangwal, 2010; Montessori, 1912) and by establishing an overall structure encouraging students' hands-on work (Nikirk, 2012). It is recommended to start the course with clearly stated goals to give motivated adult learners a roadmap for their own active learning (Chng & Coombs, 2004; Nikirk, 2012).

Figure 9. Core tenet 4: The teacher as facilitator and tone-setter steers toward learning goals.

Because strategically prepared learning environments appropriate to career education are incomplete without links to industry, the instructor's role in creating synergies between the classroom environment and employer communities is vital to students' successful acclimation to the practical and applied aspects of their career fields. The teacher's strategic linking with industry, in form of active collaboration between the teacher, career education institution, and employer communities, exposes students to practitioners' perspectives and information about career paths and expands the range of work-based learning placements available to career students (Friend, 2010). Instructors are therefore advised to maintain up-to-date practitioner skills in the career field and to

actively participate in local business and economic development groups' conversations about skill needs in order to strengthen vital links between classroom instruction and vocational practice (Hoeckel, 2010; Kis , Hoeckel, & Santiago, 2009; Kuczera, 2011; Kuczera & Field, 2010; Onsomu, Ngware, & Manda, 2010). Recommended approaches include inviting experts in the career field to the classroom for special presentations and question-and-answer sessions (Nikirk, 2012), as well as organizing vocation-related symposia at the college where students can demonstrate their created prototypes or processes in a variety of presentation formats to invited professionals and community members (Stager, 2001, 2005).

Experiential Learning: Doing, Discovery, Making

Experiential learning is at the heart of developing learners in content knowledge and across cognitive and psychosocial planes – these principles originally associated with school-age children's education and development (Dewey, 1997; Montessori, 1912) are equally effective in nurturing the skills of adult learners in career education (Chng & Coombs, 2004; Mesh, 2010). Cumulative experiences in and beyond the classroom continually add new information to learners' knowledge constructs and inner work of mentally mapping their conception of the world (Dewey, 1997; Piaget, 1977). Experiential learning takes place in form of individual exploration, practical hands-on learning activities on an individual and collaborative basis, as well as individual and collaborative creation of tangible knowledge artifacts related to the content and learning goals (Baytak, Land, & Smith, 2011; Beisser & Gillespie, 2003; Grant & Branch, 2005; Harel & Papert, 1991; Kafai & Resnick, 1996; Kafai , Desai, Peppler, Chiu, & Moya, 2008; Montessori, 1912; Papert, 1993; Stager, 2001, 2005; Willey & Burke, 2011). Although specific career-learning activities must logically vary according to the career

field being studied, the universal value of experiential learning rests with empowering students to take ownership of the knowledge base and encourages them to take initiative in pursuit of learning (Dewey, 1997).

Figure 10. Core tenet 5: Experiential learning as strategy toward learning goals.

Career education is more practically-oriented than the theoretical focus inherent in general academic education (Levesque, Laird, Hensley, Choy, Cataldi, & Hudson, 2008); learning activities must therefore impart practical skills in addition to acclimating learners to the career field's theoretical foundations (Aamodt & Havnes, 2008; Charland, 2005; Huq & Gilbert, 2009). Learning activities should furthermore strive for balance between developing practical vocation-specific skills and the broader aim of cultivating soft skills, in light of constructivist and constructionist whole-person emphasis (Dewey, 1897, 1915; Froebel, 1895; Gerver & Robinson, 2010; Montessori, 1912; Steiner, 1996; Wagner, 2010) and employers' desire for well-rounded skill sets beyond the boundaries of industry-specific competencies (Hart Research Associates, 2010). Immersion in hands-on activities fosters the skills of practical application of knowledge, creativity, problem-solving, and adjusting to ambiguities in complex situations (Gerver & Robinson, 2010;

Stager, 2001; Wagner, 2010) – skills repeatedly called for by US employers (Hart Research Associates, 2010; Manpower Group, 2012; 2013; Nagle, 2010).

Adapting Discovery Learning to Career Education. Exploration and discovery learning is compatible with the human tendency to seek out knowledge and explore (Mitra & Dangwal, 2010), natural curiosity in young children (Gerver & Robinson, 2010; Montessori, 1912), and adult course takers' high levels of motivation to learn (Mesh, 2010). Unlike Montessori's (1912) preschool with its open-ended and free-flowing explorative knowledge pursuits, career education is required to cover certain predetermined occupation-related skill areas within course structures and credentialing programs' timetables (Carnevale, Rose, & Hanson, 2012; Levesque , Laird, Hensley, Choy, Cadaldi, & Hudson. 2008). Although completely open-ended exploration is not practical within these constraints, the benefits of in-depth exploration can nonetheless be realized by adapting the exploratory component: A personal learning project, agreed-upon between the student and instructor and designed around individualized learning goals and evaluation criteria, creates the opportunity for in-depth research of an area of interest while remaining faithful to the established parameters of the course's overall learning objectives (Chng & Coombs, 2004).

Simulation and Games. Simulations and games provide students with hands-on immersive learning activities which foster critical thinking skills as students respond to the events unfolding in the simulation or game and expose learners to the complexities they will face in their professional lives (Tanner & Lindquist, 1998; Taylor, 2013). According to Taylor (2013), well-designed simulations of all sizes and scales of complexity include the three stages of planning and preparation, the simulation itself, and lastly debriefing and reflection. In the planning stage, the instructor clarifies the learning

objectives and students familiarize themselves with the rules of the simulation and learn about the aspects, topics, situations, and fellow-actors in the simulated situations, as well as the actors within the simulated learning scenario. The second stage is the simulation itself. While simulations vary from small-scale in-class scenario simulations confined to one class to the large-scale types of simulations exemplified by the Model United Nations (UN) with large numbers of participants from many colleges and schools each year, all simulations entail presenting students with a policy problem, business problem, crisis situation, or ethical dilemma in need of resolution. Students are then assigned the task of crafting workable solutions by negotiating the various simulation actors' different vantage points and conflicting interests. Actions include UN-style policy papers and resolutions (Taylor, 2013), as well as hands-on action and negotiation in business situations such as negotiating courses of action in international business or management situations, or considering the ethical dimensions of decisions and actions under difficult circumstances driven by internal or external factors (VanHise , Koeplin, & Whitty, 2013). In the simulation's final stage of debriefing and reflection, students examine and explain the why behind their decisions, actions, or policy recommendations and their implications, and the professional or theoretical background information which informed their reasoning (Taylor, 2013). Such reflection is a crucial element in honing students' skills in choosing courses of action and enhancing the degree to which the knowledge and skills are ultimately internalized (Wills & Clerkin, 2009). Simulations most effectively yielding the most preparation by students are linked to formal courses where the teacher has the greatest amount of control over designing the simulation and where the incentive for students' active involvement and research is linked to grading and outcomes-evaluation criteria (Taylor, 2013).

For example, in the Model United Nations (UN), students act as nations' delegates at Model UN conferences and prepare by conducting in-depth background research, set issues-related agendas, and practice decisionmaking (Cunningham, 2007; Efird, 1978; Manzo, 2007). Adapting the Model UN simulation principles to business-related courses with learning activities such as simulated business environments would immerse students in an approximation of real-world complexities faced by organizations which would require a multitude of career-field skills to address. A fictitious company with markets and international ecosystems created for the classroom or online learning community with built-in role-play and activities styled after the Model UN is suitable for immersing students in accounting, financial reporting, business strategy, management and labor relations, external relations, responding to markets and economic conditions, geopolitical developments, and social trends. Such activities hone technical skills such as accounting and data analysis, the art of management and strategy, interpersonal and collaborative skills, communication skills, the skill of seeing the broader picture and weighing tradeoffs in defining key interests, as well ethical considerations in decision-making (Shaw, 2009; Taylor, 2013).

More focused simulations contained within the overall training course, as for example in the area of managerial accounting, immerse students in the business tasks of cost estimating and planning, thereby honing their analytical skills such as job-costing simulations (Lippincott & Pergola, 2009) and activity-based costing simulations (Harrison, Jenkins, & Ritchie, 2008). Similarly, communications-oriented simulations immerse students in considering the context and purpose for the communication, defining their intended audiences and tailoring the message to the audience, as well as ethical considerations in the extent and veracity of information released. For example,

Brumberger's (2004) *Corporate Correspondence Project* in a third-or-fourth-year college business course aims to immerse students in imagined business contexts serving as impetus for the corporate correspondence, while also honing their workplace-style collaboration skills, enhancing their writing skills, and training the students to shift from viewing their course instructor as the sole audience toward instead considering their fictitious business-context audiences in order to develop the skill of tailoring the message to the intended audiences whom they would encounter in practical work settings. In a business course on communication ethics, students produce YouTube videos showcasing various fictitious violations of corporate ethics codes (Lehman, DuFrene, & Lehman, 2010): These videos are then shown and discussed in class where students analyze the contextual problem elements contributing to the ethics violations. Students then craft solutions to the underlying problems in ways similar to the manner in which case studies are traditionally used to cultivate reflection, analysis, and problem-solving skills. In producing the videos, students learn to tailor their presentations to target audiences of would-be business managers; in discussing each others' video-depicted scenarios, they learn to reflect upon ethical dimensions and hone their skills in problem-solving, moral reasoning, and communication.

In a manner similar to the above-described simulation approach, games immerse students in fictitious scenarios requiring reflective thought and purposeful context-sensitive action and decisionmaking. For example, Monopoly games in financial accounting education place game participants into approximations of life and business situations with financial implications requiring the development of critical thinking and planning skills (Albrecht, 1995; Knechel, 1989; Tanner & Lindquist, 1998). Preparation and publication among classmates of financial statements based on turns in the

Monopoly game and financial-statement-reading classmates' investment decisions, currency fluctuations in fictitious international scenarios, and business decisions against macroeconomic backdrops create more realistic skill-development exercises than textbook-related practice sets and teach critical thinking skills, planning, awareness of risk, strategy, communication, and collaboration (Mastilak, 2012; Shanklin & Ehlen, 2007; van der Laan Smith, 2013). Similarly, computer science students' programming skills are enhanced through use of collaborative and interactive games and virtual worlds (Esteves Fonseca, Morgado, & Martins, 2011; Theodorou & Kourdaki, 2010).

Hands-On Design and Student Presentations. Prototype design centered around addressing a problem or societal need is a practical hands-on skill-building approach in technical and mechanical fields. For example, in Stager's (2001, 2005) Constructionist Learning Laboratory, students were displeased with media reports of a soft drink firm's plan to design vending machines which would automatically adjust prices based on weather and temperature conditions indicating likelihood of thirst and desirability of the cold soft drink. Instead of following the urge to protest, interested students designed and built a prototype temperature-sensitive price-adjusting vending machine with their programmable Lego and sent the soft-drink company a scientific paper about their creation. The company replied that no such plans were on the horizon, thereby satisfying the students' underlying goal of stopping the development of such pricing mechanisms. At the same time, the project strengthened the students' crucial skills in communication and presentation, creativity and problem-solving skills, interdisciplinary thinking, collaborative skills, and practical design skills (Stager, 2001, 2005).

Incorporating opportunities for students to give presentations about their design creations and technical prototypes also helps develop students' communication skills

(Beisser & Gillespie, 2003; Stager, 2001, 2005). A similar approach of immersing students in taking ownership of the material is a strategy of supplanting sequential teacher lectures with student presentations. Assigning to individual or grouped students the presenting of textbook-chapter material steers students toward delving into the material and thereby develops deeper conceptual grasp and the skills of organizing and presenting information, editing content presentation to target audiences, communication and conveying ideas, and public speaking (Nikirk, 2012; Willey & Burke, 2011). Such presentations hone students' well-rounded skills in communication, collaboration, and organization valued by employers (*Closing the Gap*, 2012; *Critical Skills Survey*, 2012; Hart Research Associates, 2010; Manpower Group, 2013; Nagle, 2010; SHRM, 2008).

Work-Based Learning. While simulations, hands-on problem-solving learning activities, and prototype design provide fertile ground for skill development, these classroom tools still fall short of live application of skills in real-world work settings. Adding a work-based learning component to career-related courses exposes students to the dynamics of real workplaces and the practical applications of their theoretical classroom knowledge (Huq & Gilbert, 2009). Through work-based learning placements, students build connections in professional communities and experience first-hand the real-world challenges faced by organizations in their career fields and suitable strategies to address them (Charland, 2005).

Social Interaction and Collaborative Learning

Social interaction with collaborative learning is applicable to career education in form of classroom projects, online collaboration, as well as networking and mentoring interactions with practitioners in the career field (Nikirk, 2012). Activity types include creative design of prototypes (Stager, 2001, 2005), writing computer programs or

designing games to teach a topic in the career field to each other or to more junior students (Baytak, Land, & Smith, 2011; Yarnall & Kafai, 1996), mentoring (Kafai , Desai, Peppler, Chiu, & Moya, 2008) as well as collaborative research culminating in a tangible end product such as a group presentation, process design, instructions for technical processes, or charter for professional standards and conduct (Willey & Burke, 2011). Built into the course structure, such collaborative hands-on activities, as described in the preceding section on experiential learning, encourage student interaction, idea exchange, and helping each other learn. Through these interactive collaborations – combined with peer critique and evaluation mechanisms – students develop a sense of accountability for individual contributions to the group, communication skills, the art of negotiating divergent perspectives, a capacity to learn from peers, leadership skills, strategy, workflows, and coordination of effort (Baytak, Land, & Smith, 2011; Beisser & Gillespie, 2003; Taylor, 2013; Willey & Burke, 2011). Interaction and mutual support, peer learning, and peer critique have also been shown to boost adult learners' confidence and motivation (Mesh, 2010).

Figure 11. Core tenet 6: Social / collaborative core tenets and cultivation of learning goals.

These dynamics of social interaction also translate into application to online career instruction and professional development. Interactive web tools facilitate creation of community through social interaction and idea exchange (Mackey & Evans, 2011), as participants help each other learn (Chng & Coombs, 2004; Mesh, 2010) and negotiate ideas (Saab, van Joolingen, & van Hout-Wolters, 2005).

Additionally, career-related social interaction of educative value reaches beyond the classroom into the practical world of work: Practitioners in the field are important as mentors and sources of insights on real-world applications beyond theoretical foundations. Classroom visits from practitioners provide students with opportunities present their work and demonstrate prototypes to visiting experts in the field and mentors (Stager 2001, 2005). Career learners gain a glimpse into the profession and its varied types of work as invited classroom guests discuss the field's skill needs, career paths, work alongside the students in the classroom, and offer practitioners' perspectives and insights (Nikirk, 2012). Work-based learning placements as course components provide real-world immersive workplace interactions and practical acclimation to the career field (Aamodt & Havnes, 2008; Charland, 2005; Huq & Gilbert, 2009; Smith, Clegg, Lawrence, & Todd, 2007).

Reflection: Making Sense of Encountered Knowledge

Reflection spurs internalization of knowledge and deeper grasp of practical and ethical aspects inherent in the career field. Course design should intentionally incorporate debriefing and reflection into creative course projects, simulations (Taylor, 2013), service learning, and work-based learning in order to spur the pondering of professional and ethical standards (Willey & Burke, 2011), as well as the interrelations between the field's

theoretical and policy underpinnings and its practical aspects (Beisser & Gillespie, 2003;

Smith, Clegg, Lawrence, & Todd, 2007).

Figure 12. Core tenet 7: Reflection as strategy to cement learning.

Reflection about observations gleaned in the course of practical learning activities

should include tasks such as journaling and reflection papers, digital and media

communications such as film-making, blogs, and online newsletters as students' vehicles

for documenting their observations (Kafai, Desai, Peppler, Chiu, & Moya, 2008; Smith,

Clegg, Lawrence, & Todd, 2007; Stager, 2001; Taylor, 2013).

Summary

In systematically applying the seven constructivist and constructionist core tenets

to postsecondary career education in the United States, the aim of educating the whole

person across cognitive, affective, and psychomotor domains (Montessori, 1912) is

compatible with the hard and soft skills widely cited as crucial by employers (Hart

Research Associates, 2010; Manpower Group, 2013; Nagle, 2010; SHRM, 2008) and

educators (Gerver & Robinson, 2010; Wagner, 2010) and provides the career instructor

with a guiding list of learning objectives. The learner's inner work of building knowledge

structures through integrating new and prior knowledge (Piaget, 1977) reminds the career instructor to intentionally cultivate students' ability to make connections between career fields' theories and practical applications (Taylor, 2013).

Strategically prepared learning environments (Montessori, 1912) suited to career learning combine acceptance (Steiner, 1996), freedom for students to explore topics of interest (Chng & Coombs, 2004), standards and accountability for course work and conduct (Beisser & Gillespie, 2003; Zhang, 2012), as well as synergistic partnerships with industry to broaden students' career-learning opportunities (Friend, 2010). As learning coach, the career teacher establishes the learning environment and strengthens education/business synergies conducive to students' exposure to career-field experts and work-based learning opportunities (Friend, 2010; Nikirk, 2012; Stager, 2001).

Experiential learning (Dewey, 1997) adapted to career education includes exploration compatible with course objectives (Chng & Coombs, 2004), simulation (Lippincott & Pergola, 2009; Taylor, 2013), games (Tanner & Lindquist, 1998; Mastilak, 2012), and prototype design (Beisser & Gillespie, 2003; Stager, 2001, 2005). Social interaction and collaborative learning (Vygotsky, 1978) is centered on profession-specific content (Willey & Burke, 2011), interactions with career-field practitioners in a variety of settings (Nikirk, 2012; Stager, 2001, 2005) and work-based learning (Huq & Gilbert, 2009). Reflective writing and creative expressions help students internalize career-related content knowledge and ethical implications (Beisser & Gillespie, 2003; Smith, Clegg, Lawrence, & Todd, 2007; Stager, 2001; Taylor, 2013).

CHAPTER NINE

Summary and Discussion

Introduction and Overview

This study was designed to answer the question "What components of constructivism and constructionism might be logically applied to work-related training in service of enhancing human capital formation in postsecondary education settings in the United States?" To achieve this goal, the present study distilled from constructivism and constructionism seven core components for their systematic application to postsecondary career education in the United States to help address US skill needs widely cited in business, education, military and policy circles. Constructivism and constructionism emphasize active learning and developing the whole person – an instructional aim which brings value to career education, as employability success depends in equal measure on solid academic foundations, tangible competencies, and behavioral skills and values. This chapter discusses the study and its findings within broader education and training contexts and offers recommendations for future research.

The Application of Constructivism and Constructionism to Work-Related Training in Service of Enhancing Human Capital Formation in Postsecondary Education Settings in the United States

Motivated by the challenges posed by the US skill gap, the present investigation was designed to answer the question, "What components of constructivism might be logically applied to work-related training in the service of enhancing human capital

formation in postsecondary education settings in the United States?" To meaningfully

determine which core tenets might apply most logically to postsecondary career

education in the United States, it was necessary to first establish the umbrella role of

education in economies, societies, and individuals' life chances. Establishing this

contextual framework was logically followed by the task of ascertaining actual needs in

knowledge and skill realms and to glean best practices conducive to developing relevant

competencies. To gain these insights, the critical analysis method was employed to bring

together research from the traditionally separate areas of human capital theory of the field

of economics, human capital management and business research, and the education

field's perspectives on cultivating knowledge and skills.

Human Capital Theory and Current Global Insights

Human capital theory's core premise affirms education and higher-order skills as

central drivers of higher individual earnings, business competitiveness and earnings over

the long term, and nations' aggregate wealth and societal soundness (Becker, 1962, 1994;

Belfield & Levin, 2007; Ben-Porath, 1967; Iranzo & Peri, 2009; Schultz, 1961; Turner,

Tamura, Mulholland, & Beier, 2007). Current studies on nations' economic and societal

development conditions bear out these theoretical roots: Countries with highly developed

education and training systems are among the world's most advanced and best

functioning societies (Schwab & Sala-i-Martín, 2013). Conversely, countries with weak

education and training capacity, limited population reach, and educational exclusion of

population segments are among the world's least developed economies and least-

functioning societies (Schwab & Sala-i-Martín, 2013; UNCTAD, 2012).

Skill Needs and Research Movements

Education and business research converge and concur on the dual need for hard skills such as academic foundations and skill mastery, industry qualifications and technical competencies, and soft skills including higher-order analytical reasoning, creativity and intellectual agility, a learning mindset, behavioral skills and values, and a host of social and collaborative skills (*Critical Skills Survey*, 2010, 2012; Wagner, 2010) – areas in which employers find considerable shortages (Kuczera & Field, 2013; Manpower Group, 2013). Particularly in the United States, one of the world's most advanced economies (Schwab & Sala-i-Martín, 2013), complex work requires high skill levels across all areas of tangible competencies and knowledge, high-level analytical skills and critical thinking, and refined skills in the social and affective realms (*Closing the Gap*, 2010; Hart Research Associates, 2010; Nagle, 2010).

Several current skill movements emphasize the importance of both hard and soft skills: The *21ˢᵗ-century skills* movement emphasizes critical thinking, creativity, communication, collaboration, analysis and problem-solving, imagination and intellectual curiosity, initiative, and adaptability (*Critical Skills Survey*, 2010, 2012; Gerver & Robinson, 2010; Wagner, 2010). The *STEM to STEAM* movement emphasizes the importance of creativity and advocates for education in the arts to complement sciences and mathematics education in order to broaden the range of avenues for honing learners' creativity and discernment (Erickson, 2013; Root-Bernstein & Root-Bernstein, 2013). *Learning to think, thinking to learn* emphasizes the importance of critical thinking, inquiry, and reasoned analysis and synthesis (Hofmann, 2008; Pohl, 2000). The *employability* movement emphasizes the combination of tangible vocational skills augmented with social skills and etiquette, behavioral skills such as self-containment and

customer focus, and professionalism traits including work ethic, appearance, and accountability (Bray, 2010; Schneeberger, 2006; Yorke, 2004; Yorke & Knight, 2006).

Best Practices and Synergies for Skill Development

Human capital development is most effective when it considers skill needs for national competitiveness in the global arena in concert with skills needed for individuals' employability (Bray, 2010; Ramcharan, 2004). Best practices include decentralized education and training structures, open systems with flexible study pathways adaptable to a variety of needs, and local context-sensitive synergies (Kuczera & Field, 2013; Wallenborn, 2010). Stakeholder synergies such as partnerships between education and employer communities open up more learning opportunities (Friend, 2010). Examples of opportunities include learners' interactions with professionals through classroom visits from career-field practitioners, mentoring relationships, and work-based learning placements (Nikirk, 2012; Onsomu, Ngware, & Manda, 2010; Schwab & Sala-i-Martín, 2013; Stager, 2001, 2005).

US Insights: Challenges, Skill Mismatch, Training Gaps

The US skill gap is a phenomenon combining employers' difficulty in finding workers with the necessary skills on one hand (Manpower Group, 2013) and workers' weak skills across content knowledge, intellectual skills, and behavioral areas which reduce employment chances and job success on the other hand (Kis & Field, 2013). Decades of intensifying technology infusion and global macroeconomic shifts have spawned a mismatch between ever-higher skills needed to participate in evolving high-skilled lines of work and the existing skills in the workforce whose narrowly focused abilities impede attempts to bridge the gap between old and emerging skill sets of importance (Lindsey, 2013).

Many job seekers' existing skills and knowledge, especially at low-to-middle-levels, are too narrow to make the leap into newly evolving types of work owing to lacking knowledge foundations on which to build the higher-level work skills (Drucker, 1994; Hall, 2009). Gaps in training and retooling opportunities (Cappelli, 2011), paired with cost barriers (Torraco, 2007), further exacerbate this skill asymmetry. Schooling methods built around overemphasis on testing (Suárez-Orozco, 2007; Thornburg, 2002), local-wealth-driven disparities in educational quality (Klein, Rice, & Levy, 2012, Kuczera & Field, 2013) weak to mediocre primary, math, and science education (Schwab & Sala-i-Martín, 2013), and training gaps (Cappelli, 2011) are among key drivers of weak academic foundations and skills (Kis, 2011; Kuczera, 2011; Kuczera & Field, 2013). With underdeveloped knowledge foundations upon which to draw, workers' capacity to understand higher and more complex work skills is diminished (Onsomu, Ngware, & Manda, 2010), leading to an underdeveloped workforce and diminished life-sustaining work opportunities for underskilled individuals (Peck, 2011; Torraco, 2007).

Ten surveys elicited US employers' responses about specific skills in short supply (*Closing the Gap*, 2012; *Critical Skills Survey*, 2010; 2012; Hart Research Associates, 2010; Manpower Group, 2012, 2013; Nagle 2010; Schwab & Sala-i-Martín, 2012; 2013; SHRM, 2008): Employers reported shortages not only in hard skills such as industry-specific capabilities and technical competencies, but also cognitive skills such as critical thinking, analysis and synthesis, problem-solving, inquiry and imagination, creativity, as well as behavioral skills and values including work ethic and professionalism, social and collaborative skills, and integrity. Thus these skill needs and shortages not only shut out workers whose skills fall short (Lindsey, 2013; Peck, 2011; Torraco, 2007), but hiring difficulties also impede business operations in form of unmet capacity needs (Manpower

Group, 2013) and inability to innovate (Schwab & Sala-i-Martin, 2013). More broadly, an underdeveloped skill base poses the risk of undermining the nation's global competitiveness and economic soundness on the domestic front (Kis & Field, 2013; Schwab & Sala-i-Martin, 2013).

US Insights: Strategies and Strengths

Despite the aforementioned challenges, the United States has a long track record of legislation and policy measures aimed at broadening access to higher education (*Basic Opportunity Grants*, 1972; *Higher Education Act*, 1965), as well as educational goals and standards (*Common Core Standards for English*, 2010; *Common Core Standards for Mathematics*, 2010; *Goals 2000: Educate America Act*, 1994; *No Child Left Behind Act*, 2002; Race to the Top, 2009), as well as legislation defining career education (*Carl D. Perkins Vocational Education Act*, 1984; *Smith-Hughes Act*, 1907; *Vocational Education Act*, 1963). Subsequent research-informed legislation expanded postsecondary career education's scope to encompass academic foundations (*Carl D. Perkins Career and Technical Education Act*, 2006; *Carl D. Perkins Vocational and Technical Education Act*, 1998; Hyslop, 2009; Levesque, Laird, Hensley, Choy, Cataldi, & Hudson, 2008).

The United States' strong research base bolsters data-informed strategies; open systems with flexible study pathways provide US learners with multiple educational avenues and career-preparation pathways (Kuczera & Field, 2013). Furthermore, the US cultural leaning toward decentralization fosters voluntarism, stakeholder synergies, and symbiotic innovations sensitive to the contexts of local needs (Buell, 2009; Deschenes & Malone, 2011; Fishman, 2012; King, 2011; Kuczera & Field, 2013; McFadden, 2013; "SEED Public Charter School", 2011; Seligson, 2013; Tough, 2008).

Constructivism

Constructivism is a student-centered learning theory which aims to develop students across the spectrum of content knowledge and skill mastery, higher-order reasoning and analysis, social and collaborative skills, and behavioral skills and values (Dewey, 1915; Froebel, 1895; Montessori, 1912; Steiner, 1996; Wagner, 2010). Instructional strategies immerse students in individual and collaborative hands-on practical learning activities (Dewey, 1997; Montessori, 1912; Vygotsky, 1978).

Constructionism

Constructionism is centered on creative design of knowledge artifacts informed by background research across multiple disciplines (Harel & Papert, 1991; Kafai & Renick, 1996; Papert, 1993; Yarnall & Kafai, 1996). Learning takes place in an ecosystem of idea exchange, peer critique and peer mentoring, as well as educative interactions with experts and more knowledgeable peers in and beyond the classroom (Kafai , Desai, Peppler, Chiu, & Moya, 2008; Nikirk, 2012; Stager, 2001, 2005).

Constructivist and Constructionist Core Components Applied to Career Education

Originally developed in early childhood education, the learning theory of *constructivism* and its offshoot *constructionism* are not customarily deployed in postsecondary career education settings. The present study therefore distilled seven core components from constructivism and constructionism and applied them to US postsecondary career education: (1) the aim of educating *the whole person* spanning character and values, cognitive and intellectual growth, content knowledge and skill mastery, and psychoemotional maturation; (2) the learner's inner work of building *knowledge structures* through integrating new and prior knowledge; (3) *strategically prepared learning environments*; (4) *the teacher as expert guide and subtle facilitator*;

(5) *experiential learning* through exploration, hands-on learning activities, and creation of tangible artifacts; (6) *social interaction and collaborative learning*; and (7) *reflection* to make sense of encountered knowledge.

The Whole Person: Character, Cognition, Psyche, Intellect. Applied to postsecondary career education, the core tenet of educating the whole person serves as a trainer's master list of overarching skill development goals spanning academic foundations and skill mastery, higher-order cognitive skills, socioemotional skills, and values of integrity and citizenship (*Closing the Gap*, 2012; Dewey, 1897, 1915, 1916; Manpower Group, 2012, 2013; Montessori, 1912; Nagle, 2010; Steiner, 1996).

Knowledge Structures: Integrating New and Prior Knowledge. The key element of learners' inner work of building and equilibrating knowledge structures points instructors to the goal of helping learners connect new and pre-existing knowledge (Piaget, 1977) and link theory to practice (Taylor, 2013) – an important aim in first-time postsecondary career preparation as well as helping established workers with upskilling or reorienting toward new career fields (Cappelli, 2011; Peck, 2011; Torraco, 2007).

Strategically Prepared Learning Environments. Ecosystems conducive to successful knowledge acquisition are facilitated by the strategically prepared learning environment which is characterized by atmosphere and intellectual stimulation: An atmosphere of freedom to explore paired with frameworks of learning goals harnesses adult career learners' intrinsic motivation to learn and spurs delving more deeply into the knowledge related to the career field (Chng & Coombs, 2004). The atmosphere of acceptance needed for learners to flourish (Montessori, 1912; Steiner, 1996) is safeguarded by enforceable standards of conduct (Beisser & Gillespie, 2003; Willey & Burke, 2011). Encouraging effort and integrity paired with holding students individually

accountable is a key ingredient in fostering perseverance and work ethic (Beisser &
Gillespie, 2003; Dweck, 1999, 2006; Zhang, 2012). Intellectually stimulating
environments suited for career education extend beyond the classroom into synergies
between education and industry which expand the range of learning opportunities for
career students (Friend, 2010).

The Teacher: Expert Guide and Subtle Facilitator. The teacher as guide and
facilitator of active learning functions as learning coach by steering students toward skill-
building activities to strengthen areas of weakness and stretch learners' skills (Bruner,
1977; Montessori, 1912; Nikirk, 2012; Vygotsky, 1978). The teacher's role in
establishing intellectually stimulating environments extends beyond classroom planning
and creating community to include connections to employer communities to expand
students' access to work-based learning opportunities as well as facilitate students'
exposure to experts' classroom visits and to foster student interactions with practitioners
(Friend, 2010; Nikirk, 2012; Stager, 2001, 2005).

Experiential Learning: Doing, Discovery, Making. Experiential learning
immerses learners in the knowledge base and its practical applications through a variety
of purposeful hands-on learning activities. Career- relevant activities include simulations
styled after the Model UN (Taylor, 2013), games styled after Monopoly used in
accounting education (Albrecht, 1995) and collaborative computer games enlisted in
teaching computer programming (Esteves, Fonseca, Morgado, & Martins, 2011;
Theodorou & Kordaki, 2010), problem-focused artifact and prototype design (Beisser &
Gillespie, 2003; Stager, 2001, 2005), individual exploration related to agreed-upon
learning goals (Chng & Coombs, 2004), and work-based learning (Aamodt & Havnes,
2008; Huq & Gilbert, 2009; Millman, 2011). All such activities lead students through the

process of thinking through the material and how the knowledge base applies to the career field (Beisser & Gillespie, 2003; Huq & Gilbert, 2009).

Social Interaction and Collaborative Learning. The social element in career-preparation settings entails interaction and collaborative learning activities to cement the learning of the vocation-specific background knowledge and expertise areas: Content-knowledge immersion takes place in tandem with peer interaction, learning group workflows, idea exchange and negotiation of divergent views and interests (Taylor, 2013), learning from each other, and peer mentoring (Charland, 2005; Harel & Papert, 1991; Huq & Gilbert, 2009; Kafai , Desai, Peppler, Chiu, & Moya, 2008; Papert, 1993). These social elements are also key components of effective online learning communities (Chng & Coombs, 2004; Mesh, 2010; Na-Songkhla, 2011).

Reflection: Making Sense of Encountered Knowledge. Reflection steers students toward internalizing the knowledge through dedicated activities such as reflection papers, journaling, creative digital expressions, teacher debriefing of students following immersive learning activities (Taylor, 2013), or presenting lessons learned to each other or to invited career-field experts (Nikirk, 2012; Stager, 2001, 2005). These reflective exercises help students mentally process their observations and make sense of encountered knowledge (Taylor, 2013), while also helping students communicate their inner work of learning and understanding (Kafai , Desai, Peppler, Chiu, & Moya, 2008).

Discussion

This study culled constructivist and constructionist instructional strategies from their origins in early childhood education and applied them to postsecondary career education where their application has no tradition. Work-related training is designed to

develop skills for specific task areas and is not known for aiming to develop broader competencies and soft skills (Hall, 2009). College, on the other hand, targets student engagement, meaningful learning experiences, and learning communities to deepen understanding and develop character (Fink, 2003; Kuh, Kinzie, Schuh, & Whitt, 2010) but places less emphasis on workforce development (Hart Research Associates, 2010). The present study bridges this gap by combining the aims of developing job skills with the goals of cultivating broader competencies through the systematic application of constructivism and constructionism to postsecondary career education as a strategy for developing both hard and soft skills.

Education scholars and employers alike widely cite the equally pressing need for cognitive and behavioral skills including analysis and reasoning, creativity and innovative thinking, learning mindsets, professionalism, and work ethic (*Closing the Gap*, 2013; *Critical Skills Survey*, 2010, 2012; Schwab & Sala-i-Martín, 2013; Wagner, 2010). Yet despite consensus on the need for these well-rounded skills, workers and career entrants emerge from schooling and postsecondary career preparation under-equipped for practical application of knowledge and skills, unable to navigate ambiguity and complexity, lacking collaborative and interpersonal skills, and lacking communication skills such as writing and speaking skills and the ability to convey ideas and negotiate divergent views (Hart Research Associates, 2010; Klein, Rice, & Levy, 2012; Manpower Group, 2013; Nagle, 2010; Suárez-Orozco, 2007). This study provides a guiding master list of learning objectives and a blueprint for systematic application of constructivist and constructionist core elements to cultivating these skill areas.

While industries cannot flourish without workers in possession of vocation-specific content knowledge and industry competencies, the aforementioned cognitive

sophistication and soft skills are also widely cited as highly needed (Hart Research

Associates, 2010; Manpower Group, 2013; Nagle, 2010). Although at first glance the

notion of soft skills' importance to technical fields seems counterintuitive, a growing

body of literature specifically laments the lack of critical thinking, communication, and

interpersonal skills in technical fields among workers with otherwise impeccable

qualifications: A recent study on hard and soft skills noted shortage of needed soft skills

among IT professionals (Zhang, 2012). Even in less high-skilled fields, incumbents'

finesse spanning social skills, customer orientation, and self-containment (Schneeberger,

2006) contributes to improved performance and imparts assurance of company stability,

thereby contributing to customer retention and competitive advantage (Hansson, 2009).

Moreover, growing interest among behavioral ethicists in the crucial role of honesty and

moral reasoning in the workplace (Ariely, 2012; Crossan, Mazutis, Seijts, & Gandz,

2013; VanHise, Koeplin, & Whitty, 2013) magnifies the importance of contributions

from constructivism and constructionism to the development of skill and character

(Baytak, Land, & Smith, 2011; Beisser & Gillespie, 2003; Froebel, 1895; Harel & Papert,

1991; Kafai, Desai, Peppler, Chiu, & Moya, 2008; Montessori, 1912; Steiner, 1996).

Uniformity and standardization in applying constructivist and constructionist core

tenets to postsecondary career education is thwarted by the sheer variety of

postsecondary career credential types ranging from short-duration vocational certificates

focused on very specific job skills to baccalaureate degree programs in a vast variety of

career fields (Carnevale, Rose, & Hanson, 2012; Levesque, Laird, Hensley, Choy,

Cataldi, & Hudson, 2008). Despite curricular differences logically arising from

distinctions between occupations and types of credentialing programs, immersive

learning activities such as exploration of interest areas (Chng & Coombs, 2004),

simulations, games, hands-on classroom activities (Esteves, Fonseca, Morgado, & Martins, 2011; Lehman, DuFrene, & Lehman, 2010; Lippincott & Pergola, 2009; Roehl, Reddy, & Shannon, 2013; Tanner & Lindquist, 1998; Taylor, 2013), teacher-facilitated student interactions with career-field experts (Nikirk, 2012; Stager, 2001, 2005), and work-based learning (Huq & Gilbert, 2009) are adaptable to many fields of career study and to the cultivation of a wide range of skills (Beisser & Gillespie, 2013; Dweck, 1999, 2006; Willey & Burke, 2011).

The learner-centered methods inherent in constructivism and constructionism encounter detractors among advocates of strong curricula and absolute knowledge milestones who view learner-centered instructional strategies as feeble substitutes for substantive content knowledge (Hirsch, 1988, 2007; Kirschner, Sweller, & Clark, 2006). Employers insist upon substantive work skills and industry-specific knowledge (Cappelli, 2011; Manpower Group, 2013). Yet it is the very method of immersive experiential learning which develops in learners not only grasp of content knowledge but also the broader analytical and social skills, adaptability, agility, and creativity so widely cited by employers as needed but lacking (Hart Research Associates, 2010; Manpower Group, 2012, 2013; Nagle, 2010). Constructivist and constructionist methods are not intended as a substitute for mastering the canon of core knowledge and skills. Rather, they are intended as a conduit to help learners internalize the knowledge and its applications (Bray, 2010; Bruner, 1977; Charland, 2005; Dewey, 1997; Huq & Gilbert, 2009; Montessori, 1912; Wagner, 2010, 2012).

Finally, current debates about career-readiness shortages across the spectrum of hard and soft skills reflect the inherent tensions between education and training: The aim of developing specific skills for immediate employability and the long-term goal of

cultivating broader skills appear in conflict when immediate employability may be linked to short-lived utility of those skills and the long-range aim of cultivating broader skills does not produce skills which immediately fit an exact job but provide a more versatile base for continued learning and transferability between career fields over the long term. Research illustrates this dilemma: Training in immediately needed specific skills to the exclusion of broader competencies risks confining postsecondary trainees to narrow skill sets with short-lived employability prospects and lack of transferable foundations from which to branch out and adapt to continually evolving skill demands in the marketplace (Drucker, 1994; Hall, 2009). In an economic climate with ever-rising importance of high-level skills and broad-based transferable and soft skills (Lindsey, 2013), a strategy of applying constructivism and constructionism with its proven success in producing enhanced learning outcomes brings value to the enterprise of fostering in career learners the skills needed for full economic participation (Brennan & Powell, 2010; Carnevale, Rose, & Cheah, 2011; Hart Research Associates, 2010; Nagle, 2010; Wagner, 2010).

Implications for Future Research

The first recommendation for future research growing out of this study is the development of a model program in which these seven constructivist and constructionist core elements are applied to postsecondary career education, followed by a research study with a pilot program based on the model. Future research should also focus on applying these seven core tenets to training in a specific career field.

Beyond educational institutions, professional associations, government and non-profit organizations offer a variety of workforce retraining and vocational rehabilitation programs. Research on constructivist and constructionist applications to these training

venues would broaden these providers' instructional scope and thus contribute to raising trainees' employability over a longer term than by exclusive focus on narrow skill sets.

Research on applying constructivism and constructionism to teaching pedagogy to trainers is also recommended, particularly to industry trainers unfamiliar with pedagogy and knowledge progression. Moreover, the importance of academic foundations to learners' grasp of specialized work training warrants future research on systematic application of this study's constructivist and constructionist core elements to curriculum development and remedial education.

Global insights on countries' fortunes tied to their education and training successes suggest that further research is warranted on the application of these constructivist and constructionist core tenets to boosting education and training capacities in developing, transitioning, and upwardly mobile countries.

Summary

The present study distilled from constructivism and constructionism seven core components and developed a blueprint for their systematic application to postsecondary career education. While specific learning activities logically vary across fields of career study, the following core tenets enhance career instruction: *The whole-person* focus on knowledge, skill mastery, and social skills (Montessori, 1912) embodies a career instructors' master list of learning objectives directly applicable to the skill needs repeatedly cited as key to learning and employability success (Hart Research Associates, 2010; Manpower Group, 2013; Nagle, 2010; Wagner, 2010). Learners' inner work of equilibrating *knowledge structures* (Piaget, 1929, 1977) suggests activities conducive to learners' sense-making and internalizing of the knowledge (Beisser & Gillespie, 2003).

Strategically prepared learning environments (Bruner, 1977; Montessori, 1912; Steiner, 1996) need education-industry partnerships to expand students' career-learning opportunities (Bray, 2010; Friend, 2010). *The teacher as expert guide and subtle facilitator* (Bruner, 1977) sets standards, holds students accountable (Beisser & Gillespie, 2003; Zhang, 2012), steers learners into activities to develop individual skill needs (Montessori, 1912; (Nikirk, 2012) and arranges learning interactions between students and career-field practitioners (Nikirk, 2012; Stager, 2001, 2005; Willey & Burke, 2011).

Experiential learning (Dewey, 1997), *social interaction and collaborative learning* (Vygotsky, 1977), and *reflection* (Baytak, 2011; Howe & Covell, 2009; Taylor, 2013; Willey & Burke, 2011) applied to postsecondary career education settings immerse learners in their fields' foundations and practical applications through educational simulations (Taylor, 2013), games (Esteves, Fonseca, Morgado, & Martins, 2011; Mastilak, 2007; Tanner & Lindquist, 1998), hands-on activities and creative design (Beisser & Gillespie, 2003; Harel & Papert, 1991), interactions with practitioners in the field (Nikirk, 2012; Stager, 2001, 2005), and work-based learning opportunities (Huq & Gilbert, 2009). Together these constructivist and constructionist core components cultivate high-demand occupational competencies and soft skills including social skills, communication, ethical decision-making, persistence, and professionalism (Hart Research Associates, 2010; Manpower Group, 2013; Nagle, 2010; SHRM, 2008).

Recommendations for future research growing out of this study include a model program, followed by a pilot program. Future research is also recommended in applying these constructivist and constructionist core tenets to teaching pedagogy to trainers, as well as applying constructivism and constructionism to curriculum development, to remedial education, and to boosting education and training in developing countries.

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